TENSE, ATTITUDES, AND SCOPE

by

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<td>gloss</td>
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<td>adverb</td>
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</tr>
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<td>comp(lementizer)</td>
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</tr>
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</tr>
<tr>
<td>fut</td>
<td>future</td>
<td>feature</td>
</tr>
<tr>
<td>GB</td>
<td>government and binding</td>
<td>N/A</td>
</tr>
<tr>
<td>GEN</td>
<td>genitive case</td>
<td>gloss</td>
</tr>
<tr>
<td>IL</td>
<td>Intensional Logic</td>
<td>N/A</td>
</tr>
<tr>
<td>Infl</td>
<td>inflection</td>
<td>syntactic category</td>
</tr>
<tr>
<td>IP</td>
<td>inflection phrase</td>
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</tr>
<tr>
<td></td>
<td>or INFL phrase (= S)</td>
<td></td>
</tr>
<tr>
<td>LF</td>
<td>Logical Form</td>
<td>N/A</td>
</tr>
<tr>
<td>M</td>
<td>modal</td>
<td>syntactic category</td>
</tr>
<tr>
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<td>modal phrase</td>
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</tr>
<tr>
<td>N</td>
<td>noun</td>
<td>syntactic category</td>
</tr>
<tr>
<td>N'</td>
<td>(pronounced) N-bar</td>
<td>syntactic category</td>
</tr>
<tr>
<td>NEG</td>
<td>negation</td>
<td>gloss</td>
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<tr>
<td>NML</td>
<td>nominalizer</td>
<td>gloss</td>
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<td>--------------</td>
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<td>NP</td>
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</tr>
<tr>
<td>Perf</td>
<td>perfect</td>
<td></td>
</tr>
<tr>
<td>PerfP</td>
<td>perfect phrase</td>
<td></td>
</tr>
<tr>
<td>PF</td>
<td>phonetic form</td>
<td></td>
</tr>
<tr>
<td>Poss</td>
<td>possessive</td>
<td></td>
</tr>
<tr>
<td>PP</td>
<td>prepositional phrase</td>
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</tr>
<tr>
<td>Pres</td>
<td>present tense</td>
<td></td>
</tr>
<tr>
<td>PRES</td>
<td>present tense</td>
<td></td>
</tr>
<tr>
<td>Pro</td>
<td>pronoun</td>
<td></td>
</tr>
<tr>
<td>PRO</td>
<td>“big PRO”</td>
<td></td>
</tr>
<tr>
<td>PROG</td>
<td>progressive</td>
<td></td>
</tr>
<tr>
<td>QR</td>
<td>quantifier raising</td>
<td></td>
</tr>
<tr>
<td>RS</td>
<td>result state</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>sentence</td>
<td></td>
</tr>
<tr>
<td>S'</td>
<td>(pronounced) S-bar (= CP)</td>
<td></td>
</tr>
<tr>
<td>S-STR.</td>
<td>S-structure</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>tense</td>
<td></td>
</tr>
<tr>
<td>TAC</td>
<td>temporal adverbial clause</td>
<td></td>
</tr>
<tr>
<td>TAdj</td>
<td>temporal adjective</td>
<td></td>
</tr>
<tr>
<td>TC</td>
<td>temporal conjunction</td>
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<tr>
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</tr>
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<td>TP</td>
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</tr>
<tr>
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</tr>
<tr>
<td>VP</td>
<td>verb phrase</td>
<td></td>
</tr>
<tr>
<td>#!ADV</td>
<td>adverbs of the form “exactly n times”</td>
<td></td>
</tr>
<tr>
<td>#!ADVP</td>
<td>#adverb phrase</td>
<td></td>
</tr>
<tr>
<td>Ø</td>
<td>null tense</td>
<td></td>
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</tbody>
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**Examples:**

- **NP:** noun phrase
- **PASS:** passive
- **Past:** past tense
- **PAST:** past tense
- **Perf:** perfect
- **PerfP:** perfect phrase
- **PF:** phonetic form
- **Poss:** possessive
- **PP:** prepositional phrase
- **Pres:** present tense
- **PRES:** present tense
- **Pro:** pronoun
- **PRO:** “big PRO”
PREFACE

This book is an inquiry into the semantics of tense in natural language. The center of focus will be the behavior of tense morphemes in various embedded constructions, and the data will be drawn from English and Japanese. I will employ a relatively conservative Chomskyan framework for syntax and a truth-conditional model-theoretic approach for semantics. In writing this book, I have tried to make the material covered accessible to people with a variety of backgrounds: formal semanticists, theoretical linguists who are interested in tense-related natural language phenomena, linguists who specialize in Japanese, and philosophers of language with interest in tense and attitude reports. Faced with the difficult and demanding task of addressing a diverse audience, I have done my best to present the ideas in a theory-neutral way. I have tried to make clear the intuitive content of a proposal before presenting a formal version. Efforts have been made to make my proposals translatable into different frameworks. I have also tried not to presuppose extensive training on the part of the reader either in syntax or in semantics. However, I do assume some familiarity with the rudiments of syntactic theory and model-theoretic semantics. To be equipped with the necessary background knowledge, the reader should refer to such introductory textbooks as Haegeman (1994) for syntax and Chierchia and McConnell-Ginet (1990) for semantics.

This work grew out of my doctoral dissertation (Ogihara, 1989). But it has been radically revised, and a great deal of new material has been incorporated into the current version. There are many individuals to thank, but I will be brief. I am grateful to Irene Heim and Hans Kamp, who taught me not only by exploiting their pedagogical skills but by being exemplars of real scholars. I also want to thank Dorit Abusch and Mürvet Enç for their work on tense, which inspired me to work on the same topic, and for the personal contacts that I have had with them.
I also benefited from comments by (and encouragement from) Carl Lee Baker, Maria Bittner, Angelika Kratzer, Manfred Krifka, Mats Rooth, Arnim von Stechow, Corey Washington, Ede Zimmermann, and two anonymous reviewers. I also want to thank my teachers from the earlier stages of my linguistic training: Clifford Abbott, who introduced me to linguistics, and my sensei ‘teachers’ in Japan, Professors Akira Ikeya, Haruhiko Kindaichi, and Akira Ota. I would like to thank my former, current and future colleagues in the department of linguistics at the University of Washington for their encouragement: Michael Brame, Heles Contreras, Ellen Kaisse, Soowon Kim, Cecile McKee, Frederick Newmeyer, and Karen Zagona. I also thank James Lyle, Satomi Honda, and Soohee Kim for editing, proofreading, and other miscellaneous tasks related to the preparation of the camera-ready copy of the manuscript. Thanks are also due to our staff members David Miles and Ruth Honour. I am also grateful to the technical support offered by Stacy Waters at the Center for Advanced Research Technology in the Arts and Humanities. The research that has culminated in this book was partially supported by a graduate school fund granted to the author by the graduate school of the University of Washington, which is hereby gratefully acknowledged.

Lastly, I shall add some personal notes on the topic of this book. In my opinion, natural language phenomena that concern tense provide one of the ideal research areas for formal semanticists. There is a rich philosophical and logical tradition that concerns tense, and the syntax of so-called “functional categories,” which include tense morphemes, attracts a lot of attention nowadays. It is an exciting task to bring together the two traditions and produce something new. I also feel that time has a very robust ontological status, despite the popular belief that because we cannot see time, it is not there or is elusive. To those skeptics who do not think that time is formally tractable, I would like to ask: how can you know what time it is if you do not have any idea what time is? I think it is time for me to stop.

POSTSCRIPT

This book was produced on a Power Macintosh 6100/60 using Microsoft Word 5.1. The final camera-ready copy was output on Hammermill Laser Plus paper with an HP LaserJet4 with PostScript.
INTRODUCTION

1.1. A PREVIEW: A RELATIVE TENSE THEORY

Most natural language sentences are tensed in that they carry with them some information about time. In many languages, this information is indicated by overt morphemes called tense morphemes. In this book, I will be concerned with the semantics of tense in natural language. What are possible tense systems in natural language? What variations are observed, and what accounts for such variations? Are there language universals regarding tense? I will address such questions by paying particular attention to tense morphemes in embedded clauses. This book is also an attempt to conduct “comparative semantics” by drawing examples from English and Japanese. In order to provide the reader with a sense of perspective, let me make a short introductory statement about the theoretical position to be defended in this book.

The temporal interpretation of natural language sentences is a complex matter, as the reader will soon find out. Therefore, it is difficult to state my basic position with respect to tense-related phenomena in simple terms. With this caveat, I propose to call my theory a relative tense theory. The idea behind it is that tense morphemes are interpreted as embedded in the scope of structurally higher tenses. Put in rough terms, what I will claim in this book can be summed up by the following chart:

<table>
<thead>
<tr>
<th></th>
<th>English</th>
<th>Japanese</th>
<th>type/meaning</th>
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<tbody>
<tr>
<td>-s (present)</td>
<td>- (present)</td>
<td>no correlate</td>
<td>absolute present</td>
</tr>
<tr>
<td>Ø (empty)</td>
<td>-(r)u (present)</td>
<td>relative present</td>
<td></td>
</tr>
<tr>
<td>-ed (past)</td>
<td>-ta (past)</td>
<td>relative past</td>
<td></td>
</tr>
<tr>
<td>have (perfect)</td>
<td>-ta (past)</td>
<td>relative past</td>
<td></td>
</tr>
<tr>
<td>woll (future)</td>
<td>-(r)u (present)</td>
<td>relative future</td>
<td></td>
</tr>
</tbody>
</table>
The English present is indicated by an -s ending here, but it surfaces only when the subject is a third person singular NP. The empty tense indicated by “Ø” is not a surface English tense morpheme; it results from the application of the tense deletion rule to be proposed in Chapter 4. The Japanese present is represented here as -(r)u, but non-verbal predicates have different endings for the present tense. The English perfect is claimed to be ambiguous between a tense interpretation and an aspectual interpretation, and its tense interpretation is represented here. The morpheme will is the English future auxiliary neutral with respect to tense (Abusch 1988) and surfaces as either would or will. This theory contrasts sharply with an absolute tense theory, which contends that the interpretation of a tense morpheme is invariably determined in relation to speech time.1

I will claim that Japanese is a pure relative tense language in that all tense morphemes are interpreted as embedded in the scope of structurally higher tenses. The English tense system is more complex in that it is basically a relative tense language, but the simple present behaves like an absolute tense. I am aware that this non-symmetric treatment of the English tense system is controversial, and I will defend it in the course of this book. At the end of Chapter 6, I will return to this general theoretical perspective, re-evaluate my general claim about the tense systems of English and Japanese, and propose a typology of tenses on a preliminary basis.

1.2. THE BASIC TENSE FORMS AND THE MAIN ISSUES

In this book, I will adopt a model-theoretic approach to investigate English and Japanese. I would like the reader to keep in mind, however, that the theoretical claims to be made in this book are meant to be applicable to natural languages in general. English and Japanese are among the languages that have overt tense morphemes. Consider examples (2a) and (2b).

(2) a. The building collapsed.
    b. Biru-ga tubure-ta.
       building-NOM collapse-PAST
       ‘The/A building collapsed.’
(2b) is a Japanese sentence that has approximately the same meaning as English example (2a). Both (2a) and (2b) describe an event that took place in the past relative to the speech time. As in many other languages, the tense morphemes in English and Japanese are verbal affixes. In English the verbal suffix *-ed* is used as a past tense morpheme as in (2a). In Japanese, the verbal suffix *-ta* fulfills a similar function as in (2b). (2a) and (2b) show that both *-ed* and *-ta* can be used in simple sentences to describe events (or states) that obtained in the past relative to the speech time.

Consider next the so-called present tense morphemes in English and Japanese found in the following data:

(3) a. John is here.  
    b. John-wa koko-ni i-ru.  
       John- TOP here-at be-PRES  
       ‘John is here.’

Both (3a) and (3b) can describe the state of John’s being here at the utterance time. Thus, just as in the case of past tense, the English present and the Japanese present can describe the same state of affairs.

One major difference between English and Japanese with respect to tense shows up with respect to future time reference. English has a future auxiliary will, which serves as a future tense as in (4).

(4) John will come here (tomorrow).

On the other hand, Japanese has no overt future tense morpheme. Instead, the so-called present tense morpheme -(r)u is also used for future time reference. This is illustrated by (5).

(5) John-wa asita Tookyoo-e i-ku.  
   John- TOP tomorrow Tokyo-to go-PRES  
   ‘John will go to Tokyo tomorrow.’

As the English translation shows, (5) is used to describe an event that obtains at a future time. This means that the so-called present tense morpheme in Japanese is ambiguous between a “present tense meaning” and a “future tense meaning.” Since no overt morpheme distinguishes between the two meanings, it is sometimes claimed that
-(r)u is a non-past tense. However, this claim is slightly misleading because the semantics of -ru cannot be accounted for in terms of vagueness. That is, we cannot say that the meaning of some specific occurrence of -ru is vague as to whether it refers to the current time or to a future time. Consider (6), which is a stative sentence with no overt adverbial. It cannot be used to assert that John is here at some non-past time. The speaker must decide whether a claim is being made about the current time or about some future time. That is, (6) is genuinely ambiguous between the two meanings indicated by the English glosses.

(6) Taroo-ga koko-ni i-masu.
    Taro-NOM here-at be-PRES
    ‘Taro is here now’ or ‘Taro will be here.’

For example, (6) can be used as in (7a) to refer to a current state, but it can also be used to refer to a future state as in (7b).

(7) a. Kore-wa hisyositu desu.
    This-TOP secretary-office be-PRES
    Taroo-ga koko-ni ima-su.
    Taro-NOM here-at be-PRES
    ‘This is the secretary’s office. Taro is here.’

    b. Asita kite-kudasai.
    tomorrow come-please
    Taroo-ga koko-ni ima-su.
    Taro-NOM here-at be-PRES
    ‘Please come [visit us] tomorrow. Taro will be here.’

Given that the Japanese present is ambiguous between the two interpretations, it is safe to assume that the three-way semantic distinction among the past, present and future tenses exists in both English and Japanese.

The English present also can be used to describe future events. For example, sentences like (8a–b) are acceptable (Dowty 1979:155). Dowty calls this usage of the present ‘tenseless future’. It is restricted to planned events, such as those exemplified by (8a–b). (8c) is anomalous because weather conditions cannot be planned in advance.
(8)  a. Tomorrow, the Yankees play the Red Sox.
    b. John leaves town tomorrow.
    c. ?It (undoubtedly) rains tomorrow.
    d. It will (undoubtedly) rain tomorrow.

The Japanese simple present is different in this regard. It must be used for future time reference regardless of whether what is described is planned or not. That is, (9a) is acceptable, and so is (9b). Since the 'tenseless future' use of the English present is found only in a restricted set of situations, I will not discuss it any further in this book.

(9)  a. Asita-wa (zettai) ame-ga furi-masu.
     tomorrow-TOP surely rain-NOM fall-PRES
     [Lit.] ‘It (surely) rains tomorrow.’
    b. Asita Marinaazu-wa Yankiizu-to
       tomorrow Mariners-TOP Yankees-with
       siai-o si-masu.
       game-ACC do-PRES
       [Lit.] ‘Tomorrow, the Mariners play the Yankees.’

At this point, let us shift our attention to embedded clauses. It turns out that the tense morphemes in English and Japanese behave in completely different ways there. This is surprising given that in simple sentences no fundamental difference was found between the two tense systems. First, consider (10a–b), which involve verb complement clauses.

(10)  a. John said that Mary was in Seattle.
      b. Taroo-wa [Hanako-ga Siatoru-ni i-ru]
         Taro-TOP Hanako-NOM Seattle-in be-PRES
         to it-ta.
         that say-PAST
         ‘Taro said that Hanako was in Seattle [at that time].’
         [simultaneous reading only]

A striking difference between English and Japanese is found here with respect to the behavior of tenses. (10a) can be interpreted in two ways. Its default interpretation is that the time of Mary’s being in Seattle is simultaneous with John’s saying. Let us refer to this as the
simultaneous interpretation. The other reading, which is forced upon us by an adverbial like a week earlier, is that the time of Mary’s being in Seattle is earlier than John’s saying. I will call this the shifted interpretation. By contrast, (10b) has only one interpretation: Taro said in the past that Hanako was in Seattle at that time. The interpretation of (10b) equals the default interpretation of (10a). Despite this fact, they have different tense morphemes in their complement clauses: a past tense morpheme is used in the English example (10a), whereas a present tense morpheme is used in the Japanese example (10b). In English, when a verb is in the past tense, its complement clause must be in the past tense in order to receive a simultaneous interpretation. This fact is surprising not only because many languages in the world such as Russian (Comrie 1985:109) and Polish (Maria Bittner, personal communication) are like Japanese in that a present tense in a verb complement clause embedded under a past tense receives a simultaneous reading; it is surprising also because it is hard to justify this fact semantically. Suppose that tenses are interpreted either with respect to structurally higher tense morphemes or independently. If the embedded past tense in (10a) is interpreted with respect to the speech time, then we would expect that it could denote any past time. However, this is not the case because (10a) cannot describe Mary’s being in Seattle at some time between the time of John’s saying and the utterance time of (10a). On the other hand, if we assume that the past tense is interpreted in relation to the time of John’s saying, it follows that this tense cannot refer to the time of John’s saying. By definition, the time of John’s saying is not earlier than itself. Hence, it is very hard to explain why (10a) can receive a simultaneous interpretation. Adopting the traditional terminology, we will refer to the fact that the verb complement clause of (10a) is in the past tense and receives a simultaneous reading as a sequence-of-tense (SOT) phenomenon.

One possible account of the phenomena is provided by Enç (1987), who claims that some tenses behave like anaphoric pronouns. Enç’s system allows the tense in the complement to be bound by the tense in the matrix, thereby yielding a simultaneous reading. If empirically adequate, Enç’s proposal enables us to forgo the SOT rule. We will examine her proposal in detail in Chapter 3 and show that it does not account for more complex examples of the SOT phenomena, such as (11) (Abusch 1988).
INTRODUCTION

(11) John decided a week ago that in ten days at breakfast he would say to his mother that they were having their last meal together.

(11) can receive an interpretation where the time of his saying to his mother is simultaneous with the time of their having their last meal together. I will show in Chapter 4 that a proposal that incorporates an SOT rule accounts for this interpretation of (11). What I will propose there is based upon the ideas expressed by traditional grammarians such as Curme (1931) and by modern syntacticians such as Ross (1967). Informally and crudely put, the SOT rule encodes the idea that in English a past tense that occurs “in the scope” of a higher past tense can be treated as if it is semantically empty. I will claim that Japanese lacks this rule and that this constitutes a major difference between English and Japanese with respect to temporal phenomena.

The tenses in English and Japanese also differ with respect to their behavior in relative clauses. Consider the following examples:

(12) a. John met a man who is smoking over there.
b. John met a man who was smoking.
c. John-wa tabako-o sut-te i-ru otoko-ni at-ta.
   John- TOP cigarette- ACC smoke- PROG-PRES man-DAT meet-PAST
   'John met a man who is smoking (now).’ or ‘John met a man who was smoking (at the time of the meeting).’
d. John-wa tabako-o sut-te i-ta otoko-ni at-ta.
   John- TOP cigarette- ACC smoke- PROG-PAST man-DAT meet-PAST
   ‘John met a man who was smoking.’

(12a) can only mean that John met a man who is smoking now (at the speech time of (12a)). On the other hand, its literal translation into Japanese, (12c), has two interpretations: an interpretation equivalent to (12a) and the other interpretation where the time of the man’s smoking is simultaneous with John’s meeting him. In fact, the latter interpretation is more salient than the former; the former can be obtained by adding an appropriate adverbial, such as ima ‘now’ for the
embedded event and *kinoo* ‘yesterday’ for the matrix event, as in (13).

(13) John-wa ima asoko-de tabako-o
    John-TOP now over there-at cigarette-ACC
    sut-te iru otoko-ni
    smoke-PROG-PRES man-DAT
    kinoo miti-de at-ta.
    yesterday street-at meet-PAST
    ‘Yesterday John met on the street the man who is now
    smoking over there.’

On the other hand, when the relative clause is in the past tense as in (12b) and (12d), it looks as though there is no difference between the two languages. In Chapters 4 and 5, I will assume that tenses are in general interpreted in relation to local commanding tense morphemes at LF and that English has an SOT rule but Japanese does not. Then, I will show that the data are accounted for if we adopt an independently motivated mechanism for NP scoping (Montague 1973, May 1977). For example, we can account for the two readings of (12c) by assuming that the relative clause NP can have either wider or narrower scope with respect to the main clause tense, which I assume to bear sentential scope. This allows us to predict that a relative clause NP can receive two or three readings depending upon the scope property of the NP and the applicability of the SOT rule. This theory predicts for examples like (12b) and (12d) some readings that are redundant (i.e., those that entail other legitimate readings), but they are harmless. The theory has one apparent empirical problem; it predicts that (12a) can receive the simultaneous reading associated with (12c), but this reading is in fact unavailable. I will posit a special proviso to account for this fact: the English present *always* makes reference to the speech time. It turns out that this special treatment of the English present is required to account for so-called double-access sentences.

The strength of this proposal is that it accounts for examples like (14). That is, if we simply assumed that tense morphemes in relative clauses are interpreted as unembedded, we would fail to predict some crucial data that involve multiple embeddings.

(14) John said a week ago that in ten days he would buy a fish
    that was still alive.
(14) can receive a reading in which the time of the fish’s being alive is simultaneous with the time of John’s buying it. This reading can only be obtained if we assume that the relative clause is treated as a tenseless clause and is interpreted in relation to the time of buying the fish. In terms of my proposal, this means that the tense in the lowest clause gets deleted by the SOT rule, and the resulting “empty tense” is interpreted in relation to the intermediate tense. Note here that the intended interpretation requires that the time of the fish’s being alive be in the future relative to the speech time and is independent of the reading associated with the maximal scope for the tense in the relativized NP.\textsuperscript{6,7} This shows that an SOT rule is absolutely essential.

In sum, I will propose the following account of the relative clause facts in English and Japanese: NPs are subject to scoping, and tense morphemes are interpreted in relation to local commanding tenses. The difference between English and Japanese results from the fact that English has an SOT rule, whereas Japanese does not. As mentioned above, the fact that (12a) cannot receive a simultaneous reading is accounted for by the assumption that the English present invariably denotes the speech time.

In Chapter 6, I will discuss so-called double-access sentences, which are problematic for the proposal I will defend in Chapters 4 and 5. Sentences like the following have a peculiar interpretation:

(15) Taro said that Hanako is in Seattle.

(15) is grammatical and meaningful, but its interpretation is different from the Japanese sentence (10b), which is a literal translation of (15). (15) is a “double-access” sentence in that Hanako’s being in Seattle “has access” to both the speech time of (15) and the time of Taro’s saying. On the other hand, (10b) has a purely simultaneous reading. I will argue that (15) is an instance of a \textit{de re} attitude report about a state. Note that in (15) a present tense occurs in the complement clause and a past tense in the matrix clause. This pattern is also found in a sentence like (16), assuming that \textit{will} is the present tense form of the future auxiliary.

(16) Bill looked for someone who will be leaving.

Ladusaw (1977) discusses examples like (16) and observes that a \textit{de
dicto reading for the NP *someone who will be leaving* is possible. However, this is problematic for his proposal. His theory predicts that *will* is interpretable only if it is outside the scope of a past tense. This requires that the NP have matrix clause scope. However, this also means that the NP must receive a *de re* interpretation. Therefore, Ladusaw’s theory does not do justice to his own intuition. I will show that this puzzling fact can also be accounted for as an instance of a *de re* attitude report. To be more precise, it is rendered as a *de re* attitude report about an interval (or an event).

### 1.3. THE DISTINCTION BETWEEN TENSE AND ASPECT

It is hard to distinguish between tense and aspect clearly, but the following definition by Comrie (1976:1–3) gives us a good intuitive feel for the difference between the two concepts: “tense relates the time of the situation referred to to some other time, whereas aspects are different ways of viewing the internal temporal constituency of a situation.” In the tradition of formal semantics, it is assumed that a sentence is either true or false depending upon the time of evaluation (and also the world of evaluation). Given this perspective, a tense morpheme can be regarded as any expression that serves to affect the time of evaluation for a sentence without changing its “propositional content.” On the other hand, aspect morphemes affect the “propositional content” itself. This semi-formal definition is vague, but it helps us decide whether some morpheme is a tense morpheme or an aspect morpheme. In this book, I will only discuss tense morphemes and will reserve the discussion of aspectual morphemes for another occasion.

The English progressive and its alleged counterpart in Japanese *-te iru* are excluded because intuitively they are aspectual morphemes. However, linguists are divided as to whether the English perfect is a tense marker or an aspect marker. I will argue that it is ambiguous between a preterit meaning and an aspectual meaning. At first sight, the perfect is like the simple past in that it serves to locate an event in the past in relation to the speech time. But there are differences between the two constructions. In the linguistic literature that falls outside the formal semantic tradition, the perfect is often treated as an
aspectual construction (e.g., Comrie 1976). This is because a present perfect sentence requires some type of “current relevance” of the event or state described by the sentence. Consider the following sentence:

(17) John has lost his book.

At least in its most salient reading, its truth requires not only that John’s losing his book obtain in the past but also that the book have not turned up yet as of now. This “current relevance” reading of the present perfect is obligatory in tensed clauses. It is characterized by the fact that it does not allow co-occurring adverbials that denote definite past intervals, such as yesterday, last month, two years ago, etc. (McCoard 1978, Dowty 1979). That is, (18a–b) are grammatical, whereas (18c–d) are not.

(18) a. John lost his ticket last month.
   b. John graduated from college two years ago.
   c. *John has lost his ticket last month.
   d. *John has graduated from college two years ago.

Henceforth, we will refer to this reading as an aspectual reading of the perfect.

I will argue in what follows that the perfect can receive an interpretation that is semantically identical with the interpretation of the simple past. Various forms of the perfect other than the present perfect in tensed clauses can occur with temporal adverbials that denote definite past intervals. In these cases, the perfect plays the same role that the simple past does in finite clauses. Consider the following data (Stump 1985:223, 230):

(19) a. Having been on the train yesterday, John knows exactly why it derailed. [free adjuncts]
   b. Mary may have played the piano yesterday. [unmarked infinitival complements]
   c. Bill seems to have slept yesterday. [marked infinitival complements]
   d. He said that Mary had been reading books yesterday. [the past perfect]
Note that the adverb *yesterday*, which denotes a definite past interval, is allowed to occur in (19a) through (19d) and restricts the temporal location of each event. I take this to be solid evidence for the claim that the perfect can be used as a preterit. This does not mean, however, that the perfect must be used as a preterit when used in constructions like those exemplified by (18a–d). When there is no accompanying adverbial that clearly denotes an interval earlier than the “point of reference,” the perfect in these constructions can also be used for the aspectual interpretation. This can be supported by the fact that both (20a) and (20b) entail (20c).

(20)  
a. John said, “I lost my ticket.”
b. John said, “I have lost my ticket.”
c. John said that he had lost his ticket.

The direct quote in (20a) by definition can only have a preterit interpretation. We assume that the direct discourse (20b) can only have an aspectual interpretation because it is a finite clause in the present perfect. Thus, we can conclude that (20c) is ambiguous between an aspectual interpretation and a preterit interpretation. In this book, I will be concerned only with the preterit interpretation of the perfect.

The contrast between the two readings of the perfect can also be substantiated by discourse examples. The past perfect can be used in an extended discourse for two different readings, and the ambiguity thesis is clearly vindicated here. Consider the following two narrative discourses. E, S, and ST stand for “event,” “state,” and “speech time,” respectively.

(21) John arrived at the airport at nine.  
E₁  
He had left home two hours earlier.  
E₂  
He had met a friend of his on his way to the airport.  
E₃  
______________________________________________ >E₂ E₃ E₁ ST
(22) John arrived at the airport at nine.
\[ E_1 \]

Mary had already arrived there. He smiled at her.
\[ S_1 E_2 \]

\[ E_1 S_1 E_2 \rightarrow ST \]

Two temporal points separated from each other in the graphic representations indicate that there is some non-trivial temporal distance between them; two points that are adjacent to each other indicate extreme temporal proximity. The first occurrence of the past perfect in (21) induces a flashback effect. The past perfect here serves to introduce a new time located earlier than the time of John’s arriving at the airport and to assert that John’s leaving home obtains at this time. The second occurrence of the past perfect describes an event that occurs after his leaving home, but before his arrival at the airport. The past perfect in (22) has a different flavor. Intuitively, the second sentence describes the “result state” of Mary’s arriving at the airport, i.e., Mary’s being at the airport. Although the italicized sentence does say that the time of Mary’s arrival is located before John’s arrival, this is not the main assertion made by the sentence. The main assertion is that Mary was already there when John arrived, and this is indirectly indicated by a result state of Mary’s arriving at the airport (i.e., Mary’s being at the airport) that obtains at the time of John’s arrival.

The two interpretations of the perfect exemplified by (21) and (22) are overtly distinguished in Japanese. As (23) and (24) show, (21) and (22) translate into Japanese discourses that involve different constructions. (21) translates as in (23).

(23) Taroo-wa ku-zi-ni kuukoo-ni tui-ta.
\[ \text{Taro-TOP nine-o'clock-at airport-at arrive-PAST} \]
‘Taro arrived at the airport at nine.’

Kare-wa ni-zikan-mae-ni ie-o de-ta.
\[ \text{he-TOP two-hour-before-at house-ACC leave-PAST} \]
[Lit.] ‘He left home two hours earlier.’

Totyuu-de tomodati-ni at-ta.
\[ \text{on-the-way-at friend-DAT meet-PAST} \]
[Lit.] ‘He met a friend of his on his way,’
Note that in (23), the past tense form of the verb V-ta is used where the past perfect is employed in the English discourse (21). (22) translates as in (24) in Japanese.

Taro-TOP nine-o’clock-at airport-at arrive-PAST
‘Taro arrived at the airport at nine.’
Hanako-wa moo kuukoo-ni tui-te i-ta.
Hanako-TOP already airport-at arrive-RS-PAST
[Lit.] ‘There was already a result state of Hanako’s arriving at the airport’
Taroo-wa Hanako-ni hohoemikake-ta.
Taro-TOP Hanako-DAT smile-PAST
‘Taro smiled at Hanako.’
[N.B.: RS stands for ‘result state’.]

The V-te iru form in Japanese is usually referred to as a progressive construction. However, it can also have a different interpretation traditionally referred to as a result state (kekka zanzon, literally ‘result remaining’) reading (Kindaichi 1950, Fujii 1966, for an English source see Jacobsen 1982). I assume that the V-te iru form as used in (24) has a result state interpretation.

If the V-ta form and the V-te ita form (the past “progressive” form) in (23) or (24) are switched, the resulting discourses are infelicitous, as (25) and (26) show. In (25), the second sentence is acceptable, but it gives the reader the strong impression that the sentence is about some state (perhaps a result state) that obtains at the time Taro arrives at the airport. It means roughly “(when he arrived at the airport,) Taro had the experience of having left home two hours earlier” and does not induce a flashback effect. The third sentence is only marginally acceptable, and if it is acceptable at all, it can only receive a result state interpretation on a par with the second sentence. In (26), the second sentence is anomalous: moo ‘already’ cannot occur felicitously with the past tense marker -ta in this context. The fact that the past tense morpheme -ta and the “progressive form” -te iru in Japanese are not interchangeable supports the view that the perfect in English is ambiguous between whatever meanings these two Japanese forms represent. I call the interpretation of the past tense morpheme in
Japanese a preterit interpretation, and the reading represented by the 
-te iru form an aspectual interpretation.

   Taro-TOP nine-o’clock-at airport-at arrive-PAST  
   ‘Taro arrived at the airport at nine.’
   # Taroo-wa ni-zikan-mae-ni  
   Taro-TOP two-hour-before-at  
   ie-o de-te i-ta.  
   house-ACC leave-PROG-PAST  
   ‘He had the experience of having left home two hours  
   earlier.’
   # Ttyuu-de tomodati-ni at-te i-ta.  
   on-the-way-at friend-DAT meet-PROG-PAST  
   ‘He had the experience of having met his friend on the way  
   (to the airport).’

(26)  Taroo-wa ku-zi-ni kuukoo-ni tui-ta.  
   Taro-TOP nine-o’clock-at airport-at arrive-PAST  
   ‘Taro arrived at the airport at nine.’
   # Hanako-wa moo kuukoo-ni tui-ta.  
   Hanako-TOP already airport-at arrive-PAST  
   [Lit.] ‘Hanako already arrived there.’
   Taroo-wa Hanako-ni hohoemikake-ta.  
   Taro-TOP Hanako-DAT smile-PAST  
   ‘Taro smiled at Hanako.’

Additional support for the ambiguity of the English perfect comes 
from English discourse examples. It is sometimes noted (e.g., Partee 
1984:264) that a simple past can substitute for a past perfect without 
changing the meaning. However, in a narrative discourse, a past 
perfect used for an aspectual meaning cannot be supplanted by a past 
tense, as shown in (27a), whereas a past perfect used as a preterit can, 
as shown in (28a).

(27)  a. John went back home at eleven.  
   # His wife already went to bed.
   b. John went back home at eleven.  
   His wife had already gone to bed.
16  CHAPTER ONE

(28)  a. John arrived at the airport at 10. He left his house two hours earlier. He met a friend of his on his way to the airport.
    b. John arrived at the airport at 10. He had left his house two hours earlier. He had met a friend of his on his way to the airport.

This contrast between (27a) and (28a) also supports the distinction between an aspectual reading and a preterit reading of the perfect.

Let us turn to Japanese. It has been pointed out in the literature that the so-called “past tense” in Japanese is ambiguous between a past tense meaning and a present perfect meaning (e.g., Nakau 1976). Consider the following data:

(29)  a. Ano eega mi-ta?
    That movie see-PAST
    ‘Did [you] see the movie?’ or
    ‘Have [you] seen the movie?’
    b. Mada mi-te-na-i.
    yet see-PROG-NEG-PRES
    ‘[I] have not seen [it] yet.’
    c. Mi-ta-katta kedo, mi-na-katta.
    see-want-PAST but see-NEG-PAST
    ‘[I] wanted to see [it], but [I] didn’t.’

As the two types of negative answer indicate, the question can be understood in two different ways. The answer (29b) is appropriate when the question is analogous to an English question in the perfect form. On the other hand, (29c) is an appropriate answer to a question that concerns a particular past interval, e.g., yesterday. Therefore, it is often claimed that the so-called past tense in Japanese is ambiguous between a preterit interpretation and a perfect-like interpretation.

It is clear that there are subtle semantic differences between the English past and the Japanese past. However, the above facts do not necessarily show that the Japanese past is ambiguous. As we shall see in Chapter 2, English sentences in the simple past often involve reference to a specific past interval within which the episode in question is located. On the other hand, the English present perfect does not license an adverbial that indicates a definite past interval. This can
be taken to mean that the present perfect concerns the entire past interval. Although this is hardly the whole story about the difference between the simple past and the perfect, it is arguable that this correctly describes one aspect of the semantic difference between them. If so, the presence or absence of a contextual restriction may be responsible for the two “interpretations” of the question in (29a). When a contextually salient interval narrowly restricts the meaning of a past tense, the resulting interpretation resembles the default interpretation of an English sentence in the past tense; when there is no such adverbial, the meaning is likened to that of a present perfect in English. Thus, I assume for the purpose of the following discussion that there is no essential difference between the English past and the Japanese past.

1.4. THE OVERALL ORGANIZATION OF THE BOOK

I will work within the tradition of truth-conditional model-theoretic semantics but will try to be as theory-neutral as possible in my exposition. Moreover, whenever I present a formal proposal, I will also describe it informally so that the reader can grasp the intuitive idea behind it.

In Chapter 2, I will discuss the temporal semantics of simple sentences, i.e., sentences that have no embedded clauses. I will present my own proposal, which has the following characteristics: (i) tense morphemes serve to introduce predicates of times; (ii) for each tense morpheme, one reference time can be optionally introduced, and this can be done either implicitly (by a contextually available “reference time”) or explicitly (by an overt temporal adverbial); (iii) the semantic contribution of tense morphemes is given in a compositional manner. In Chapter 3, I will summarize the previous studies that deal with tenses in embedded clauses. In Chapter 4, based on the discussion in Chapter 3, I will develop my own theory for the SOT phenomena in complement clauses. I will extend this analysis to adjunct clauses in Chapter 5. This includes an account of how the SOT phenomena interact with NP scope. Chapter 6 deals with a small but important set of problematic data: so-called double-access sentences in English. I will explicate their peculiar interpretations in terms of de re attitude.
reports about states or intervals. The book concludes with a grammar for a fragment of English and Japanese that is capable of generating and interpreting the range of data discussed in the book.

Finally, a word of caution is in order concerning the syntactic category labels employed in this book. The syntactic proposal that I will advance includes a rather liberal interpretation of X-bar theory (Jackendoff 1977, etc.). For example, I will employ such maximal projections as CP (for Complementizer), TP (for Tense), MP (for Modal), and PerfP (for the Perfect), along with other standard phrasal categories. The term IP (for Inflection) is not used in my own proposal, and this is partly because the category Infl does not play any role in it. I will instead employ the traditional label S (for Sentence). The reader can regard S either as an alias for IP or as a special category that does not fall squarely within the X-bar scheme. Note also that some of the authors discussed in this book represent tense-related information in different ways. For instance, Ladusaw (1977) employs the category Aux, within which tense morphemes occur, and Enç (1987) considers Infl to be the locus of tense. The reader should be prepared for this relatively minor terminological divergence.

NOTES

1 The terms “relative tense” and “absolute tense” are due to Comrie (1985).
2 The past tense morpheme in Japanese is also suffixed to so-called adjectives (keeyoosii) and adjectival verbs (keeyoo-doosi), as in the following examples:

   (i) [utukusii is an adjective (keeyoosii).]
      Sono e-wa utukusikat-ta.
      that picture-TOP beautiful-PAST
      ‘That picture was beautiful.’

   (ii) [kenkooda is an adjectival verb (keeyoo-doosi).]
      Titi-wa kenkoodat-ta.
      father-TOP healthy-PAST
      ‘My father was healthy.’

3 The terms “event” and “state” will be used in an informal and pre-theoretical manner until they are defined formally in Chapter 6.
4 Binary tense systems are common among the world’s languages (Comrie 1985:49).
5 My proposal is much more complicated than what this informal description indicates. For example, the SOT rule I will propose also applies to a present tense that is in the scope of a higher present tense. Please refer to Chapter 4 for details.
6 The expression “relativized NP” (or “relative clause NP”) will be used in this book to refer to an NP that contains a relative clause.
7 Scoping the NP to the complement clause level does not predict the intended interpretation, either.
8 The diagrams represent my view of how these two narratives should be analyzed.
10 This may explain why Montague (1973) regards the present perfect as the English construction that corresponds to the past tense operator in Intensional Logic (IL), which simply quantifies over past times. Bennett and Partee (1972) consider this possibility.
CHAPTER TWO

TENSE AND TEMPORAL ADVERBIALS
IN SIMPLE SENTENCES

2.1. TENSE AS A QUANTIFIER OVER INTERVALS

Let us start with a simple question. What does a tensed sentence mean? What is the semantic contribution of tense morphemes? Consider (1) first.

(1) John cried.

Prior (1957, 1967), the pioneering figure in tense logic, translates past tense sentences like (1) as formulas of the form $P\phi$ where $P$ is a past tense operator, and $\phi$ is any formula. $P$ is understood as an existential quantifier over past times. Thus, a formula of the form $P\phi$ is true iff there is a past time at which $\phi$ is true. On this analysis, (1) would be taken to mean that there is a past time $t$ such that John’s crying obtains at $t$. That is, a past tense sentence is assumed to involve existential quantification over times. Since our objective is to investigate natural language semantics with model-theoretic tools, let us consider what we mean by times. As a first approximation, let us assume that a past tense sentence of the form “NP V-ed” is true iff there is a past interval at which “NP V” is true. Then the above truth conditions for (1) can be informally restated as follows: (1) is true at interval $t$ if and only if there is an interval $t'$ preceding $t$ such that John cries at $t'$. Two points must be discussed here. Why is it that an existential quantifier should be invoked in analyzing the meaning of tense morphemes? Why is it that the truth value of a sentence is determined with respect to an interval, rather than with respect to some other entity (say, an instant)? Let us consider these questions in turn.
First, it is clear that at least some tensed sentences involve pure existential quantification over a set of times. Consider the following example:

(2) *John graduated from Harvard* and, therefore, belongs to its alumni.

The past tense of the italicized sentence in (2) seems to receive a simple existential quantifier meaning. It is roughly equivalent to “John is a Harvard graduate.” In the context in question, it does not matter exactly when he received his degree. The same claim can be made about Japanese. We can find past tense sentences that do not seem to refer to a particular past time.

(3) **Suzuki-san-mo erakunat-ta-nee.**
Mr. Suzuki-also become-important-PAST-exclamation
[Lit.] ‘Isn’t it a little surprising that] Mr. Suzuki became
[an] important [figure].’
Ima-wa syatyoo-san-dat-te.
now-TOP president-([I]-hear-that)
‘He is now president [of a company].’

The first sentence literally says that Mr. Suzuki *became* an important person. But the point the speaker wants to make is that he is now an important person. It is beside the point when he became one. I take this example to mean that the Japanese past can be used for existential quantification over times. Thus, there is no question that *some* past tense sentences in English and Japanese receive an interpretation that involves simple existential quantification over past times. The question is whether this is a rule or an exception. I will discuss this question in Section 2.3.

Second, let us discuss why interval-based systems have become standard in the formal semantics literature. This requires a detailed discussion. It was assumed implicitly in the early period of formal semantics that the non-empty set of temporal entities furnished by the model intuitively corresponds to a set of moments of time. Montague makes this assumption in his PTQ paper (1973) and imposes a linear order upon the set of times. A linear order is an order that is connected. Intuitively, the order corresponds either to “<” or to “≤.”
The former is strict and linear, and the latter is weak and linear. Let us take the former and discuss its properties briefly. The symbol “<” is used in arithmetic for “less than,” and it has become customary in temporal semantics to establish an analogy between numbers and temporal objects (or concepts). A strict linear order is defined as follows:

(4) A relation $R$ is a strict linear order iff

- (i) $\forall x, y, z [x R y \& y R z \rightarrow x R z]$ (transitive), and
- (ii) $\forall x \neg [x R x]$ (irreflexive), and
- (iii) $\forall x, y [x R y \rightarrow \neg [y R x]]$ (asymmetric), and
- (iv) $\forall x, y [x \neq y \rightarrow [x R y \lor y R x]]$ (connected)

It is left to the reader to see that the order of “less than” intuitively satisfies the conditions given in (4). If we think of the set of times as being composed of moments of time, it is intuitively correct to say that a strict linear order is imposed upon this set. For example, given three moments say 1 P.M., 2 P.M., and 3 P.M., and given also that 2 P.M. follows 1 P.M. and 3 P.M. follows 2 P.M., we can conclude that 3 P.M. is later than 1 P.M. This indicates that the first condition is satisfied. Moreover, 1 P.M. does not precede or follow itself (irreflexivity). If 1 P.M. is assumed to precede 2 P.M., then 2 P.M. does not precede 1 P.M. (asymmetry). And for any two distinct moments, say 1 P.M. and 2 P.M., one of them necessarily precedes the other (connectedness). To be slightly more technical, given a finite set of moments \{1 P.M., 2 P.M., 3 P.M.\}, the order that corresponds to our intuitions is the following set of pairs: \{<1 P.M., 2 P.M.>, <2 P.M., 3 P.M.>, <1 P.M., 3 P.M.>\}, where the first coordinate of each pair is understood as a time located earlier than the second coordinate of this pair. This is called a discrete time structure in that for any time, say 1 P.M., there is one unique time that immediately follows it. It is also a finite structure in that it has a definite beginning point and a definite ending point.

In order to do justice to our intuitions about time, the time structure I have sketched must be further enriched. For one thing, we normally believe that time extends infinitely into the past and into the future. This aspect of time structure cannot be captured by the above proposal. Thus, the set of moments must be an infinite set. Moreover, it has been suggested that the time structure is more like reals or rationals than like integers. Given our intuition that time flows continuously (i.e., has
no gaps), we must suppose that the set of times is dense. The set of moments is said to be dense iff given any two arbitrary moments, we can always find a third moment that falls between the two moments. That is, a set of moments $Mt$ is dense iff it satisfies the condition given in (5).

\[
(5) \quad \forall t_1 \forall t_2 [(t_1 \in Mt \& t_2 \in Mt \& t_1 < t_2) \rightarrow \exists t_3 (t_3 \in Mt \& t_1 < t_3 \& t_3 < t_2)]
\]

We now have an infinite and dense set of moments with a strict and linear order imposed on it. It is not clear whether PTQ presupposes a dense time structure; it simply posits a non-empty set as the ontological basis for time. An interpretation function furnished by the model applies to any constant and yields its intension, which in turn applies to a world-time pair and gives its extension at this world-time pair. In this system, the intension of any expression applies to members of $W \times T (= \{ <w, t> \mid w \in W \& t \in T \})$, where $W$ is a set of worlds and $T$ is a set of times. Let us identify $T$ with $Mt$ for now. According to this approach (1) is true iff there is a past moment at which John cries. However, many subsequent researchers regard this approach as inadequate.

One line of criticism was based upon the study of aspectual properties of verbs (often referred to as Aktionsarten). For example, it has been pointed out by Vendler (1967), Taylor (1977), Dowty (1979) and others that so-called accomplishments (e.g., *build a house*) can occur with *in*-adverbials but not with *for*-adverbials, whereas so-called statives (e.g., *be in the room*) and activities (e.g., *walk*) can occur with *for*-adverbials, and not with *in*-adverbials. Consider the following examples:

\[
(6) \quad \begin{align*}
\text{a.} & \quad \text{John was in the room for thirty minutes.} \\
\text{b.} & \quad \# \text{John was in the room in thirty minutes.} \\
\text{c.} & \quad \text{John built a house in three months.} \\
\text{d.} & \quad \# \text{John built a house for three months.}
\end{align*}
\]

What does it mean to say that (6a) is true? Intuitively, it means that John was in the room continuously for thirty minutes. How could we explain this intuition within an instant-based framework? The immediate possibility is to say that there is a set of moments that
corresponds to a thirty-minute period and John is in the room is true at every element of this set. This account will do fine with stative sentences like (6a), but not with examples like (6c). (6c) seems to say that a three-month period was required for John to complete a house. However, it is not clear how the difference described could be captured in an instant-based system. In order to characterize the distinctions among the above Aktionsarten classes in terms of their semantic properties, Bennett and Partee (1972) motivate an interval-based system. That is, any constant is evaluated with respect to a world-interval pair, not a world-moment pair. As Bennett and Partee (1972) and Dowty (1979) do, intervals can be defined in terms of moments.4 Let us adopt the following definition of interval here.

\[
(7) \quad \text{Let } Mt \text{ be the rational numbers. } Mt \text{ is to be regarded as the set of moments of time. Let } < \text{ be a strict linear ordering of } Mt. I \text{ is an interval of } Mt \text{ if and only if } I \subset T \text{ and for any } t_1, t_3 \in I \text{ such that } t_1 < t_3, \text{ if } t_2 \text{ is such that } t_1 < t_2 < t_3, \text{ then } t_2 \in I. \quad \text{[paraphrasing Dowty (1979:351)]}
\]

Informally put, (7) says that an interval is a subset I of the set of moments such that it has no “gaps.” In Bennett and Partee (1972), the fundamental aspectual difference between (6a) and (6c) is characterized in the following way. Building a house generally takes time. Supposing that John starts building a house at \( t_1 \) and finishes it at a later moment \( t_2 \), the interval \( \{ t \mid t_1 \leq t \leq t_2 \} \) is considered to be the time at which the extension of \textit{build-a-house} (assuming that it is a one-place predicate) includes John as its element. However, given the situation just described, John is not in the extension of \textit{build-a-house} at any proper-subinterval of \( \{ t \mid t_1 \leq t \leq t_2 \} \). In other words, the truth of (6c) at \( \{ t \mid t_1 \leq t \leq t_2 \} \) cannot be reduced to its truth at all of its subintervals. On the other hand, predicates like \textit{be-in-the-room} have different semantic properties. For example, if John enters the room at \( t_1 \) and leaves the room at \( t_2 \), John is in the extension of \textit{be-in-the-room} at the interval \( \{ t \mid t_1 \leq t \leq t_2 \} \). Furthermore, he is also in the extension of \textit{be-in-the-room} at all of its subintervals. Let us define the term “subinterval property” here.
(8) For any sentence \( \alpha \), \( \alpha \) is said to have the subinterval property iff the truth of \( \alpha \) at some time \( t \) entails the truth of \( \alpha \) at all the subintervals of \( t \).

Armed with the definition of the subinterval property given in (8), we can define sentences like (6c), often referred to as telic (= bounded) sentences, as those that do not have the subinterval property, and sentences like (6a), called atelic (= non-bounded) sentences, as those that do. Because it is not our main concern to investigate the Aktionsarten properties of predicates and sentences, I will not discuss this topic any further. Interested readers are referred to Dowty (1979) and the subsequent literature for a more detailed and formal discussion of this topic and related matters. The only theoretical point to keep in mind for our purposes is that in an interval-based system the extension of any constant will be determined with respect to an interval, rather than an instant.

Based upon the above discussion, the interpretation of tense operators is revised as in (9). Double brackets “[]” are used to indicate the denotation of the object language expression enclosed in them. \([P\phi]_{w,t} \) reads “the denotation of \( P\phi \) with respect to \( w \) and \( t \).” \( T \) is a set of intervals, and “<” is interpreted in such a way that \( t < t' \) holds iff every element of \( t \) precedes every element of \( t' \).

\[
\begin{align*}
(9) \quad & \text{a. } [P\phi]_{w,t} = \text{true for any } t \in T \text{ iff there is an interval } t' \in T \text{ such that } t' < t \text{ and } [\phi]_{w,t'} = \text{true.} \\
& \text{b. } [F\phi]_{w,t} = \text{true for any } t \in T \text{ iff there is an interval } t' \in T \text{ such that } t < t' \text{ and } [\phi]_{w,t'} = \text{true.}
\end{align*}
\]

On this proposal, (1) receives the following interpretation. First, it translates as in (10).

\[
(10) \quad P[cry' (\text{John})]
\]

cry' is a one-place predicate, and John is its argument. (10) is predicted to be true in \( w \) at \( t \) iff there is a time (i.e., interval) \( t' < t \) and \([\text{cry}' (\text{John})]_{w,t'} = \text{true.} \) This condition is satisfied iff \([\text{John}]_{w,t'} \) is an element of \([\text{cry}']_{w,t'} \). To obtain the value of \([\text{cry}']_{w,t'} \), the interpretation function furnished by the model applies to cry' and yields its intension, then the intension of cry' applies to the world-time
pair \langle w, t' \rangle \) and returns as its value the denotation of cry' at \langle w, t' \rangle. Thus, we now have a predicate logic-based language with tense operators which is interpreted by an interval-based semantic system.

2.2. THE CHOICE OF A LOGICAL REPRESENTATION LANGUAGE: SENTENTIAL TENSE OPERATORS VS. OBJECT LANGUAGE QUANTIFICATION OVER TIMES

In this section, I will discuss several alternative logical languages with which to symbolize tensed sentences in natural language. At the same time, I will take into consideration temporal expressions other than tense morphemes, such as temporal adverbials. At the end of this section, I will choose a logical representation language that is optimal for our purposes. Our discussion starts with the system that we developed in the last section: a predicate logic language with tense operators interpreted in terms of an interval-based semantics. This system translates (11a) as in (11b). There are alternative logical systems that accomplish approximately the same effect. For example, it is possible to introduce temporal terms and existential quantifiers explicitly in the logical language in order to represent quantification over times. At least two such logical systems have been proposed in the literature. They render (11a) as (11c) and (11d), respectively.

b. \( P[\text{graduate-from-Harvard}'(j)] \)
c. \( \exists t [t < \text{now} \& AT(t, \text{graduate-from-Harvard}'(j))] \)
d. \( \exists t [t < \text{now} \& \text{graduate-from-Harvard}'(t, j)] \)

Truth conditions for tense logic formulas of the form \( P\phi \) show that there are three components to the meaning of a past tense operator: (i) there is some time \( t \) (existential quantification over times); (ii) \( t \) is located before the speech time (the quantificational force is restricted to past times); (iii) the sentence with the past tense stripped off is true at \( t \). By incorporating temporal terms into the logical language, we can state the semantic effects of tenses in a more straightforward way and, more importantly, in a more flexible way. Dowty (1979) proposes a
notational system that produces formulas like (11c). It preserves PTQ’s view that the extension of any expression is given relative to a world-time pair. Therefore, aside from the “special” predicates such as “<” and “AT,” “normal” (verbal and nominal) predicates do not require temporal arguments. AT(t, φ) reads, “φ is true at t.” The truth conditions for (11c) are exactly like (11b) because the semantic contribution represented by a past tense operator in tense logic is represented explicitly in the logical language. An existential quantifier represents the quantificational force of the operator; the clause “t < now” in (11c) shows that its domain of quantification is restricted to past times; an AT operator represents the fact that the scope of the tense is the entire formula. The interpretation of (11c) proceeds as follows: [∃t(t < now & AT(t, graduate-from-Harvard’(j)))]_{w_0, t_0, g} is true iff there is a t_1 < t_0 such that [AT(t, graduate-from-Harvard’(j))]_{w_0, t_0, g'} is true, where g'(t) = t_1. For any temporal term t and any formula φ, [AT(t, φ)]_{w_0, t_0, g} (for some w_0, t_0, and g) is true iff [φ]_{w_0, g(t), g} is true. In other words, an AT operator has the effect of ignoring the evaluation time of the entire expression and forcing its sentential argument to be evaluated with respect to the denotation of its temporal argument. This is one way of introducing temporal individuals into the logical language.

Needham (1975) proposes a system that yields formulas like (11d). This type of system assumes that the intension of any expression applies to a world, not a world-time pair, to yield its extension. In other words, an index is composed of a world, not a world-time pair, and times are completely extensionalized. Unlike Dowty’s system, this system introduces times as arguments of verbal predicates. As (11d) shows, the predicate graduate-from-Harvard’ has an “extra” argument place for a temporal term. Thus, for example, for some world w, the extension of graduate-from-Harvard’ is a set of pairs {<x, t> | x graduates from Harvard at t}. This system is formally less redundant than Dowty’s system since times do not appear as coordinates of the index. One more potential difference between Needham’s system and others is that the former allows some predicates to have no temporal argument. The system that underlies (11d) is not used widely in the literature, but a similar system that employs event variables, instead of time variables, has been proposed
by Davidson (1967) and is adopted by many researchers. For example, Davidson would analyze (11a) as follows:

\[(12) \quad \exists e [e < \text{now} \land \text{graduate-from-Harvard}(e, j)]\]

This means that there is a past event of John’s graduating from Harvard. A verbal predicate is understood as denoting a relation between an event and an individual. Although events are different from times, the above two proposals are technically very similar to each other. There are other event-based representational languages that accomplish roughly the same semantic effects, but I will not pursue this topic here. I will take up event-based approaches in Chapter 6.

At this point, I will briefly discuss the formal properties of tense logic (i.e., logical systems that incorporate sentential tense operators, as in (11b)) and “standard logic” (i.e., others that incorporate temporal terms in the language, as in (11c) and (11d)). Van Benthem (1977) points out that although tense logic may have interesting logical properties, as we increase the empirical coverage of the system, tense logic and standard logic look more and more alike. Van Benthem points out further that the burden of proof is on the tense logic side since it proposes a substantial departure from the existing system. I concur with van Benthem. Furthermore, predicate-logic-based notations are more flexible and readily accommodate the complex temporal facts in natural language, as we shall see later in this chapter. I will therefore adopt a logical system that incorporates temporal terms. Since the system associated with (11d) is more economical and flexible than Dowty’s notation exemplified by (11c), we will adopt the former in the rest of the book. This choice of the logical language should not be taken as an important theoretical decision. I adopt Montague’s view that a logical representational language is used only for convenience, and it should not be considered to be a “logical form” that mirrors the semantic structure of natural language. The only important issue is whether the language has enough tools to describe the target constructions in natural language, and the reader will find that our notational system is indeed powerful enough for our purposes.
2.3. CONTEXT DEPENDENCY OF TENSE INTERPRETATION

Many recent discussions in formal semantics invoke the notion of context. The idea is that the denotation of some natural language expressions is determined with regard to the context of use and that the world and the time at which they are used are either irrelevant or inadequate to determine their denotations. Such expressions are called indexicals. Kaplan (1977) has made an important contribution in constructing a formal system that accounts for the behavior of indexical expressions. I will adopt a system that is essentially the same as Kaplan’s original proposal. The most obvious examples of indexicals include expressions like *I* and *you*. The referent of the expression *I* or *you* in (13) depends on who the speaker and the listener are. It is not sufficient to fix the world and the time at which it is uttered to determine their referents.

(13) I love you.

Suppose that John and Mary are talking to each other in a room. If John utters (13) and it is directed to Mary, *I* intuitively refers to John and *you* to Mary. If Mary says (13) and John is the addressee, then *I* refers to Mary and *you* to John. It is misguided to assume that *I* (or *you*) is a constant that refers to different individuals at different times (or worlds). John and Mary can utter (13) simultaneously addressing to each other, and their utterances would not convey the same information. In fact, it is quite possible that only one of them is true. This type of phenomenon is widespread in natural language. There have been two major ways of incorporating these terms into a formal system. One is to incorporate the necessary information into the index of a model. That is, we can let the index include such coordinates as a speaker, an addressee, and a place, etc. in addition to a world and a time. See Lewis (1972) for one such attempt. A different view was defended by Kaplan (1977). He claims that indexical expressions are directly referential in that they directly denote objects, independently of the index (or the “circumstance of evaluation” to use Kaplan’s terminology).

Suppose that I utter (14a) now here in my office in Seattle. It is intuitively false because I could be somewhere else now. On the other
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hand, (14b) is true whenever someone utters it at some place at some time. Kaplan proposes a logical system that captures these intuitions.

(14) a. Necessarily, I am here now.
    b. I am here now.

Before looking at Kaplan’s proposal, let us see for ourselves that extending the index to incorporate contextual information does not predict the above intuitions, at least not straightforwardly. Suppose that (14a–b) translate loosely as (15a–b), where “□” is a necessity operator.

(15) a. □[I be-located here now]
    b. I be-located here now

Let $S, L, P$ be a set of speakers, a set of listeners, and a set of positions, respectively, and let an index be a quintuple $<w, t, s, l, p>$, an element of $W \times T \times S \times L \times P$. Assume further that $[\text{here}]_{w, t, s, a, p} = s$, $[\text{now}]_{w, t, s, a, p} = p$, and $[\text{I be-located here now}]_{w, t, s, a, p} = t$. On this index approach, $[\text{I be-located here now}]_{w, t, s, a, p} = \text{true}$ iff $s$ is located at $p$ in $w$ at $t$. If we assume that validity is defined in terms of truth at all indices, (15b) turns out to be a contingent sentence. This result does not reflect our intuition that it is true whenever it is uttered. Kaplan (1977) shows that by restricting our attention to those indices $<w, t, s, l, p>$ (referred to as “proper indices”) where $s$ is located at $p$ in $w$ at $t$, (15b) is predicted to be valid. However, if we extend this analysis to the necessity operator and say that $\square \phi$ is true at some index iff $\phi$ is true at every “proper” index, we incorrectly predict that (15a) is also valid. Thus, the index approach to indexicals does not distinguish between (14a) and (14b). It is possible to correct this problem by dividing the index coordinates into those that are shiftable and those that are fixed, as in Kamp’s (1971) double-index system. However, Kaplan opposes this approach because he regards such an attempt as conceptually misguided.

Kaplan (1977) proposes an alternative to the index approach that accounts for the data in (14) and many others in a natural way. Unlike the traditional Fregean theory that has two levels of meaning, namely intension and extension, Kaplan’s theory distinguishes between what he calls “character” and “content,” in addition to extension. The most important aspects of Kaplan’s theory that I will adopt are the
following. The model must include the following set-theoretic objects: $A$ (a set of individuals), $W$ (a set of worlds), $Mt$ (a set of moments of time), $P$ (a set of positions), $C$ (a set of contexts), and $F$ (an interpretation function). $T$ (a set of intervals of time) is constructed from $Mt$ as shown in (7). The interpretation function furnished by the model applies to any constant and yields its character, which applies to the context and yields its content (i.e., normal intension). The content (or intension) then applies to a world-time pair (or a world) and gives the extension of the expression. Indexical constants and non-indexical constants differ from each other in that the former have a stable content, while the latter have a stable character. The denotation of each expression is determined with respect to $M$, $w$, $t$, $g_c$, $c$ ($M =$ model, $w =$ world, $t =$ time, $g_c =$ assignment furnished by $c$, and $c =$ context). For any $M$, $w$, $g_c$ and $c$, $\lbrack \Box \; \phi \rbrack_{M,w,g_c,c} = F(I)(c)(w) = c_{AG}$ (the agent of $c$), $\lbrack \Box \; \text{be-located}'(here)(I)(now) \rbrack_{M,w,g_c,c} = F(\text{be-located}'(here)(I)(now))(w) = c_{AD}$ (the addressee of $c$), $\lbrack \Box \; \text{now} \rbrack_{M,w,g_c,c} = F(\text{now})(c)(w) = c_T$ (the time of $c$), and $\lbrack \Box \; \text{here} \rbrack_{M,w,g_c,c} = F(\text{here})(c)(w) = c_P$ (the position of $c$). Moreover, the denotations of various indexical expressions are constrained in such a way that for any context $c$, the following conditions hold (among others): (i) $c_{AG}$ is located at $c_P$ in $c_W$ (the world of $c$) at $c_T$. (ii) $c_{AG}$ addresses $c_{AD}$ in $c_W$ at $c_T$. Let us look at how the system helps to account for the seemingly conflicting intuitions about (14a–b) by examining their formalized versions (16a–b).

\begin{enumerate}
  \item (16) a. $\Box \lbrack \text{be-located}'(here)(I)(now) \rbrack$
  \item \quad be-located'(here)(I)(now)
\end{enumerate}

Before we try to think about the interpretation of (16a–b), we must decide how to interpret the necessity operator “$\Box$."

\begin{enumerate}
  \item (17) $\lbrack \Box \phi \rbrack_{M,w,g_c,c}$ (for any formula $\phi$) = 1 iff for every $w' \in W$, $\lbrack \phi \rbrack_{M,w',g_c,c} = 1.$
\end{enumerate}

In (17) necessary truth is defined in terms of all worlds, and with respect to the original time and context. The interpretation of (16a) proceeds as follows. $\lbrack \Box \lbrack \text{be-located}'(here)(I)(now) \rbrack \rbrack_{M,w,g_c,c} = 1$ iff for every $w' \in W$, $\lbrack \text{be-located}'(here)(I)(now) \rbrack_{M,w',g_c,c} = 1$. This is the case iff for every $w' \in W$, $\lbrack \text{be-located}'(here)(I)(now) \rbrack_{M,w',g_c,c} = 1$. This is presumably false because the agent of $c$ is not guaranteed to be located
at the place of $c$ at the time of $c$ at worlds other than the original world (i.e., $w$).

On the other hand, the fact that (14b) is true whenever it is uttered can be accounted for in terms of the concept of validity as defined in (18) (Kaplan 1977:547).

(18) A formula $\phi$ is valid iff for every $M$, and every context $c$ of $M$, $\phi$ is true at $c_W$ and $c_T$ relative to $c$ and $M$.11,12

For any model $M$ and $c$, be-located'(here) (I)(now) is true in $c_W$ at $c_T$ relative to $M$ and $c$. This is so because for any $c$, $c_{AG}$ is guaranteed to be located at $c_P$ in $c_W$ at $c_T$. Thus, according to (18), (16b) turns out to be valid. In sum, in Kaplan’s system, necessary truth is obtained by quantifying over all worlds while fixing the context and the time. On the other hand, validity is defined as above in terms of quantification over possible models and contexts. This important difference between necessary truth and validity accounts for the observed difference between (14a) and (14b).

In what follows, I will adopt a Kaplan-type framework to deal with the semantics of tenses and temporal expressions. It has been claimed that English temporal expressions like now, today, yesterday, and tomorrow are indexical expressions. Kamp (1971) shows clearly by taking now as an example that a temporal coordinate (sometimes referred to as an evaluation time) of the index is not enough to predict the right interpretations for such indexical expressions. Kamp (1971:229) considers the following examples:

(19) a. I learned last week that there would be an earthquake.
    b. I learned last week that there would now be an earthquake.

In (19b), the expression now is in a clause that serves as the complement clause of a verb that is in the past tense. However, the denotation of now does not seem to be influenced by the presence of a past tense in the matrix sentence. This indicates that the interpretation of now is not bound to the time of learning, which is indicated by the matrix clause. Rather it is bound to the “context time” (i.e., the speech time). The denotation of other indexical temporal adverbials can be defined in a straightforward manner.
For any \( c \in C \) and \( w \in W \), the following hold:

a. \( F(\text{today})(c)(w) \) = the day that contains \( F(\text{now})(c)(w) \) as part
b. \( F(\text{yesterday})(c)(w) \) = the day that immediately precedes the day of which \( F(\text{now})(c)(w) \) is part
c. \( F(\text{tomorrow})(c)(w) \) = the day that immediately follows the day of which \( F(\text{now})(c)(w) \) is part

What about tense morphemes in natural language? If we follow the way in which tense operators are analyzed in tense logic, we expect them to be evaluation time sensitive. However, Kamp shows that at least some tense morphemes in natural language behave as if they are indexicals or indexical-dependent expressions. Consider the following examples:

(21) a. A child was born that would become ruler of the world.
    b. A child was born that will become ruler of the world.

(21a) places the time of the child’s becoming a ruler at some time later than the time of his birth, whereas (21b) places it some time after the speech time. Kamp represents the interpretation of (21a) as (22), which employs a tense logic notation.13

(22) \[ P \exists x[\text{child}(x) \& \text{be-born}(x) \& F(\text{become-ruler-of-the-world}(x))], \]
where \( P \) and \( F \) are interpreted in the following way:
\[
[P \phi]_{M,w,t,g} = 1 \text{ iff for some } t' < t, [\phi]_{M,w,t',g} = 1
\]
\[
[F \phi]_{M,w,t,g} = 1 \text{ iff for some } t' > t, [\phi]_{M,w,t',g} = 1
\]

This shows that the conventional interpretation of the tense operators that says that their interpretation is evaluation time sensitive is enough to make the right predictions about the past tense morpheme and the future tense morpheme \textit{would}. On the other hand, the meaning of (21b) cannot be represented merely by \( P \) and \( F \).14 Kamp proposes the following translation:

(23) \[ P \exists x[\text{child}(x) \& \text{be-born}(x) \& N\!F(\text{become-ruler-of-the-world}(x))] \]
Here, $N$ stands for “now” and is interpreted in relation to the speech time. For the purpose of indicating the interpretation of $N$, we need a time index for the speech time that is never shifted by operators. The truth condition for formulas that involve $N$ is given as follows:

$$(24) \quad [N\phi]_{M,w,s,s,g} = 1 \text{ iff } [\phi]_{M,w,s,s,g} = 1$$

The assumption here is that any expression is evaluated with respect to $M, w, t, s, g$, where $t$ is the “evaluation time” and $s$ is the speech time (or the “context time”). A sentence $\phi$ uttered in $w_0$ at $t_0$ is evaluated with respect to $M, w_0, t_0, s$, $g$. Note that the initial evaluation time is the speech time. The evaluation time coordinate can be shifted by various operators, but the context time coordinate is never shifted and is used to keep track of the speech time. This type of index system is called a double-index system. In informal terms, this means that we distinguish between the index for the circumstance of evaluation and the index for the context. (24) says that a sentence that contains the future tense will means “it is the case now that $\phi$ is true at a time later than now.” Let us see how (21b) is interpreted via the translation (23).

$$(25) \quad [\exists x[\text{child}^e(x) & \text{be-born}^e(x) & \text{NF}[\text{become-ruler-of-the-world}^e(x)]]]_{M,w,t,s,g} = 1 \text{ iff there is a time } t_1 < s \text{ such that the following holds:}$$

$$[\exists x[\text{child}^e(x) & \text{be-born}^e(x) & \text{NF}[\text{become-ruler-of-the-world}^e(x)]]]_{M,w,t_1, s,g} = 1. \text{ This is the case iff there is a child } e \text{ that is born in } w \text{ at } t_1 \text{ and } [\text{NF}[\text{become-ruler-of-the-world}^e(x)]]_{M,w,t_1, s,g} = 1, \text{ which holds iff}$$

$$[\text{F}[\text{become-ruler-of-the-world}^e(x)]]_{M,w,s,s,g} = 1$$

Note here that the shiftable evaluation time is reset to $s$. $g^e$ reads, “the function that is exactly like $g$ with the possible exception that it assigns $e$ to $x$.” It is easy to arrive at the conclusion that the time at which $e$ becomes the ruler lies at a time later than the speech time. This is the desired result.

Although Kamp’s original contribution was made in the context of motivating a double-index system, which predates Kaplan’s proposal, we can reinterpret the above result in terms of the system I am adopting. Kamp makes it clear that having an index that contains just a world coordinate and a time coordinate is not sufficient to predict the
semantic contribution of the English future tense. In terms of our system, the above example (21b), which involves the future tense will, can be rendered as in (26). Instead of using now, I will henceforth use the symbol “s∗” to designate the speech time, which should be understood as an indexical constant that always denotes the context time.

\[
\exists t < s^* \& \exists x [\text{child}(t, x) \& \text{be-born}(t, x) \& \exists t' [s^* < t' \& \text{becomes-ruler-of-the-world}(t', x)]]
\]

Regardless of the choice of the framework, we should note the point that Kamp makes: expressions like would are evaluation time sensitive (i.e., sensitive to the time index which is shiftable), whereas others like will and now are speech time sensitive. Other expressions that are speech time sensitive (i.e., context time sensitive) include yesterday and tomorrow.

I follow Chomsky (1957) and the subsequent literature and assume that the future auxiliary surfaces as will or would depending upon its tense. I will claim that the English present is inherently speech time sensitive, but the English past is not. As for the Japanese tense morphemes, I will show in Chapter 4 that neither the present nor the past is speech time sensitive. Thus, according to my analysis, the behavior of the English future auxiliary will that Kamp discusses is an exception, rather than a rule, among the tense morphemes we study in this book. I posit a truth definition that has the effect of introducing speech time dependency. I will show that this truth definition is not an artifact of a formal system but is based upon a substantive claim about the semantics of speech acts, which is also closely related to the semantics of indirect discourse verbs (e.g., say). In order to show that we must adopt this position with respect to the tense morphemes we deal with (with the important exception of the English present), we must await a detailed discussion of embedded tenses, which will be presented in Chapter 3 onwards.

Context dependency of the interpretation of tenses or tensed sentences is also discussed from a different angle. It has been pointed out that simple existential quantification over times is not enough to understand the semantics of tense morphemes. Let us take the simple past and the past perfect to make the point. For example, the intuitive
The semantic difference between (27a) and (27b) cannot be captured by the formulas given in (28a–b).

\[
(27) \quad \begin{array}{l}
a. \text{John left.} \\
b. \text{John had left.}
\end{array}
\]

\[
(28) \quad \begin{array}{l}
a. \exists t [t < \text{now} \land \text{John leaves at } t] \\
b. \exists t [t < \text{now} \land \exists t' [t' < t \land \text{John leaves at } t']] \\
\end{array}
\]

(28a) simply says that there is a past time at which John leaves, while (28b) says that there is a past time \(t\) and there is a time \(t'\) located before \(t\) such that John leaves at \(t'\). Given that time is dense, (28a) and (28b) have exactly the same truth conditions. Thus, the formulas given in (28a–b) do not capture the intuitive difference between (27a–b).

Reichenbach (1947) suggests how to capture this type of difference. Let us summarize his main points. Reichenbach’s system employs three temporal entities: the point of speech (S), the point of reference (R), and the point of the event (E). The point of speech is the time at which the sentence is uttered, and the point of the event is the time at which the event described in the sentence obtains. We have already seen by citing Kamp’s work that the point of speech should be included in the context because some embedded tense morphemes need to refer to it and that some expressions like \textit{now} crucially depend on it for their reference. We can also understand what the point of the event is. Although the truth conditions for a past tense sentence in our proposal involve existential quantification over times and, therefore, no event time as such is referred to by the sentence, we must find a time that satisfies the truth conditions in order to render the sentence true. We can think of such a time as an event time for the sentence. However, in the context of the traditional temporal semantics, it is hard to understand what the point of reference is.

Reichenbach (1947:290) claims that the following diagrams represent the temporal interpretations associated with various tense forms in English:
We thus come to the following tables, in which the initials ‘E’, ‘R’, and ‘S’ stand, respectively, for ‘point of the event’, ‘point of reference’, and ‘point of speech’, and in which the direction of time is represented as the direction of the line from left to right:

\[
\begin{array}{ccc}
\text{Past Perfect} & \text{Simple Past} & \text{Present Perfect} \\
\text{I had seen John} & \text{I saw John} & \text{I have seen John} \\
\text{E} & \text{R} & \text{S} & \text{E} & \text{R} & \text{S} & \text{E} & \text{R} \\
\end{array}
\]

The introduction of R enables Reichenbach to distinguish between the simple past and the past perfect: the event time is located prior to the reference point for the past perfect, and the event time is simultaneous with the reference point for the simple past. But it is not clear how these diagrams should be interpreted in a model-theoretic framework.

Formal semanticists (e.g., Needham 1975, Bäuerle 1978, Kratzer 1978, Nerbonne 1984) agree that Reichenbach’s point of reference should be taken to be a contextually determined interval salient at a certain point in a discourse. For instance, in a narrative discourse, we generally do not talk about all past times. We focus on a specific interval in the past, and the temporal reference of the sentence is made in relation to this interval, which we may refer to as the point of reference. Reichenbach’s point is that a past tense sentence serves to locate the event described in the sentence at the reference point, whereas a sentence in the past perfect serves to locate the event before the reference point. Reichenbach (1947:288–89) quotes the following passage from Macaulay:
In 1678 the whole face of things had changed … eighteen years of misgovernment had made the … majority desirous to obtain security for their liberties at any risk. The fury of their returning loyalty had spent itself in its first outbreak. In a very few months they had hanged and half-hanged, quartered and emboweled, enough to satisfy them. The Roundhead party seemed to be not merely overcome, but too much broken and scattered ever to rally again. Then commenced the reflux of public opinion. The nation began to find out to what a man it had intrusted without conditions all its dearest interests, on what a man it had lavished all its fondest affection.

Reichenbach (1947:289) then claims the following:

… the point of reference is here the year 1678. Events of this year are related in the simple past, such as the commencing of the reflux of public opinion, and the beginning of the discovery concerning the character of the king. The events preceding this time point are given in the past perfect, such as the change in the face of things, the outbreaks of cruelty, the nation’s trust in the king.

The point of reference then is a definite interval given by the context. If Reichenbach is right, the simple past tense serves to locate events within this interval, whereas the past perfect locates events before it. Within our framework, Reichenbach's proposal can be executed in the following way. For example, the difference between the simple past and the past perfect in (27a–b) is represented as in (31a–b).

\[(31)\]
\[
\begin{align*}
\text{a. } & \exists t [ t < s^* \land t \subseteq t_R \land \text{leave}'(t, \text{John})] \\
\text{b. } & \exists t [ t < s^* \land t < t_R \land \text{leave}'(t, \text{John})]
\end{align*}
\]

The symbol “\(\subseteq\)” is used to indicate a subset (“part of”) relation between two intervals. The symbol “\(t_R\)” is mnemonic for the point of reference and is regarded as a free variable. We assume that a context-sensitive value assignment \(g_c\) assigns an appropriate value to the point of reference. On this assumption, (31a) says that John leaves within this reference time, whereas (31b) says that John leaves before this time.\(^{15}\) Although the representations given in (31a–b) should not be taken as a definitive analysis of the difference between the simple past
Partee (1973) also demonstrates from a slightly different point of view that the interpretation of a past tense sentence depends in part upon a contextually salient past interval. She draws an analogy between pronouns and tenses by showing that they have many properties in common. Before discussing their similarities, let us briefly look at how pronouns are dealt with in the formal semantics literature. In the formal semantics literature before the advent of Discourse Representation Theory (Kamp 1981, Heim 1982), it was customary to recognize two types of pronouns: bound-variable pronouns and free pronouns (e.g., Partee 1978). The former refer to those pronouns that behave like (or translate as) bound variables in predicate logic. The latter refer to those that behave like free variables in the logical representation. Consider the following examples:

(32)  
   a. Every boy likes himself.  
   b. (Pointing at a man) He is the criminal.  
   c. John is a graduate student. He studies linguistics.

I assume that *himself* in (32a) is treated as a case of variable-binding in the usual logical sense: the pronoun *himself* does not denote a particular male individual; (32a) means that for every boy x, x likes x. The pronoun *himself* is represented as a variable x that is bound by a universal quantifier. On the other hand, (32b) has a different property. The information about the referent of the pronoun *he* comes from the immediate situation in which the utterance is made. The identification of the referent is assisted by a pointing gesture. This type of pronoun is usually referred to as a deictic or demonstrative pronoun. (32c) is traditionally referred to as an anaphoric pronoun. It “refers back” to John in the first sentence. Under the assumptions made in predicate logic (or in similar logical systems), it cannot be dealt with as an instance of a bound variable. Examples like (32b) and (32c) are grouped together and are referred to as referential pronouns or free pronouns. They are so-called because they can translate as free variables that receive values from the context and behave like referential expressions. In (32a) it makes no sense to ask which individual *himself* refers to. By contrast, this question is meaningful with regard to examples like (32b–c). As mentioned above, I posit a
context-sensitive value assignment function (denoted by $g_c$) that assigns appropriate values to free variables at the logical representation level (see, for example, Heim and Kratzer 1993). There are some problematic occurrences of pronouns that fall outside this classification (e.g., the so-called E-type pronouns discussed by Evans (1980) and donkey pronouns discussed by Kamp (1981) and Heim (1982)), and these problems caused some authors to reconsider this typology of pronouns, but I assume the traditional dichotomy of pronouns for the purpose of this book.

Given the above assumptions about pronouns, Partee (1973, 1984) points out that pronouns and tenses have some similar properties. The point that I will focus on is Partee’s (1973) claim that tenses (at least in some cases) behave like free pronouns. First, let us consider some examples originally due to Bäuerle (1978) and Partee (1973, 1984).

(33) a. Sheila had a party, and Sam got drunk.
    b. When John saw Mary, she crossed the street.
    c. John got up, went to the window, and raised the blind.

The examples in (33) show that the temporal interpretation of a sentence that occurs in a narrative discourse is often obtained from the previous sentence. In (33a), the time of Sam’s getting drunk is the time of the party. In (33b), the time at which Mary crosses the street is almost simultaneous with the time of John’s seeing her. Thus, the interpretation of these sentences depends on the intervals that the context provides. The question is whether the interval provided equals the time at which the episode in question obtains. For example, I said that the time at which Sam gets drunk is the time of the party. But this is clearly a very crude and inaccurate way of describing the interpretation of *Sam got drunk* in (33a). Suppose that the party started at eight and lasted until eleven. Then Sam probably got drunk within this three-hour interval or possibly after the party was over. The same is true of (33b). Although John’s seeing Mary and Mary’s crossing the street are temporally close to each other, they do not necessarily occur simultaneously. The temporal relations between when-clauses and main clauses have been widely discussed in the literature (e.g., Vlach 1981, Hinrichs 1986), but no clear conclusion has been reached as a result of such discussions. It seems best to say in the context of the above proposal that a when-clause provides a relatively extended
interval, which does not necessarily correspond completely to the event or state specified by the *when*-clause, and the main clause serves to locate an event *within* this interval. (33c) shows that in a narrative discourse, a sentence is often understood as describing an event that *follows* the event depicted by the preceding sentence.\(^{16}\) If tense were really like a free pronoun, we would expect that the second sentence in (33a), for example, translates as (34).

(34) \[ t < s^* \& \text{get-drunk}'(t, \text{Sam}) \]

Then the context would supply the value of the free variable \( t \). This analysis draws a complete parallel between referential pronouns and (some uses of) tenses. I will refer to this type of theory as the *referential theory of tense*. The position Partee defends in her earlier paper (1973) can be identified with this theory. However, Partee later (1984) concedes that the analogy between free pronouns and tenses is not complete. It is best for our purposes to conclude that the context supplies a relatively extended interval for the interpretation of a past tense sentence and that the episode described by the sentence falls within this interval. This is the view originally due to Bäuerle (1978). We can assume that this contextually supplied interval is what Reichenbach had in mind when he proposed the point of reference. We have thus learned in this section that the interpretation of tense may involve two types of context dependency: (i) dependency upon the speech time, and (ii) dependency upon reference times. I have argued, however, that reference times merely constrain the semantic contribution of tense and do not completely determine it.

### 2.4. THE INTERACTION OF TENSE AND TIME ADVERBIALS

In this section, I will consider how temporal adverbials interact with tenses. The problems to be addressed here involve both syntactic and semantic issues. Temporal adverbials come in many types. I will first consider so-called frame adverbials (or main tense adverbials in Dowty’s (1979) terms) like *yesterday* and *1993*. Dowty (1979) points out that if a frame adverbial like *yesterday* is understood as an operator
on a par with tense operators, we make the wrong predictions. Since we have already concluded that yesterday is an indexical, we will not discuss why yesterday cannot be regarded as a sentential operator. The reader is referred to Dowty’s original discussion. Let us simply adopt Dowty’s conclusion that yesterday must serve as a restriction upon the time variable in a logical representation. It can in fact be seen as an expression that supplies a reference time. According to our notational system, which resembles Dowty’s, (35a) is symbolized as in (35b).

\[(35) \quad \begin{align*}
\text{a.} & \quad \text{John coughed yesterday.} \\
\text{b.} & \quad \exists t [t < s^* \& t \subseteq \text{yesterday}' \& \text{cough'}(t, j)]
\end{align*}\]

As mentioned earlier, the expression yesterday’ is understood as an indexical constant that denotes the twenty-four hour interval which immediately precedes the day that contains the speech time. (35b) states correctly that there is a past time which is part of yesterday and at which John coughs.

Let us now consider how to execute this proposal compositionally. Dowty (1979) proposes a syntactic rule that applies to a frame adverbial such as yesterday and a tenseless sentence and yields a tensed sentence that contains the adverbial. (36) represents how the sentence in (35a) is syntactically analyzed.

\[(36) \quad \text{John coughed yesterday.} \]

\[
\begin{array}{c}
\text{yesterday} \\
\text{John cough}
\end{array}
\]

Note that the relevant syntactic rule combines a tenseless sentence like John cough and an adverbial like yesterday to yield a tensed sentence. This means that the past tense morpheme is introduced syncategorematically (= without being assigned to any syntactic category). In order to make our discussion accessible to the reader, I will reinterpret Dowty’s original semantic proposal in my notational system. First, yesterday is taken to denote the set of all sets of times that include a part of yesterday as an element. Second, tenseless sentence John cough translates as cough'(j), which denotes a set of times in my system unlike in Dowty’s.\(^{17}\) Third, the relevant translation rule says that (36) translates as \(\alpha(\lambda t' [t' < s^* \& \beta(t')])\), where \(\alpha\) is the translation of the adverbial (e.g., yesterday) and \(\beta\) is the translation of the tenseless
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The symbol "\( P_t \)" is used for a variable for sets of times. The final translation was presented earlier as (35b). Dowty's proposal could be taken to mean that an adverbial and a tense morpheme jointly contribute to the existential quantification associated with tensed sentences.

Dowty acknowledges three problems with his system. First, since it generates a tensed sentence only when a tenseless sentence combines with an adverbial, he must posit two special rules to produce tensed sentences with no overt adverbs. For example, (38a) is produced with a rule that combines a tenseless sentence \( \text{John smile} \) with an adverbial that means "at some past time," which does not surface. A similar procedure is required to produce (38b). This is rather artificial.

\[
\begin{align*}
(38) \quad a. & \quad \text{John smiled.} \\
& \quad \text{John will smile.}
\end{align*}
\]

Second, the system has difficulty with multiple adverbials. Since combining an adverbial with a tenseless sentence necessarily produces an existentially closed formula, no additional adverbial can be added on to it. And third, since adverbs must "conspire" with tense morphemes to give the right surface structures, temporal adverbials like \( \text{today} \) that are compatible with different tenses must belong to multiple categories.

Stump (1985) proposes a system that corrects the above problems. His system translates a tensed sentence as a "temporal abstract" (a set of intervals at which a sentence is true, represented by an expression of the form \( \lambda t \{ \ldots t \ldots \} \)), and a frame adverbial as a function from sets of intervals into sets of intervals. Thus, tensed sentences with or without a frame adverbial are interpreted as sets of intervals. Even after an
adverbial is incorporated into a tenseless sentence, the output is still a temporal abstract. Thus, it can still be combined with another adverbial, and the process can be repeated any number of times. An existential quantifier is then introduced because of the truth definition. This system has several advantages over Dowty’s system. First, we no longer need an empty adverbial to account for tensed sentences that have no overt adverbial. Second, we can easily deal with sentences with multiple adverbials. A general “existential closure” rule takes care of tensed sentences. Although Stump does not explicitly claim it, his existential closure rule seems to represent the view that no particular lexical item is responsible for existential quantification over times. I will incorporate Stump’s idea in the proposal given at the end of this chapter.

Let us now turn to the proposal of Bäuerle and von Stechow (1980), who argue against the view that a tense morpheme itself translates as (an expression that includes) an existential quantifier. Consider (39a–b).

(39) a. John coughed exactly twice yesterday.
   b. John coughed exactly three times yesterday.

Let us refer to adverbials like (exactly) twice and (exactly) three times “number adverbials,” reserving the term “frequency adverbial” to expressions like always and often. Intuitively, (39a) and (39b) translate as (40a) and (40b), respectively.

(40) a. \[ \exists_2 t [ \exists \ast t < s^* \& t \subseteq \text{yesterday} \& \text{John coughs at } t ] \]
   b. \[ \exists_3 t [ \exists \ast t < s^* \& t \subseteq \text{yesterday} \& \text{John coughs at } t ] \]
   [N.B.: \( \exists_2 y[ \ldots t \ldots ] \) is true with respect to some \( w, g_c, \) and \( c \) if there are exactly two \( i \in T \) such that \( [ \ldots t \ldots ] \) is true with respect to \( w, g_c^i/t, \) and \( c, \) where \( g_c^i/t \) is exactly like \( g_c^i \) with the possible exception that \( g_c^i(t) = i. \) Similarly for \( \exists_3 t. \)]

It seems natural to let number adverbials translate into expressions that contain special existential quantifiers like \( \exists_2 t \) and \( \exists_3 t. \) However, if we assume that past tense also induces a (normal) existential quantifier independently of the one introduced by a number adverbial, we predict
two distinct scope relations between the two quantifiers. For example, (39b) translates either as (41a) or as (41b).

\[(41)\]

\[
a. \exists t' \exists t'[t' \subseteq t & t' \subseteq \text{yesterday} & t' < s^* & \text{John coughs at } t']
\]

\[
b. \exists t'[t' < s^* & t' \subseteq \text{yesterday} & \exists t[t \subseteq t' & \text{John coughs at } t]]
\]

The translation (41a) predicts that (39b) is never true because when there is at least one time, say \(t_0\), within yesterday at which John coughs, there are infinitely many intervals within which \(t_0\) is located. (41b) on the other hand entails (42).

\[(42)\]

\[
\exists t'[t' < s^* & t' \subseteq \text{yesterday} & \exists t[t \subseteq t' & \text{John coughs at } t]]
\]

Our current system translates (39a) into (42). This means that (39b) entails (39a). This obviously is an undesirable result. In order to arrive at the desired formulas given above as (40a) and (40b), we must suppress an existential quantifier normally associated with past tense morphemes (or sentences). The trouble is, though, that when a number adverbial is not around, an existential quantifier is required.

\[(43)\]

\[
a. \text{John coughed yesterday.}
\]

\[
b. \exists t[t \subseteq \text{yesterday} & t < s^* & \text{John coughs at } t]
\]

(43a) means that John coughed at least once yesterday. If so, (43b) appears to be the right symbolization of the interpretation in question. But if we assume that past tense does not serve to introduce an existential quantifier (or that there is no default existential closure rule), what accounts for the existential quantifier interpretation of (43a)? Bäuerle and von Stechow assume that a covert adverbial at least once is around to supply the existential quantifier force in this case.

This account suggests that we need one overt or covert number adverbial in any sentence and it is responsible for the existential quantifier meaning associated with the entire sentence. However, the presence of a “number adverbial” like twice does not preclude the possibility that the entire sentence receives an existential quantifier
interpretation with regard to its tense morpheme. I assume that the expression *used to* indicates an existential assertion about a past propensity on the part of the subject.

(44)  
a. John used to sneeze exactly three times every day.  
b. \( \exists t [ t < s^* \& \forall t' [(t' \subseteq t \& a\text{-}day'(t')) \rightarrow \exists t'' [ t'' \subseteq t' \& \text{John sneezes at } t'']] \) (where *a\text{-}day* is assumed to denote a set of intervals \( t \) such that \( t \) exactly corresponds to a day.)  
c. John sneezed exactly three times every day.  
d. John ran around the park exactly three times every day, but that was a long time ago.

(44a) then means that there is some past interval during which John sneezes exactly three times every day. This interpretation is represented as in (44b). It may be suggested that the expression *used to* specializes for expressing a past habit, and is not a normal tense. I believe, however, that given an appropriate context, (44c–d) also could express a simple existential quantification over past times. This seems to suggest that the source of the existential quantification associated with a matrix sentence is not a number adverbial.

Moreover, note that the problem suggested by Bäuerle and von Stechow (1980) occurs only when the adverb *exactly* is present. Sentences such as the following pose no problems for the hypothesis that past tense induces existential quantification over times:

(45)  
a. John coughed three times yesterday.  
b. John coughed twice yesterday.

If we interpret *three times* as meaning ‘at least three times’ and *twice* as ‘at least twice’, which is justified by a Gricean pragmatic principle (Grice 1975), the system that predicts that (45a) entails (45b) is not problematic. We can simply let the existential quantifier associated with the past tense morpheme have wider scope than the quantifier associated with the number adverbial, and we obtain the desired interpretation.

I think it is fair to say that tensed sentences generally induce existential quantification over times. I shall offer the following account of the behavior of the number adverbials that contain the word *exactly*.
When we count the number of events and claim that a certain type of event occurred exactly \(x\) times, we must restrict our attention to some specific interval within which this counting takes place. This is clear because by making a claim about the exact number of occurrences of something, we make an implicit commitment about the non-occurrence of the same type of episode at the temporal locations where it could occur. In other words, one must decide on an exact interval which is to be checked in order to claim an exact number of occurrences of something. This intuitive idea is incorporated in my proposal to be presented at the end of this chapter. According to this proposal, (39b) translates compositionally into IL as in (46), which has the same truth conditions as (47). \(^{21}\)

\begin{align*}
(46) & \text{LF: John Past cough exactly three times yesterday.} \\
& 1. \text{exactly three times } \Rightarrow \lambda t'' \lambda x \lambda \exists t_3 \exists ! t_3 [t_3 \subseteq t & t = t'' & P(x)(t_3)] \\
& 2. \text{exactly three times yesterday } \Rightarrow \lambda P \lambda x \lambda \exists t_3 \exists ! t_3 [t_3 \subseteq t & t = \text{yesterday}' & P(x)(t_3)] \\
& 3. \text{cough exactly three times yesterday } \Rightarrow \lambda x \lambda \exists t_3 \exists ! t_3 [t_3 \subseteq t & t = \text{yesterday}' & \text{cough'}(x)(t_3)] \\
& 4. \text{Past cough exactly three times yesterday } \Rightarrow \lambda \, \emptyset \lambda t' \{ \lambda x \lambda \exists t_3 \exists ! t_3 [t < t' & t \subseteq t_{RT} & \exists ! t_3 [t_3 \subseteq t & t = \text{yesterday}' & \text{cough'}(x)(t_3)]\\
& 5. \text{John Past cough exactly three times yesterday } \Rightarrow \lambda t'' \{ \lambda P(t_1, j) [P(t_1, j) \lambda x \lambda \exists t_3 \exists ! t_3 [t_3 \subseteq t & t = \text{yesterday}' & \text{cough'}(x)(t_3)]\\
& 6. \exists t_1 [t_1 < s* & t_1 \subseteq t_{RT} & \exists ! t_3 [t_3 \subseteq t_1 & t_1 = \text{yesterday}' & \text{cough'}(j)(t_3)]] \text{ (Truth Definition)}
\end{align*}

Although the translation given in (46) is existentially closed as in other past tense sentences, there is only one interval that satisfies the condition, namely the interval that corresponds exactly to yesterday, and it says furthermore that there are exactly three times within this interval (i.e., yesterday) at which John coughs. This is the desired interpretation. The proposed analysis is syntactically unnatural in that \textit{exactly three times} combines with \textit{yesterday} first, rather than with the VP. A better syntactic analysis is possible, but it would complicate the proposal and, therefore, is not executed for the purpose of this book.
Another argument against the existential quantifier analysis of past tense sentences might be raised in connection with point adverbials. That is, those sentences that involve point adverbials do not seem to induce existential quantification over times. We obviously need to allow for the possibility that tensed sentences make reference to an instant, or a very short interval, in examples like (48).

(48) The train arrived at the station at 1 P.M. sharp.

In (48) at 1 P.M., which can be regarded as the reference time for this sentence, narrows down the time in question to a very short interval. But the existence of such sentences is no proof that tensed sentences in general do not exhibit existential quantification over times. We can simply translate (48) as (49a) or as (49b) and assume that because the reference time is so short that we just do not recognize the force of the quantifier.

(49) a. ∃t[t < s* & t ≤ 1 P.M. & arrive′(t, the-train)]
    b. ∃t[t < s* & t = 1 P.M. & arrive′(t, the-train)]

The case of number adverbials can be seen in the same light: although an existential quantifier is there, there is only one interval that satisfies the conditions.

I hope to have shown that Bäuerle and von Stechow’s (1980) examples discussed above do not necessarily show that tense morphemes do not have an inherent quantificational force. I think it is fair to say that both the quantificational theory and the referential theory have a point. As mentioned above, Partee (1984) expresses the same view. There are cases in which simple existential quantification over a set of times is required of a sentence in the simple past tense. There are others that do not require an existential quantifier. The question is which we should take to be the default. As I have shown, it is possible to maintain the assumption that any tensed sentence involves existential quantification over a set of times. This requires some complex treatments of a small set of cases that involve number adverbials when they occur with exactly, but I believe it is justified given their exceptional status. I think this is better than positing a phantom adverbial at least once, which does not surface for a large number of cases. Note, finally, that what is at issue is not whether
tense morphemes themselves translate as (an expression that contains) an existential quantifier over times. What is at issue is whether the interpretation of a tensed sentence has an existential quantifier meaning as a rule or only in exceptional cases. I identify with the former position.

2.5. THE STRUCTURE OF THE AUXILIARY AND “COMPOSITIONALITY”

In this section, we will look more closely at the English auxiliary system. In the syntactic literature, it has been assumed since the publication of Chomsky’s Syntactic Structures (1957) that the past tense morpheme -ed, the future auxiliary, and the perfect form have are distributionally independent of each other. In other words, sentences such as (50a–b) are well-formed English sentences.

(50)  a. John will have finished the paper.
     b. John said that he would call me.

However, in the formal semantics literature, this syntactic generalization was rarely incorporated into formal systems. For example, Montague’s PTQ (1973) can only produce sentences in the present perfect or in the future tense other than tenseless sentences. In other words, it cannot generate such complex tense forms as those exemplified by (50a–b). It is possible to propose additional syntactic rules that yield stacked tense forms such as will have or would at once, but this would simply miss the point. What we need is a set of syntactic rules for English that generates various auxiliary configurations in a systematic way and a semantic mechanism that is based upon this set of rules. As far as I know, Ladusaw (1977) is the first to propose such a system. Thus, let us examine his proposal here.

Ladusaw constructs a system that combines an empirically motivated syntactic structure of the auxiliary node with its explicit semantic interpretation. Ladusaw’s (1977:97) syntactic and semantic rules that concern tense morphemes are summarized in (51).22
Ladusaw assumes that an auxiliary node of the form *Present will* surfaces as *will*, and one of the form *Past will* as *would*. Thanks to the improved syntactic rules, he can generate examples like (50a–b) with no problem. PAST and WILL correspond to $H$ (a past tense operator) and $W$ (a future tense operator) used in PTQ. Note also that because of the way the translation rules work, the system is constrained just enough so that it does not generate logical formulas like (52), which has no English correlate.

\[
(52) \quad \text{WILL[WILL[PAST walk'j]]}
\]

Ladusaw does not incorporate the perfect into his system. However, given what he says about other tense morphemes, it is easy to extend his system to the perfect, assuming that the perfect behaves semantically as a past tense morpheme. The mapping relation between syntax and semantics that Ladusaw’s proposal offers therefore gives us the foundation upon which we can build further. One thing we need to do is to supplement Ladusaw’s system with Reichenbach’s reference times.

At this point, let us return to Reichenbach’s proposal. In addition to introducing the point of reference to account for the semantic contribution of tenses, Reichenbach’s analysis of the English tense system as I understand it also attempts to provide a “compositional semantic system” for tense morphemes. It is not a compositional system in the normal sense of the term because what is determined compositionally is not the model-theoretic meaning of the auxiliary items; it is the graphic representations of various tense forms in English. That is, Reichenbach’s proposal seems to show that the syntactic structure of the auxiliary is systematically related to the graphic representations he proposes. Although Reichenbach himself does not make this claim, this interpretation of Reichenbach’s system is found in the existing literature. Ota (1971), Hornstein (1977, 1990), and Bouchard (1984) propose this interpretation of Reichenbach’s
system. By looking at the above diagrams, we can arrive at the following algorithm:

\[\begin{align*}
(53) & \quad \text{Present tense } \rightarrow R = S \\
& \text{Past tense } \rightarrow R < S \\
& \text{Future tense } \rightarrow S < R \\
& \text{Presence of the Perfect } \rightarrow E < R \\
& \text{Absence of the Perfect } \rightarrow E = R
\end{align*}\]

This algorithm allows us to predict the desired representations for the following sentences.

(54)  
\begin{align*}
a. & \quad \text{John lost his book.} \\
b. & \quad \text{John had lost his book.}
\end{align*}

(54a) is in the past tense. Thus the reference point is located before the speech time, and the point of the event is simultaneous with this reference point. On the other hand, (54b) is in the past perfect. Thus, the reference point is prior to the speech point, and the event time is located prior to this reference point.

Moreover, the difference between the simple future tense and the future perfect can be represented nicely as in (55).

(55)  
\begin{align*}
a. & \quad \text{I shall see John} \\
b. & \quad \text{I shall have seen John}
\end{align*}

\[\begin{array}{ccc}
S & E, R & \rightarrow \\
S & E & \rightarrow
\end{array}\]

Reichenbach (1947:295) is ambivalent about the semantic contribution of the simple future and claims that it gives rise to two possible representations, depending upon the accompanying adverbial.

(56)  
\begin{align*}
a. & \quad \text{Now I shall go.} \\
b. & \quad \text{I shall go tomorrow.}
\end{align*}

\[\begin{array}{ccc}
S, R & \rightarrow \\
S & E, R
\end{array}\]

Accepting this proposal would mean that there is no systematic relationship between tense forms and their graphic representations. For the sake of argument, let us assume that the representation given in (56b) is what we want for the future, rather than (56a). On this assumption, it appears that the systematic relations between tense
forms and graphic representations are still in place. This system works as long as we deal with examples like (57a–f).

(57) a. John will be here. \(S < R \& E = R\)
b. John will have been here. \(S < R \& E < R\)
c. John is here. \(S = R \& E = R\)
d. John has been here. \(S = R \& E < R\)
e. John was here. \(R < S \& E = R\)
f. John had been here. \(R < S \& E < R\)

However, the algorithm given in (53) ignores the fact that English also has modal auxiliary \textit{would}, which is considered to be the past tense form of \textit{will}. This creates some formal as well as empirical problems. Suppose that \textit{would} indicates that the event time is in the future in relation to the reference time. This means that we adopt the following algorithm:

(58) \textit{would} \rightarrow R < E

This accounts for the following example:

(59) John said that he would be here.

Reichenbach’s rule called “permanence of the reference point” is used here to translate (59) into (60).

(60) \(R_1 < S \& R_1 = E_1 \& R_1 = R_2\) (permanence of the reference point) \& \(R_2 < E_2\)

Subscript 1 indicates the main clause, and subscript 2 the complement clause. Permanence of the reference point requires that \(R_1\) and \(R_2\) be simultaneous, as in (60). This predicts that \(E_2\), the time of John’s being here, follows \(R_2\).

This proposal fails because of an example like the italicized sentence in the following short discourse, in which \textit{would} occurs with the perfect.
(61) John and Bill were talking about the July 28th deadline for the submission of grant proposals. *John said that Mary would have finished hers a month before that.*

It is clear that *would* and the perfect *have* have distinct and well-defined roles to play in the sentence. However, our current system cannot describe the semantic contributions of these morphemes. As the rules now stand, *would* and *have* determine the order of R and E in contradictory ways.

(62) the presence of the perfect $\rightarrow$ E $<$ R
    the presence of *would* $\rightarrow$ R $<$ E

Since Reichenbach’s system seems to assume that one clause is allowed to have only one reference time and one event time, we do not see any immediate solution to the problem.25

We might attempt to correct the problem by analyzing *would* into past tense and the future auxiliary, which we will call *woll* following Abusch (1988). According to the above algorithm, past tense means R $<$ S. Then we must decide how to interpret *woll*. Let us tentatively assume that it means R $<$ E. Intuitively, *woll* denotes the July 28th deadline introduced in the first sentence. What then is the contribution of the perfect? Intuitively, it serves to specify the actual time of Mary’s finishing her grant proposal: “a month before that.” According to the above algorithm, the perfect requires that E precede R. If we follow this reasoning, E is the time of Mary’s finishing her grant proposal, and R is the July 28th deadline. We have arrived at a contradiction once again, as the diagram in (63) shows.

(63) Past Tense: $R_1$ (J’s saying) $<$ S
     Future: $R_2$ (J’s saying) $<$ E$2$? (July 28th)
     The Perfect: $E_2$ (M finishes) $<$ R$2$? (July 28th)

The basic problem is that Reichenbach’s system does not provide enough temporal points to represent the temporal information conveyed by tensed English sentences.

I follow Ladusaw (1977) and adopt Chomsky’s (1957) view that the English auxiliary expands in the following way:26
The essence of Reichenbach’s original proposal can be captured by the following revised algorithm that maps tense forms to graphic representations. The symbols “<” and “=” are used to indicate temporal precedence and simultaneity relations.27

(65) \[ \begin{align*}
\text{Past} & \rightarrow \text{RT} < \text{S} \\
\text{Pres} & \rightarrow \text{RT} = \text{S} \\
\text{woll} & \rightarrow \text{RT} < \text{RM} \\
\text{absence of woll} & \rightarrow \text{RT} = \text{RM} \\
\text{have+en} & \rightarrow \text{E} < \text{RM} \\
\text{absence of have+en} & \rightarrow \text{E} = \text{RM}
\end{align*} \]

RT is mnemonic for a Reference time for a Tense morpheme, and RM for a Reference time for a Modal verb. As can be easily verified, this algorithm maps all the English tense configurations to well-formed (i.e., non-contradictory) graphic representations. If we assume that RT and RM are semantically interpreted as contextually salient intervals assigned by the context, this revised Reichenbachian proposal predicts that the context includes two points of reference for each clause. This system predicts that temporal information conveyed by the italicized sentence in (61) (repeated here as (66a)) would be represented as in (66b).

(66) \[ \begin{align*}
\text{a.} \quad & \text{John said that Mary would have finished hers a month before that.} \\
\text{b.} \quad & \text{main clause} \quad \text{RT}_1, \text{E}_1 < \text{S} \\
& \text{subordinate clause} \quad \text{RT}_2 < \text{RM}_2 \\
& \quad \quad \text{E}_2 < \text{RM}_2 \\
\end{align*} \]

[where \( \text{RT}_1 = \text{RT}_2 = \text{the time of John’s saying; RM}_2 = \text{the July 28th deadline; E}_2 = \text{time of Mary’s finishing her grant proposal} \)]
It turns out that two reference times for each clause are still not enough. The algorithm given in (65), when interpreted model-theoretically, seems to show that there is no reference time within which the episode indicated by the perfect falls. This does not seem to be the right prediction when we consider examples like (67).

(67) John met Bill on the street. Bill asked John if he had seen his wife. Since *he had seen his wife*, he said, “Yes, I did.”

The italicized sentence should not be taken to mean that John saw his wife *sometime* before the time of John’s meeting Bill, which is the reference time. This would be trivially true. Rather, it should be taken to mean that there is a time \( t \) within a different reference time, say the day in question, such that John sees his wife at \( t \). This shows that the perfect needs its own reference time. Thus, (65) must be revised as follows:

(68) Past \( \rightarrow \) RT \( < \) S  
Pres \( \rightarrow \) RT \( = \) S  
woll \( \rightarrow \) RT \( < \) RM  
   absence of woll \( \rightarrow \) RT \( = \) RM  
have+en \( \rightarrow \) RP \( < \) RM  
   absence of have+en \( \rightarrow \) RP \( = \) RM  
all cases \( \rightarrow \) E \( \subseteq \) RP (or E \( = \) RP)

RP is mnemonic for “reference time for the perfect,” and I posit a default rule that places the event described by the sentence within RP. This algorithm maps all well-formed tensed English sentences into non-contradictory Reichenbachian graphic representations. What we have seen is that every tense (or quasi-tense) morpheme that occurs in the same sentence needs its own reference time, and this generalization will be incorporated into the formal system proposed in the next section.
2.6. A COMPOSITIONAL THEORY FOR TENSE MORPHMES

The discussion in the previous section indicates that Reichenbach’s three temporal entities are not enough to execute a compositional syntax-semantics program successfully. The conclusion is that we need one reference time for each morpheme that carries tense-related information. Semantically, this means that the context provides each clause with more than one interval. I now propose a set of syntactic and semantic rules that accounts for the data discussed in this chapter, incorporating all the insights that we have gained along the way. I have not discussed Japanese data in this chapter mainly because I do not see any theoretically relevant difference between the tense morphemes in the two languages when we restrict our attention to simple sentences. The reader can assume that the conclusions that we have reached above on the basis of English data carry over to Japanese data straightforwardly. The main difference between them is that Japanese only has two overt tense morphemes and, therefore, has a simpler auxiliary structure than English. I will include a Japanese fragment here to show the syntactic difference between the two languages with regard to tense.

2.6.1. The Model-Theoretic Definitions

1. The set of types is defined as follows: (i) $e$, $i$, $p$, and $t$ are types; (ii) if $\alpha$ is any type, then $<s, \alpha>$ is a type; (iii) if $\alpha$ and $\beta$ are any types, then $<\alpha, \beta>$ is a type; (iv) nothing else is a type.
2. The set of possible denotations of type $\alpha$, denoted $D_\alpha$, is defined recursively as follows: $D_e = A$, $D_i = T$, $D_p = P$, $D_t = \{0, 1\}$, for $s$ and any type $b$, $D_{<s,b>} = D_b^W$ and for any type $a$, $b$, $D_{<a,b>}$ = $D_b^{D_a}$ (= $\{f | f$ is a function from $D_a$ into $D_b\}$).
3. The model $M$ consists of $<A, W, Mt, <$, $P, C, F>$, where $A$ is a non-empty set (the set of “normal individuals”), $W$ a non-empty set (the set of possible worlds), $Mt$ the set of rationals, understood to be the set of moments, $<$ a linear order imposed upon $Mt$, $P$ a non-empty set (a set of positions), $C$ a non-empty set (a set of contexts), and $F$ an
interpretation function for all constants of the translation language IL. 
F is a function that applies to an IL constant and yields its “character.”
(For example, for any expression α of type a, c ∈ C and w ∈ W,
F(α(c)(w)) ∈ Da.) The set of intervals of time T is defined in terms of
Mt: 
\[ T = \{ t \mid t \subseteq Mt \text{ such that for any } m_1, m_2, m_3 \in Mt \text{ if } m_1, m_3 \in t \text{ and } m_1 < m_2 < m_3, \text{ then } m_2 \in t \} \].

4. If c ∈ C, then
(i) c_AG (the agent of c) ∈ A
(ii) c_AD (the addressee of c) ∈ A
(iii) c_T (the time of c) ∈ T
(v) c_W (the world of c) ∈ W

5. If c ∈ C, then
(i) F(be-located′)(c)(c_W)(c_P)(c_AG)(c_T) = 1 (That is, c_AG is located at c_P in c_W at c_T.)
(ii) F(address′)(c)(c_W)(c_AD)(c_AG)(c_T) = 1 (That is, c_AG addresses c_AD in c_W at c_T.)
(iii) g_c(t_RT) ∩ g_c(t_RM) = ∅, g_c(t_RT) ∩ g_c(t_RP) = ∅, and g_c(t_RM) ∩ g_c(t_RP) = ∅. (That is, the reference times used in the translation of a single clause must be pairwise disjoint sets.)

6. For any context c, the value assignment g_c furnished by c is a function that assigns to each variable of type a a value in Da.

2.6.2. The Syntax and Interpretation of IL

I will leave out the subscript indicating the model M, unless explicitly required.
1. For any constant α, [α]_{w,g,c} = F(α)(c)(w)
2. For any variable α, [α]_{w,g,c} = g_c(α), where g_c is the assignment furnished by c.
3. [∃2!u α]_{w,g,c} (where u is a variable of type a, and α a formula) is true iff there are exactly two objects k ∈ Da such that [α]_{w,g,k/u,c} = 1.
Where g_c k/u is a value assignment exactly like g_c with the possible exception that g_c k/u(u) = k. Similarly for [∃3!].
4. [I]_{w,g,c} = F(I)(c)(w) = c_AG (the agent (or speaker) of c)
5. [s^t]_{w,g,c} = F(s^t)(c)(w) = c_T (the time of c)
6. [here]_{w,g,c} = F(here)(c)(w) = c_P (the position of c)
7. \([\text{you}]_{w,g,c} = F(\text{you})(c)(w) = c_{\text{AD}}\) (the addressee of \(c\))
8. \([t_{\text{RT}}]_{w,g,c} = g_{c}(t_{\text{RT}})(c)(w) = \text{the reference time associated with the tense morpheme in } c\).
9. \([t_{\text{RM}}]_{w,g,c} = g_{c}(t_{\text{RM}})(c)(w) = \text{the reference time associated with the future auxiliary in } c\).
10. \([t_{\text{RP}}]_{w,g,c} = g_{c}(t_{\text{RP}})(c)(w) = \text{the reference time associated with the perfect in } c\).
   (I trust that the rest are standard and straightforward. All the details are given in the fragment at the end of the book.)

Additional Definitions

1. **Truth Definition**: An IL expression \(\phi\) of type \(<i,<i,t>>\) that serves as a translation of a natural language matrix sentence is true in the context \(c\) (in the structure \(M\)) iff there is a time \(i \in T\) such that \([\phi]_{M,c_{W},g,c}(c_{T})(i) = 1\) (equivalently, \(\exists t[\phi(s^{*})(t)]\last{M,\text{c}_{W},g,c} = 1\)).

2. **Definition of Validity**: An IL expression \(\phi\) of type \(<i,<i,t>>\) that serves as a translation of a natural language matrix sentence is valid iff for every structure \(M\) and every context \(c\) of \(M\), \(\phi\) is true in \(c\).

Notational Conventions

\(\mathcal{R}\) is a variable of type \(<<<e,<i,t>>>,<i,t>>>,<i,t>>\).
\(\phi\) is a variable of type \(<<<e,<i,t>>>,<i,t>>\).
\(P\) is a variable of type \(<e,<i,t>>\).
\(P_{i}\) is a variable of type \(<i,t>>\).
\(t\) is a variable of type \(i\).
\(x, y, z\) are variables of type \(e\).

For any expression \(\alpha\) of type \(<a,<b,t>>\) where \(a\) and \(b\) are any types (“two-place predicate”), and its arguments \(\beta\) (of type \(a\)) and \(\gamma\) (of type \(b\)), \(\alpha(\gamma; \beta)\) is a relational notation equivalent to the official notation \(\alpha(\beta)(\gamma)\). Similarly for “\(n\)-place predicates,” where \(n \geq 3\).
2.6.3. English Fragment

Syntax

1. $S \rightarrow NP\ TP$
2. $TP \rightarrow T\ MP$
3. $TP \rightarrow T\ PerfP$
4. $TP \rightarrow T\ VP$
5. $MP \rightarrow MP\ Adv$
6. $MP \rightarrow M\ PerfP$
7. $MP \rightarrow M\ VP$
8. $PerfP \rightarrow PerfP\ Adv$
9. $PerfP \rightarrow Perf\ VP$
10. $VP \rightarrow V$
11. $VP \rightarrow VP\ Adv$
12. $\#!AdvP \rightarrow \#!Adv\ Adv$
13. $VP \rightarrow VP\ #!AdvP$

Translation into Intensional Logic

Bold-face symbols indicate $IL$ translations. For example, $NP$ = the translation of NP.

1. $[S\ NP\ TP]$ translates into $TP(NP)$
2. $[TP\ T\ MP]$ translates into $\lambda \varphi \lambda t' \lambda t [T(t)(t') \ & \ \exists t_1[Mp(\varphi)(t)(t_1)]]$
3. $[TP\ T\ PerfP]$ translates into $\lambda \varphi \lambda t' \lambda t [T(t)(t') \ & \ \exists t_1[PerfP(\varphi)(t)(t_1)]]$
4. $[TP\ T\ VP]$ translates into $\lambda \varphi \lambda t' [\varphi(\lambda x \lambda t [T(t)(t') \ & \ VP(x)(t)))]$
5. $[MP\ MP\ Adv]$ translates into $\lambda \varphi \lambda t' [t \subseteq Adv \ & \ MP(\varphi)(t)(t_1)]$
6. $[MP\ M\ PerfP]$ translates into $\lambda \varphi \lambda t' \lambda t [M(t)(t') \ & \ \exists t_1[PerfP(\varphi)(t)(t_1)]]$
7. $[MP\ M\ VP]$ translates into $\lambda \varphi \lambda t' [\varphi(\lambda x \lambda t [M(t)(t') \ & \ VP(x)(t)))]$
8. $[PerfP\ PerfP\ Adv]$ translates into $\lambda \varphi \lambda t' [t \subseteq Adv \ & \ PerfP(\varphi)(t)(t_1)]$
9. $[PerfP\ PerfP\ VP]$ translates into $\lambda \varphi \lambda t' [\varphi(\lambda x \lambda t [PerfP(t)(t') \ & \ VP(x)(t)))]$
10. $[VP\ V]$ translates into $V$
11. \([\text{VP VP Adv}]\) translates into \(\lambda x \lambda t [t \subseteq \text{Adv} \& \text{VP}(x)(t)]\)
12. \([\#\text{AdvP} \#!\text{Adv Adv}]\) translates into \(\#!\text{Adv}(\text{Adv})\)
13. \([\text{VP} \#!\text{AdvP}]\) translates into \(\#!\text{AdvP}(\text{VP})\)

Lexicon

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>LEXICAL ITEM</th>
<th>TRANSLATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>Past</td>
<td>(\lambda t_1 \lambda t_2 [t_1 &lt; t_2 &amp; t_1 \subseteq t_{RT}])</td>
</tr>
<tr>
<td>T</td>
<td>Pres</td>
<td>(\lambda t_1 \lambda t_2 [t_1 = s^* &amp; t_1 \subseteq t_{RT}])</td>
</tr>
<tr>
<td>M</td>
<td>woll</td>
<td>(\lambda t_1 \lambda t_2 [t_2 &lt; t_1 &amp; t_1 \subseteq t_{RM}])</td>
</tr>
<tr>
<td>Perf</td>
<td>have</td>
<td>(\lambda t_1 \lambda t_2 [t_1 &lt; t_2 &amp; t_1 \subseteq t_{RP}])</td>
</tr>
<tr>
<td>Adv</td>
<td>in-1983</td>
<td>1983'</td>
</tr>
<tr>
<td>Adv</td>
<td>tomorrow</td>
<td>tomorrow'</td>
</tr>
<tr>
<td>Adv</td>
<td>in-January</td>
<td>January'</td>
</tr>
<tr>
<td>#!Adv</td>
<td>exactly twice</td>
<td>(\lambda t_1 \lambda P \lambda x \lambda t[3][t_3 \subseteq t &amp; t = t_1 &amp; P(x)(t_3)])</td>
</tr>
</tbody>
</table>

Comments

Some comments on the above fragment are in order here. It posits a hierarchical structure among the tense morphemes and the auxiliary verbs (i.e., the future auxiliary \(\text{woll}\) and the perfect \(\text{have}\)), which is intuitively correct. This also is in line with the recent syntactic proposals (e.g., Pollock 1989) that attribute a hierarchical structure to such items. I have decided to adopt this syntactic proposal because it can state the semantic contribution of temporal adverbials easily. As the above rules show, temporal adverbials like \(\text{tomorrow}\) can be associated with \(\text{VP, PerfP, or MP}\). However, we must also account for the fact that the subject NP is in the scope of the tense morphemes. There are several possible means of accomplishing this effect. One possibility is to move the tense to the matrix \(S\). This seems to be an attractive choice when there is only one tense morpheme in a clause. But my fragment is already complex enough with the future auxiliary and the perfect, and moving all these items leaving all the scope relations intact seems to be too artificial an operation to adopt for the present purposes. Another possibility is to move the subject NP down into the specifier position of the \(\text{VP}\), but I felt allowing downward movement at LF is perhaps too liberal. It is also possible to adopt a
“flat structure” for the auxiliary verbs as in [S NP Aux VP], but this structure makes it difficult to accommodate temporal adverbials. The above proposal instead complicates the translation rules to obtain the desired effect. The subject NP, which translates as a generalized quantifier, serves as the argument of the predicate with which it combines. This complexity is not required in the case of Japanese because it has a head-final structure, and a tense morpheme occurs at the end of a sentence. Thus, I simply let the tense combine with the translation of a (tenseless) sentence.

The next comment concerns reference times. It is necessary to constrain their denotations in such a way that two or more reference times used in the translation of the same clause may not refer to overlapping intervals. This is needed in an example like (69) (Reichenbach 1947:288–89).

(69) In 1678 the whole face of things had changed … eighteen years of misgovernment had made the … majority desirous to obtain security for their liberties at any risk.

According to the above proposal, the italicized sentence in (69) translates roughly as in (70).

(70) \( \exists t (t < s^* \& t \subseteq 1678' \& \exists t_1 (t_1 < t \& t_1 \subseteq t_{RP} \& \text{eighteen years of misgovernment makes the majority desirous to obtain security for their liberties at any risk at } t_1)) \)

Since the event indicated by the italicized sentence in (69) is assumed to have taken place prior to 1678, which is the reference time associated with the tense morpheme, the denotation of \( t_{RP} \) and the year 1678 must be non-overlapping intervals. This constraint is given in the basic model-theoretic definition above and can be restated informally as follows:

(71) **Disjointness Requirement for Reference Times:** When two or more reference times are used in the translation of a single clause, the assignment furnished by context must assign non-overlapping intervals to them as their denotations.
The above fragment does not discuss scope properties of NPs. I will discuss this topic in detail in Chapters 3 and 5.

Note also that the truth definition introduces an existential quantifier as well as the speech time indicated by $s^*$. This is valid for both English and Japanese. This means that any matrix sentence translates as a relation between intervals, denoted by an expression of the form $\lambda t \lambda t' \lbrack \ldots t \ldots t' \ldots \rbrack$. In this expression schema, the variable $t$ indicates the time with respect to which the inherent temporal orientation of the tense is indicated. On the other hand, the variable $t'$ indicates the temporal location of the episode described by the sentence. Thus, a past tense sentence translates as an expression of the form $\lambda t \lambda t' \lbrack t' < t \& \ldots t' \ldots \rbrack$. Two comments are in order here. First, as mentioned earlier in this chapter, the indexical constant $s^*$ is given here as part of the truth definition not simply as a consequence of a formal technique, but as an expression of a more substantive claim about the semantics of speech acts. This topic will be discussed in Chapter 4. In this connection, note also that the speech time dependency that the truth definition provides is redundant when it comes to present tense sentences since the English present already includes information about the utterance time. This redundancy does not look attractive at this point, but the indexical nature of the English present is needed when we turn to double-access sentences in Chapter 6. Second, existential closure must be introduced in the final stage because the time variable indicating the event or state described in the sentence must be available for further processing and therefore should not be existentially bound within a tensed sentence. Chapter 5 introduces one such construction: temporal adverbial clauses. Since I will eventually incorporate temporal adverbial clauses only in the Japanese fragment, existential closure for English could be introduced sentence-internally (e.g., as part of the translation of each tense morpheme) without producing any undesirable consequences. However, I decided to adopt the same truth definition for English as well in order to minimize the difference between the two fragments. An existential quantifier could presumably be introduced in some other way with exactly the same empirical consequences. Therefore, this part of the truth definition is not meant to carry a substantive theoretical claim.

Given the above fragment, let us look at how it deals with simple sentences.
A man Past have die yesterday.

A man Past have die in 1983.

(73) LF: A man Past die
1. Past die ⇒ λρλt′[ρ(λxλt[t < t′ & t ⊆ tRT & die′(x)(t)])]
2. A man Past die ⇒ λρλt′[ρ(λxλt[t < t′ & t ⊆ tRT & die′(x)(t)])][λPλt″∃y[man′(t′, y) & P(t′, y)]]
3. λ′λt″∃x[man′(t′, x) & t″ < t′ & t″ ⊆ tRT & die′(x)(t″)]
4. ∃t1∃x[man′(t1, x) & t1 < s* & t1 ⊆ tRT & die′(t1, x)]

(Truth definition)

(74) LF: A man Past die yesterday
1. die yesterday ⇒ λxλt1[t1 ⊆ yesterday′ & die′(t1, x)]
2. Past die yesterday ⇒ λρλt′[ρ(λxλt[t < t′ & t ⊆ tRT & t ⊆ yesterday′ & die′(t, x)])]
3. A man Past die yesterday ⇒ λρλt′[ρ(λxλt[t < t′ & t ⊆ tRT & yesterday′ & die′(t, x)])][λPλt″∃y[man′(t′, y) & P(t′, y)]]
4. λ′λt″∃x[man′(t′, x) & t″ < t′ & t″ ⊆ tRT & yesterday′ & die′(t″, x)]
5. ∃t″∃x[man′(t″, x) & t″ < s* & t″ ⊆ tRT & yesterday′ & die′(t″, x)] (Truth Definition)

(75) LF: A man Past have die in 1983
1. have die ⇒ λρλt′[ρ(λxλt[t < t′ & t ⊆ tRP & die′(x)(t)])]
2. have die in 1983 ⇒ λρλt2λt1[t2 ⊆ 1983′ & ρ(λxλt[t < t2 & t ⊆ tRP & die′(x)(t)])(t1)]
3. Past have die in 1983 ⇒ λρλt2λt0[t0 < t8 & t0 ⊆ tRT & ∃t0[t0 ⊆ 1983′ & ρ(λxλt[t < t0 & t ⊆ tRP & die′(x)(t)])(t0)]]
4. A man Past have die in 1983 ⇒ λρλt2λt0[t0 < t8 & t0 ⊆ tRT & ∃t0[t0 ⊆ 1983′ & ρ(λxλt[t < t0 & t ⊆ tRP & die′(x)(t)])(t0)][λPλt″∃y[man′(t″, x) & P(t″, x)]]}
(75) shows that a temporal adverbial such as 1983 does not have to indicate the “event time” of the episode. In this derivation, 1983 is the time with respect to which the man’s death is located in the past. One could also obtain a reading in which 1983 is the time of the man’s death. This is derived via the following structure: [VP [VP die][Adv 1983]].

2.6.4. Japanese Fragment

Unless otherwise stated, the conventions posited for the English fragment are also valid here.

Syntax

1. \( S \rightarrow NP \ VP \ T \)
2. \( VP \rightarrow Adv \ VP \)
3. \( VP \rightarrow V \)

Translation into Intensional Logic

Bold-face symbols indicates IL translations.
1. \([S NP \ VP \ T]\) translates into \(T(NP (VP))\)
2. \([VP \ Adv \ VP]\) translates into \(Adv(VP)\)
3. \([VP \ V]\) translates into \(V\)
## Lexicon

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>LEXICAL ITEM</th>
<th>TRANSLATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>Past</td>
<td>$\lambda P_1 \lambda t_1 \lambda t [t &lt; t_1 &amp; t \subseteq t_{RT} &amp; P_1(t)]$</td>
</tr>
<tr>
<td>T</td>
<td>Pres</td>
<td>$\lambda P_1 \lambda t_1 \lambda t [t = t_1 &amp; t \subseteq t_{RT} &amp; P_1(t)]$ (simultaneous meaning) or $\lambda P_1 \lambda t_1 \lambda t [t_1 &lt; t &amp; t \subseteq t_{RT} &amp; P_1(t)]$ (future meaning)</td>
</tr>
<tr>
<td>Adv</td>
<td>1983-nen-ni</td>
<td>$\lambda P \lambda x \lambda t [t \subseteq 1983' &amp; P(x)(t)]$</td>
</tr>
<tr>
<td>Adv</td>
<td>asita</td>
<td>$\lambda P \lambda x \lambda t [t \subseteq tomorrow' &amp; P(x)(t)]$</td>
</tr>
<tr>
<td>Adv</td>
<td>itigatu-ni</td>
<td>$\lambda P \lambda x \lambda t [January'(t) &amp; P(x)(t)]$</td>
</tr>
</tbody>
</table>

## Comments

I shall make few comments on the Japanese fragment. As far as the examples discussed in this chapter are concerned, the major difference between English and Japanese resides in the syntax. English has three distinct syntactic categories relevant to the interpretation of tense (i.e., tense morphemes, the future auxiliary, and the perfect). Japanese has only one category, and it has only two members: present and past. Another difference has to do with the headedness of the two languages. Since Japanese is head-final, tense morphemes come at the end of a sentence, which allows me to simplify the syntactic and semantic rules for Japanese as in the above. See (76) for one sample derivation.

(76) Dareka-ga kinoo ki-ta.
someone-NOM yesterday come-PAST
"Someone came yesterday."
1. Dareka 'someone' ⇒ $\lambda P \lambda x \exists x [\text{person}'(t, x) & P(t, x)]$
2. ki 'come' ⇒ come'(type: $<e, <i, t>>$)
3. kinoo ki 'come yesterday' ⇒ $\lambda x \lambda t [t \subseteq \text{yesterday}' & \text{come}'(t, x)]$
4. Past ⇒ $\lambda P_1 \lambda t_1 \lambda t [t < t_1 & t \subseteq t_{RT} & P_1(t)]$
5. Dareka-ga kinoo ki ta 'Someone came yesterday' ⇒
CHAPTER TWO

\[ \lambda P \lambda t_1 \lambda t \left[ t < t_1 \& t \subseteq t_{RT} \& P_t(t) \right] \]
\[ (\lambda t_2 \exists x [\text{person}'(t_2, x) \& t_2 \subseteq \text{yesterday}' \& \text{come}'(t_2, x)]) \]

6. \[ \lambda t_1 \lambda t [t < t_1 \& t \subseteq t_{RT} \& \exists x [\text{person}'(t, x) \& t \subseteq \text{yesterday}' \& \text{come}'(t, x)]] \]

7. \[ \exists t [t < s^* \& t \subseteq t_{RT} \& \exists x [\text{person}'(t, x) \& t \subseteq \text{yesterday}' \& \text{come}'(t, x)]] \) (Truth Definition)

The final translation predicts the desired reading for the Japanese sentence given in (76).

NOTES

1. \( F \) is used as a future tense operator, and \( F \phi \) (where \( \phi \) is any formula) is regarded as a future tense sentence.

2. PTQ stands for ‘The Proper Treatment of Quantification in Ordinary English’, which is the title of Montague (1973).

3. An order is a binary relation that is transitive and also (i) reflexive and antisymmetric (in which case the order is weak) or else (ii) irreflexive and asymmetric (in which case it is strict or strong). Readers who are not familiar with such technical matters are encouraged to consult introductory textbooks, such as Partee et al. (1990) and Gamut (1991).

4. See also Taylor (1977).

5. See Dahl (1981), for example, for the distinction between telics and atelics.

6. To be formal, \( [\text{cry}']_{w,t} = F(\text{cry}'(<w,t>)) \), where \( F \) is an interpretation function furnished by the model.

7. Dowty (1979) employs predicates of times PAST, PRES, FUT, instead of relations like “<.”

8. \( g \) is a value assignment, a function from variables to appropriate values.


10. For a concise introduction to Kaplan’s ideas about indexicals and to indexicals in general, see Forbes (1989).

11. This type of validity is sometimes referred to as pragmatic validity. See, for example, Chierchia and McConnell-Ginet (1990:277).

12. A more formal version is found at the end of this chapter.

13. The translations and notations deviate slightly from the original found in Kamp (1971), but I trust that nothing of consequence has been changed.

14. One obvious alternative is to give the NP scope wider than the matrix tense, including the extrapolated relative clause. However, this does not seem viable since the head noun ‘child’ seems to be in the scope of the matrix past tense. If the NP is quantified in, the resulting interpretation does not seem to do full justice to the reading that (21b) has.

\[ \exists x [\text{child}'(x) \& F[\text{become-ruler-of-the-world}'(x)] \& P[\text{be-born}'(x)]] \]
(i), among other things, says that the individual in question is a child now, which is not necessarily the case.

15 I will henceforth employ the term “reference time” instead of “point of reference.”

16 See Kamp and Reyle (1993) for a semantic system that is capable of dealing with such “discourse phenomena.”

17 In terms of type theory, this means that in the system I propose cough is a constant of type \(<e,<i,t>>\), where \(i\) is a type for intervals, whereas in Dowty’s system it is a constant of type \(<e,t>\).

18 In terms of type theory, it is a variable of type \(<i,t>\).

19 For a concise summary of the points made by Bäuerle and von Stechow, the reader is referred to Kuhn (1989).

20 On the assumption that tense has scope over adverbials, which I take to be the null hypothesis, we predict that (41b) is the right translation for (39b).

21 The expression exactly three times is regarded as a single lexical item here. A truly compositional analysis should clarify the semantic contribution of exactly.

22 For any category \(\alpha\), \(\alpha'\) indicates the translation of \(\alpha\) in Ladusaw’s notation.

23 As mentioned in Chapter 1, I assume that the perfect can receive a preterit interpretation as well as an aspectual interpretation.

24 This problem was pointed out in Ogihara (1989) and also in Gamut (1991:39).

25 It is not obvious that Reichenbach makes this assumption. However, from the ways in which he draws diagrams, we can say that this is his intention. Furthermore, his principle called the “permanence of the reference point” discussed in the main text would not make sense if we assumed otherwise.

26 This is a simplified version of the proposal given by Chomsky (1957:39).

27 It is not semantically desirable to use the equal sign “=” for the reasons explained above. It will be replaced by the subset symbol “\(\subseteq\)” in the formal system presented at the end of this chapter.

28 In the rest of the book, I occasionally deviate from this truth definition and use a locution like “\(\phi\) is true in \(w\) (in \(c\)).” This should be taken to mean that \(\phi\) is true in \(c\) and the evaluation world \(w\) happens to be \(c_W\).
PREVIOUS ANALYSES OF TENSES
IN EMBEDDED CLAUSES

3.1. THE PLAN FOR THIS CHAPTER

In Chapter 2, we looked at how simple tensed sentences in English and Japanese are analyzed in terms of a compositional semantic theory. On the basis of the proposal we developed there, we will study in the rest of the book the behavior of tense morphemes in various types of embedded clauses. In this chapter, I will review the previous literature and point out some problems with the existing analyses of the sequence-of-tense (SOT) phenomena. Proposals made by traditional grammarians (Jespersen 1931, Curme 1931), modern descriptivists (Quirk et al. 1972), and a modern syntactician (Ross 1967) will be examined first. We will then turn to three recent accounts of the SOT phenomena proposed by semanticists. We will discuss Ladusaw (1977), Enç (1987), and Abusch (1988).

3.2. SEQUENCE-OF-TENSE PHENOMENA
AND TRADITIONAL GRAMMAR

Suppose that John utters (1a) at some time \( t \). Then Bill can report John’s utterance at a time \( t' \) later than \( t \) with either (1b) or (1c).

\[
(1) \quad \begin{align*}
\text{a.} & \quad \text{John: Mary is sick.} \\
\text{b.} & \quad \text{Bill: John said, “Mary is sick.”} \\
\text{c.} & \quad \text{Bill: John said that Mary was sick.}
\end{align*}
\]

Since (1c) is a report of (1a), it has a simultaneous reading in that the
time of Mary’s being sick is simultaneous with the time of John’s saying.\(^1\) Note that the verb complement clause is in the past tense and yet receives a simultaneous interpretation in (1c), thereby creating a discrepancy with the tense form in direct speech given in (1b). It should be emphasized that this is a very peculiar fact. We cannot say simply that since the time of Mary’s sickness is located in the past relative to the speech time, the complement clause is in the past tense. If we assume that a past tense quantifies over all past times regardless of its structural position, we predict that the time of Mary’s sickness can be any past time. However, (1c) cannot indicate a situation in which Mary’s sickness obtains at a time before the speech time of (1c) but after the time of John’s saying. On the other hand, we cannot account for the simultaneous interpretation of (1c) by assuming that the past tense in the verb complement indicates that the embedded clause episode is located in the past in relation to the time of the matrix predicate. On this assumption, we would predict that the time of Mary’s sickness is prior to the time of John’s saying, which is a possible interpretation but is not the one under discussion.

Japanese tense morphemes, on the other hand, behave in a drastically different way in verb complement clauses. Consider the examples in (2).

\[
(2) \quad a. \quad \text{Taro-wa [S Hanako-ga byooki-da]-to it-ta.} \\
\quad \text{Taro-TOP Hanako-NOM be-sick-PRES that say-PAST} \\
\quad \text{‘Taro said that Hanako was sick [at that time].’} \\
\quad b. \quad \text{Taro-wa [S Hanako-ga byookidat-ta]-to} \\
\quad \text{Taro-TOP Hanako-NOM be-sick-PAST that} \\
\quad \text{say-PAST} \\
\quad \text{‘Taro said that Hanako had been sick.’}
\]

(2a) has a past tense in the matrix clause and a present tense in the embedded clause and only conveys a simultaneous interpretation. On the other hand, (2b) has a past tense morpheme both in the matrix clause and in the complement and means unambiguously that the time of Hanako’s being sick is prior to the time of Taro’s saying. It cannot receive a simultaneous interpretation.

An embedded past tense can receive a simultaneous interpretation in English only when the main predicate is also in the past tense. For
example, when the main predicate is in the present tense, we find no
difference between direct speech and indirect speech as shown in (3b–
c). Suppose that (3a) is a statement that John utters habitually. Then
this can be reported either as in (3b) or as in (3c). These two reports
are identical as far as tense forms are concerned.

(3)  
\[ \begin{align*} 
\text{a. John: } & \, \text{Mary is unhappy.} \\
\text{b. Bill: } & \, \text{John always says, “Mary is unhappy.”} \\
\text{c. Bill: } & \, \text{John always says that Mary is unhappy.} 
\end{align*} \]

Note also that (4) cannot be used as a report of John’s utterance given
as (3a). (4) can only receive a shifted interpretation: John says at \( t \) that
Mary was unhappy at some time earlier than \( t \).

(4)  
\[ \text{Bill: John always says that Mary was unhappy.} \]

In fact, when the main clause is in the present tense, we do not find
any discrepancy between Japanese and English tense forms in
complement clauses, as we can confirm by looking at the following
Japanese data:

(5)  
\[ \begin{align*} 
\text{a. Taro: } & \, \text{Boku-wa fusiawase-da.} \\
\text{\qquad I-TOP unhappy-be-PRES} \\
\text{\qquad Taro: ‘I am unhappy.’} \\
\text{b. Jiro: } & \, \text{Taro-wa itumo “Boku-wa} \\
\text{\qquad Taroo-wa TOP always I-TOP} \\
\text{\qquad fusiawase-da” to iu.} \\
\text{\qquad unhappy-be-PRES that say-PRES} \\
\text{\qquad Jiro: ‘Taro always says, “I am unhappy.”’} \\
\text{c. Jiro: } & \, \text{Taro-wa itumo zibun-wa} \\
\text{\qquad Taroo-wa TOP always self-TOP} \\
\text{\qquad fusiawase-da to iu.} \\
\text{\qquad unhappy-be-PRES that say-PRES} \\
\text{\qquad Jiro: ‘Taro always says that he [lit. self] is unhappy.’} 
\end{align*} \]

The “original statement” (5a) is in the present tense and the same tense
form is used in direct speech as in (5b) and in indirect speech as in
(5c), where the difference between direct speech and indirect speech is
indicated by the use of the pronouns.
Let us briefly look at the SOT phenomena from a historical point of view. According to Binnick (1991), the SOT phenomena were recognized in Latin and Greek, and their grammarians used terms that are analogous to “sequence of tenses.” Binnick (1991:86) states:

The Roman grammarians recognized that the tense of a finite verb is governed by that of the verb of the matrix or including clause, and defined rules for what was variously called the ‘connection’ (coniectio), ‘conjunction’ (contiaunctio), ‘coming together’ (conventio), or ‘sequence’ (consecutio) of tenses (temporum); today these rules are known as “sequence-of-tense(s)” rules (henceforth SOT).

For various reasons, English inherited the SOT rules from Latin. I have not been able to determine who first used the term “sequence of tenses” in reference to English. Among the so-called traditional grammarians, Curme (1931) adopts the term “sequence of tenses,” whereas Jespersen (1931) employs the term “back-shifting.” Let us briefly review the reasons why traditional grammarians such as Jespersen and Curme propose “rules” or processes called sequence of tenses. Jespersen (1931) discusses the SOT phenomena in the context of the direct speech vs. indirect speech contrast. He states (pp. 151–2):

When one wishes to report what someone else says or has said (thinks or has thought)—or what one has said or thought on some previous occasion oneself—two ways are open to one. Either one gives, or purports to give, the exact words: direct speech—but this does not concern us in this volume—or else one adapts the words according to the circumstances in which they are now quoted: indirect speech—and in this the tenses are very often different from what they would have been in direct speech. This is true whether we have dependent speech (introduced by some sentence like “he said that” or “he thought that”, etc.) or reported speech (not introduced by some such sentence); the latter kind is by other writers termed “style indirect libre” or “erlebte rede.”

The most important case of tense-shifting in indirect speech is what I shall term back-shifting. It occurs when the main sentence is (or would be if it were expressed) in the past. Typical examples are:

<table>
<thead>
<tr>
<th>Direct speech</th>
<th>Indirect speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>“I am glad to see you”</td>
<td>“I was glad to see me” (1)</td>
</tr>
<tr>
<td>“I saw her on Tuesday”</td>
<td>“I had seen her on Tuesday” (2)</td>
</tr>
<tr>
<td>“I have not seen her yet”</td>
<td>“I had not seen her yet” (3)</td>
</tr>
</tbody>
</table>
We shall call these uses of the tenses
(1) back-shifted present
(2) back-shifted preterit
(3) back-shifted perfect

The pluperfect cannot be further shifted: “I had already seen her before she bowed” becomes “he said that he had already seen her before she bowed.” The indirect “had seen” thus corresponds to three direct tenses, saw, has seen and had seen.

As is clear from this quote, Jespersen conceptualizes the SOT phenomena in terms of the relation between direct speech and indirect speech. To be more specific, he takes direct speech to be the “original” and indirect speech to be the output of some operation on it. The choice of the term also reveals the way he analyzes the phenomena. Jespersen chooses the term “back-shifting,” which implies that the episode described in the present tense is pushed into the past and is reported in the past tense. Appealing to the correlation between direct speech vs. indirect speech in describing and accounting for the SOT phenomena automatically means that any construction that does not involve a direct vs. indirect discourse contrast is excluded from the SOT phenomena. For example, according to Jespersen’s description of the SOT phenomena given above, relative clauses and temporal adverbial clauses are simply disregarded.

On the other hand, Curme (1931) presents an account of the SOT phenomena that relies solely upon the structural properties of the sentences in which the phenomena are found. As far as I can see, Curme’s account comes close to what may be called a configurational account of the SOT phenomena in that his rules refer only to structural properties of the tenses involved in the SOT phenomena and not to the direct speech vs. indirect speech contrast. Let me quote Curme (1931:354) here:

In English, there is a general rule of sequence when a past tense form precedes. When the governing proposition has a past tense form, a past tense form usually follows whether it is suitable to the occasion or not: ‘He says he is going tomorrow,’ but ‘He said he was going tomorrow.’ ‘He says he has often done it,’ but ‘He said he had often done it.’ ‘He will surely decide to do it before his father comes,’ but ‘He decided to do it before his father came.’
Curme succinctly describes the distributional properties of past tense in terms of structural configurations, using the term “govern.” Intuitively, A governs B iff A is structurally higher than B and no relevant expression intervenes between them. Note that Curme does not invoke the relation between indirect discourse and direct discourse in order to define the SOT phenomena or the relevant rules. He even has examples that involve temporal adverbial clauses. Depending upon the definition of the expression “governing proposition,” other types of clauses (such as relative clauses) could be subsumed under the above generalization. The SOT rule that I will propose is very similar to Curme’s rule given in the above quote.

By contrast, Jespersen (1931) has a quasi-semantic explanation of the SOT phenomena in mind. Consider the following example by Dickens that Jespersen (p. 152) cites:

(6) I told her how I loved her … how I was always working with a courage such as none but lovers knew … how a crust well-earned was sweeter than a feast inherited.

Jespersen states:

The shifting of the tenses is often quite natural and, in fact, inevitable, when the fact reported belongs definitely to the past, as in “he told me that she was ill, but now (he tells me that) she is all right again.” … But [the example in (6)] show us the frequent phenomenon that the shifting is not required logically, but is due simply to mental inertia: the speaker’s mind is moving in the past, and he does not stop to consider whether each dependent statement refers to one or the other time, but simply goes on speaking in the tense adapted to the leading idea.

Jespersen evidently wants to show that any past tense refers to a past time relative to the speech time. He believes that the quotation from Dickens he cites is exceptional because what is described there is not necessarily an episode that belongs totally to the past. For example, take the italicized clause in (6): how a crust well-earned was sweeter than a feast inherited. If what this sentence describes is a truth, it is a universal truth, not something that was once true but not any more. Despite this fact, the clause is in the past tense. This I believe makes Jespersen claim that “the shifting is not required logically but is due simply to mental inertia.” This is definitely not a purely syntactic
account of the phenomena. But even Curme, who presents a configurational account of the SOT phenomena, is not completely free from the temptation to explain the phenomena in a quasi-semantic way. Curme says in the above quote that the SOT phenomenon occurs “whether it is suitable to the occasion or not.” Then, he cites the example *He said he was going tomorrow*. Presumably, the past tense morpheme in this example is “not suitable” because it contains the adverb *tomorrow*, which indicates that his going is a future event. Curme’s remarks, then, indicate his desire to interpret such past tenses “at face value.” In this sense, Curme is not very different from Jespersen. I will show that this position is incorrect.

Let us now turn to a modern descriptively-oriented work by Quirk, Greenbaum, Leech, and Svartvik (1972). They employ the term “back-shift” and offer a syntactic account of the SOT phenomena, but they specifically refer to “reporting verb” as shown in (7), thereby restricting the applicability of the structurally defined rule (p. 86).

(7) In INDIRECT (REPORTED) SPEECH past tense in the reporting verb tends to make the verb of the subordinate clause past, too. This phenomenon is called back-shift.

Quirk et al. (1972:786) explain the phenomena by claiming that when one reports something that was originally conveyed by a present tense sentence at a later time, it is natural to use past tense to talk about the content of the original utterance. We again find a quasi-semantic explanation of the phenomena here.

In sum, SOT phenomena have received various accounts in the past, but traditional grammarians and modern descriptively-oriented grammarians generally agree that the phenomena are triggered by the presence of a past tense in a higher syntactic position within a local domain. On the other hand, they do not have a definitive theory about how the correct temporal interpretation is or should be obtained. This is not surprising given that no formal semantic framework was in place then. But it is not even clear whether traditional grammarians such as Jespersen and Curme would want to use the surface tense forms or the “underlying tense forms” to predict the desired semantic interpretation. As for the conditions that govern the occurrences of the SOT phenomena, I follow Curme in that I posit a structurally defined rule. But unlike the traditional grammarians I discussed above, my position
with respect to semantic interpretation is clear. As far as semantic interpretation is concerned, a past tense in an SOT context is simply not the right tense for a simultaneous reading. We need a present tense (or no tense) instead.

Let us consider at this point how to justify an SOT rule from a semantic point of view. Although the formal proposal I will give later predicts that the SOT rule applies to a variety of embedded clauses, not just to verb complement clauses, I take up verb complement clauses here as a representative example. As mentioned above, when someone utters a sentence in the present tense and it is reported in indirect speech at a later time, the complement clause is in the past tense. This mismatch between the original utterance and the report in indirect speech obtains only when the matrix clause predicate of the report is in the past tense. Therefore, if we assume that there is a syntactic rule that converts a present tense into a past tense in the immediate scope of a past tense, the morpho-syntactic facts are accounted for. They are “accounted for” to the extent that the rule correctly describes the discrepancy between direct speech and indirect speech. We are yet to account for the semantic interpretation of such past tenses in verb complements.

Suppose that John utters the sentence in (8a) at some time \( t_0 \), and Bill reports at some later time \( t_1 \) what John said at \( t_0 \).

(8)  
   a. John: Mary is sick.  
   b. Bill: John said that Mary was sick.

If the purpose of indirect speech is to convey to the hearer what the original utterance was about, the simplest option is to reconstruct the information expressed by the original utterance made by John. This means, among other things, that the temporal deixis center for the episode conveyed by the complement clause is the time of John’s saying: \( t_0 \). John’s utterance was about Mary’s being sick at \( t_0 \), which is thus the “current time” from John’s perspective. Thus we expect the verb complement clause to be in the present tense for the purpose of semantic interpretation. However, the present tense is converted into a past tense in the syntax because it is located immediately under the matrix past tense. If this argument is on the right track, English must have a rule that relates a surface tense to a possibly distinct tense form
that is required for interpretation, whereas Japanese has no such rule as indicated by examples like (2a–b).

The idea I have just described informally can be executed in many different formal frameworks. One possibility is to employ a framework in which an “underlying structure” feeds the semantic component. If we think in terms of the semi-procedural rule schema adopted by traditional and descriptively-oriented grammarians, where direct speech constitutes an “underlying structure” and indirect speech the output of some operation on it, this type of framework is a logical choice. Chomsky’s (1965) standard theory is one such framework. Ross’s (1967) and Ladusaw’s (1977) proposals to be discussed below are made in this type of theory. In the standard theory, deep structure trees are first semantically interpreted and then are turned into surface structure trees by transformational rules. In this framework, the SOT rule can be defined roughly as one that changes a present tense into a past tense iff a past tense is in the immediately higher clause. For example, the SOT rule applies to the deep structure form given in (9a) and yields the surface sentence in (9b).

\[(9) \quad \begin{align*}
\text{a. } & \text{John Past say that Mary Pres be sick.} \\
\text{b. } & \text{John said that Mary was sick.}
\end{align*}\]

The shifted reading of (9b) is obtained on the basis of the deep structure given in (10).

\[(10) \quad \text{John Past say that Mary Past be sick}\]

The SOT rule thus defined can account for the behavior of the future auxiliary as well if we assume with the traditional grammarians discussed above that \textit{will} is the present tense form of the future auxiliary, whereas \textit{would} is its past tense form. Consider the following example:

\[(11) \quad \begin{align*}
\text{John: Mary will be sick.} \\
\text{Bill: John said that Mary would be sick.}
\end{align*}\]

The present tense form \textit{will} is changed into its past tense form \textit{would} due to the presence of a past tense in the matrix clause. This
morphological analysis of the future auxiliary is also supported by Chomsky’s (1957) celebrated analysis of the English auxiliary system. Ross (1967:206) discusses sentences like (12) and argues for an SOT rule that employs the notion “command.”

\[
(12) \quad [s[NP[S \text{That the sun was out}][VP \text{was obvious}]])^2
\]

According to the structure that Ross assumes for (12), the main clause tense is part of the VP, and the concept of “being in construction with” defined in (13) is not adequate for his purposes.

\[
(13) \quad \text{Node A of a phrase-marker is in construction with B iff B is dominated by the node which immediately dominates A.}^3
\]

[paraphrasing Klima (1964:297)]

In (12), the matrix tense is not in construction with the tense in the sentential subject. Hence, if the SOT rule were described in terms of the notion of “being in construction with,” we would make the wrong prediction for (12) because the SOT rule would not apply to the tense in the sentential subject. Thus, Ross adopts Langacker’s (1969) “command” instead. The structural relation “command” is defined as follows:

\[
(14) \quad \text{A commands B iff neither A nor B dominates the other, and the S-node that immediately dominates A also dominates B.}^4
\]

[paraphrasing Langacker (1969:167)]

The matrix tense in (12) commands the tense in the clausal subject as desired. The SOT rule that I think Ross had in mind can now be stated in terms of command as follows:

\[
(15) \quad \text{If a tense A commands another tense B and A is a past tense, then B is changed into a past tense.}^5
\]

As we shall see later in this chapter, Ladusaw (1977) adopts a similar proposal for the SOT phenomena. A full-fledged proposal based upon the standard theory is possible, but since much of the recent work in syntax is conducted in GB theory (Chomsky 1981, etc.), I will adopt a framework that shares the basic
overall assumptions about the structure of grammar with GB theory. That is, I follow Chomsky and Lasnik (1977) in that I adopt the so-called upside-down Y model, which has the following structure:

\[
\begin{array}{c}
\text{D-structure} \\
\text{S-structure} \\
/ \quad \quad \quad \quad \quad \quad \quad \quad \text{Phonetic} \\
\text{Form} \quad \quad \quad \quad \quad \quad \quad \quad \text{Logical} \\
\text{Form}
\end{array}
\]

The above proposal is encoded in this model in the following way. The D-structure form of a sentence is the same as its S-structure configuration as far as tense morphemes are concerned. The SOT rule is an optional rule that applies at LF and deletes a past tense locally commanded by another past tense. As we shall see in Chapter 5, this analysis enables us to account for the NP-tense scope interactions correctly. Put simply, this proposal treats some surface occurrences of the English past as semantically empty.

More recently, Comrie (1985), Baker (1989), Hornstein (1990), and Stowell (1993) have argued in favor of an SOT rule. In the formal semantics literature, Ladusaw (1977) and Abusch (1988) adopt an SOT rule. Ladusaw (1977) is a direct precursor of my analysis, and Abusch’s (1988) conclusion is very similar to the proposal I will put forth in Chapter 4. The view that some English tense morphemes are semantically empty has met with some opposition. This is because adopting the SOT rule defined above means that some occurrences of the English past are “dummy past tense morphemes.” All else being equal, it would be better if the English past had one constant meaning. Enç (1987) pursues this non-ambiguity thesis for the English tense morphemes. In the rest of this chapter, I will discuss three previous attempts to account for the SOT phenomena. I will examine two articles that endorse the SOT rule: Ladusaw (1977) and Abusch (1988). I will take up Enç (1987) as a representative theory that posits no SOT rule. These three papers will be discussed in chronological order.
3.3. LADUSAW (1977) ON NP SCOPE AND TENSES

Ladusaw’s (1977) proposal combines Chomsky’s (1965) syntax and Montague’s (1973) semantics and is modeled upon Cooper (1975). The major difference between Ladusaw’s proposal and Cooper’s is that the former proposes an SOT rule, whereas the latter does not. Ladusaw is mainly concerned with the SOT phenomena in relative clauses, rather than with those in verb complements. I have already discussed one aspect of Ladusaw’s proposal in Chapter 2. Ladusaw recognizes the distributional independence of the past tense morpheme -ed and the future tense form will (or would) and proposes syntactic and semantic rules that incorporate this fact. To refresh the reader’s memory, let me repeat Ladusaw’s syntactic and semantic rules for tense morphemes in (17).

(17) Syntax Semantics (translation)
   a. Aux → Tense (Modal) λp[Tense[^Modal'(p)]]
   b. Tense → Present λp[^p]
   c. Modal → will λp[WILL ^p]

Recall that in Ladusaw’s system the Aux node has scope over the entire sentence it combines with. The rules given in (17) are necessary not only for an accurate syntactic and semantic description of tenses in simple sentences, but also for explaining the SOT phenomena in embedded clauses. Note that the SOT phenomena are found in the following sentences as well:

(18) a. A child was born that would be king.
    b. John said that Mary would come to Seattle.

In order to maintain the generalization that the SOT rule turns a present tense into a past tense when it is locally commanded by another past tense, the occurrences of would in (18a–b) must be past tense forms of the future auxiliary, and this is what Ladusaw’s proposal predicts.

Ladusaw’s proposal introduces NPs in three different ways. One
possibility is to introduce them in surface positions by the rules given in (19).

\[(19)\] Syntax Semantics (translation)
a. \(S \rightarrow (\text{NEG})\) NP AUX VP \(\rightarrow\) AUX\(^\star\)\(\text{[NP'(VP')]}\)
b. \(VP \rightarrow Vt\) NP \(Vt\)\(^\star\)

The other two options are provided by the phrase structure rules given in (20).

\[(20)\] Syntax Semantics (translation)
a. \(S \rightarrow \text{NP Vbl S} \rightarrow \lambda\text{Vbl S}\)
b. \(VP \rightarrow \text{NP Vbl VP} \lambda x\{\text{NP'(\lambda\text{Vbl}[VP'(x)])}\} \\
\text{[where Vbl stands for ‘variable’]}\)

The rules in (20a–b) generate NPs in “dislocated” positions. They are designed to predict various scope options for NPs. An NP generated by (20a) has scope over the lower S, whereas an NP generated by (20b) has scope over the lower VP.

At this point, let us discuss two important transformational rules that Ladusaw posits in his grammar. The first is an SOT rule given here in (21).

\[(21)\] Sequence of Tense:
\[
\begin{array}{ccccccc}
X & (\text{TENSE}) & Y & \text{PAST} & Z & (\text{TENSE}) & W \\
1 & 2 & 3 & 4 & 5 & 6 & 7 \\
1 & 4 & 3 & 4 & 5 & 4 & 7 \\
\end{array}
\Rightarrow
\]

where 4 commands 2 and 6, but neither 2 nor 6 commands 4

The SOT rule in (21) changes any tense into a past tense iff it is asymmetrically commanded by a past tense.\(^{10,11}\) In Ladusaw’s system, the SOT rule is an obligatory rule in that it must apply if its structural condition is satisfied. The other important transformational rule is that of NP lowering originally proposed by G. Lakoff (1971), which moves the NPs generated by the rules in (20a–b) down into structurally lower pronoun positions.
(22) NP Lowering:
\[
\begin{array}{ccccccc}
\text{NP} & x_i & X & [\text{he}i] & \text{NP} & (Y & \text{he}i) & Z \\
\text{Ø} & \text{Ø} & 3 & 1 & 5 & 6 & 7 & \Rightarrow \\
1 & 2 & 3 & 4 & 5 & \text{he/she/it/he} & 7
\end{array}
\]

(22) says that a “dislocated” NP replaces a pronoun that has the same index as the variable \(x\), and any subsequent occurrence of a pronoun with the same index is turned into an appropriate pronoun. The rule of NP lowering has the same role as quantifying-in operations in PTQ and May’s (1977) quantifier raising. In order to make the right predictions about the interactions among NP scope, SOT phenomena, and the temporal properties of tense morphemes that occur within NPs, the SOT rule applies before the NP lowering rule does.

In Ladusaw’s proposal, these two transformational rules make interesting predictions about \textit{de re} vs. \textit{de dicto} ambiguity of NPs. Ladusaw adopts Montague’s (1973) analysis of \textit{de re} vs. \textit{de dicto} ambiguity, which reduces it to a scope ambiguity between NPs and intensional transitive verbs (or verbs that take sentential complements). In general, when a relativized NP occurs in the object NP position of a transitive verb, there are three possible underlying structures for it as shown in (23).

\begin{align*}
(23) & \quad \text{a. } [S_{\text{NP}} … [S_{2} … \text{tense}_2 … ] … Vbl [S_{1} … \text{tense}_1 … ] ] \\
& \quad \text{S-level scope} \\
& \quad \text{b. } [S_{1} … \text{tense}_1 … [VP[NP … [S_{2} … \text{tense}_2 … ] … ] Vbl [VP … ] ] ] \\
& \quad \text{VP-level scope} \\
& \quad \text{c. } [S_{1} … \text{tense}_1 … [VP[V[NP … [S_{2} … \text{tense}_2 … ] … ] ] ] ] \\
& \quad \text{in situ}
\end{align*}

(23a) represents a case where the relativized NP has matrix-S scope. The tense in the relative clause is not subject to the SOT rule and is independent of the scope of the matrix tense. If the matrix clause predicate is an intensional transitive verb, the NP receives a \textit{de re} interpretation. Both (23b) and (23c) represent cases where the tense in the NP is subject to the SOT rule (if the matrix clause is in the past tense) and is interpreted relative to the matrix clause predicate. (23b–c) produce identical semantic results when the main clause has an extensional verb. With an intensional transitive verb such as \textit{seek},
(23b) yields a de re reading for the NP, whereas (23c) produces a de dicto reading for it.

Let us consider Ladusaw’s proposal in connection with some examples that involve the extensional transitive verb *see*.

(24) a. John saw the unicorn that was walking.
b. John saw the unicorn that is walking.
c. John saw the unicorn that will walk.
d. John will see the unicorn that walked.
e. John will see the unicorn that is walking.
f. John will see the unicorn that will walk.

(24a) is predicted to have three distinct interpretations, two of which entail the other. When the relative clause NP contains a past tense morpheme at deep structure and has scope over the entire sentence, neither of the two tenses command the other. Thus, this results in an interpretation in which both the time of John’s seeing the unicorn and the time of walking are in the past in relation to the speech time, with no order specified between them. If the NP contains a past tense in deep structure but is in the scope of the matrix tense by being generated either in a VP adjoined position or in the surface position, the SOT rule applies but has no visible effect because the tense in the NP is already a past tense. This results in an interpretation where the time of the unicorn’s walking is earlier than the time of John’s seeing. A third possibility is that the relative clause is in the present tense at the deep structure level, and the NP is introduced either in a VP-adjoined position or in the surface position. In this case, the SOT rule turns the present tense into a past tense. The interpretation is that the time of the unicorn’s walking is simultaneous with the time of John’s seeing it. Note that the second and third readings entail the first one.

(24b) has a different property. Recall that the SOT rule is an obligatory rule for Ladusaw. If the relativized NP were generated in a position that is commanded by the matrix past tense, the relative clause tense would be caught by the matrix past tense and turned into a past tense. Thus, the relativized NP in (24b) must be generated in an S-adjoined position. This derivation predicts that the time of the unicorn’s walking is the speech time. This is the right prediction.
(24c) has a similar property. Since *will* is analyzed as a future auxiliary in the present tense, the NP that contains *will* cannot have been generated within the scope of the matrix tense. Thus, it can only have been generated in an S-adjoined position. This derivation predicts that the time of the unicorn’s walking is in the future relative to the speech time. This is again the right prediction.

(24d) has two distinct readings, one of which entails the other. Since the main clause has *will*, which is morphologically present, the SOT rule does not apply to the tense morpheme in the relative clause regardless of its position. Thus, the past tense in the relative clause must also be a past tense in deep structure. Depending upon whether the relative clause tense is caught by the matrix future tense, the unicorn’s walking is either before the future time of John’s seeing or before the speech time. The latter reading entails the former. (24e) and (24f) are also ambiguous. In (24e) the time of the unicorn’s walking is either the utterance time or the time of John’s seeing. In (24f) the time of the unicorn’s walking is either after the speech time or after the time of John’s seeing. Thus, Ladusaw’s proposal makes the right predictions for the examples in (24).

Let us now turn to intensional constructions and consider the examples in (25):

(25) a. Bill will try to find a man who is walking in the park (now).
    b. Bill will try to find a car that isn’t burning oil (now).
    c. John wished to walk in a park that won’t be closed on Christmas.
    d. John sought a man who will be leaving.

The NP *a man who is walking in the park (now)* in (25a) is predicted to receive only a *de re* reading because the relative clause tense must denote the utterance time and therefore must have matrix clause scope. This means that there is a man who is walking now in the park. However, Ladusaw observes that this is not necessarily the case and that a “*de dicto* reading” is also possible. This is not accounted for by Ladusaw’s system. (25b) makes the same point.

Similarly, *a park that won’t be closed on Christmas* in (25c) must have matrix clause scope because it contains a present tense form of
the future auxiliary and must not be subject to the SOT rule. This would also mean that it should be outside the scope of the intensional transitive verb wish. Thus, we predict that the NP must receive a de re interpretation. However, Ladusaw says that his own intuitions do not confirm these predictions. Both (25c) and (25d) seem to have a “de dicto reading” as well as a de re reading. Thus, by his own admission, Ladusaw has created for himself a scope paradox: if the NP is scoped to the S-level, a de dicto reading is not predicted, but if the NP is interpreted in the surface position, he predicts that the present tense in the relative clause is turned into a past tense. I will refer to the problem as Ladusaw’s scope puzzle. The scare quotes in the above discussion reflect my solution to this problem. According to the proposal I will advance in Chapter 6, the type of interpretation Ladusaw is concerned with is a de dicto reading for the nominal part of the NP and a de re interpretation for its temporal part.

Ladusaw also points out that the examples in (26), which involve verb complement clauses, are problematic for his system:

(26) a. John will say that someone is searching his apartment.
   b. John believed that Telemachus will go to Athens.

(26a) is predicted to mean unambiguously that the search time is simultaneous with the time of John’s saying. (26b) ought to be ill-formed because will cannot be generated in the scope of the matrix past tense. Neither prediction is borne out. In general, Ladusaw’s proposal cannot deal with a sentence that has a present tense commanded by a past tense in deep structure. For example, (27) is also problematic for Ladusaw’s proposal.

(27) John said that Mary is pregnant.

Ladusaw’s proposal, including these problematic examples, will be discussed again in Chapters 4 through 6 in conjunction with my own theory. The problems connected with the examples in (25) through (27) will be handled as various types of double-access sentences that involve de re attitudes about states or intervals.
3.4. ENÇ (1987) ON A REFERENTIAL ANALYSIS
OF THE SOT PHENOMENA

Based upon Partee (1973), Enç (1987) argues for a referential theory of tense (and temporal expressions in general). The referential theory of tense as I outlined it in Chapter 2 assumes that tense morphemes directly refer to intervals that are salient in the context of use. Under this theory, sentence (28a) translates as an open formula as in (28b), and the variable \( t \) receives as its value a contextually salient past interval. Informally put, (28b) says that John saw Mary at the contextually salient past time.

\[
\begin{align*}
(28) & \quad \text{a. John saw Mary.} \\
& \quad \text{b. } t < s^* \& \text{see}'(t, \text{John, Mary})
\end{align*}
\]

In Chapter 2, I argued against the referential theory of tense and proposed an alternative theory in which both temporal quantifiers and contextual restrictions upon their quantificational force are posited. However, let us assume in this section that the referential theory of tense is still viable and test whether this assumption helps us to account for the behavior of tense morphemes in embedded clauses.

If we adopt the referential theory of tense, there is an obvious restriction upon the possible values that allegedly referential past tense morphemes can assume. It is empirically wrong to say that a past tense can denote any past time. For example, the embedded past tense in (29) cannot denote a time later than the time of John’s saying. Mary’s pregnancy must either overlap or completely precede the time of John’s saying.

\[
(29) \quad \text{John said that Mary was pregnant.}
\]

Thus, if we assume that tenses are referential expressions, their potential denotations must be constrained in some way. Enç (1987) attempts to show exactly what the right constraints should be. Let us first introduce some technical terms needed for the following discussion.
(30)  a. A *c-commands* B iff the first branching node that dominates A also dominates B.
   b. A *binds* B iff A c-commands B and A and B are coindexed.
   c. A *governs* B iff A is an X₀ (= lexical and head) category, A c-commands B, and there is no barrier intervening between A and B. (That is, there is no maximal projection C such that A c-commands C and C c-commands B.)
   d. α is a *governing category* for β iff α is the minimal category containing β and a governor of β, where α is NP or IP (=S).†

Enç makes two additional assumptions. First, tense is identified with Infl, which is the head of IP (= S). Second, if α governs β, then α also governs the head of β.

Enç’s basic idea is to account for the behavior of tense in embedded clauses by constructing a mechanism analogous to the Binding Theory proposed in the nominal domain (Chomsky 1981, etc.). Principle A of the Binding Theory requires that the reflexive pronoun *himself* in (31) be bound within its governing category. The complement clause is the governing category for *himself* because it is the minimal category of the relevant sort (i.e., IP or NP) that contains the verb *likes*, which governs *himself*. Since *himself* is indeed bound within its governing category in (31), it is licensed.

(31) Bill said that John₁ likes himself₁.

In Enç’s system, a tense obligatorily carries a temporal index, whereas a Comp optionally carries one. A Comp with a temporal index is then required to stand in a certain prescribed relation to the tense it governs. Enç defines the term “local Comp” as in (32) and proposes some restrictions upon possible denotations of indices on tenses and Comps as in (33).

(32) A Comp β is a local Comp of a tense α iff β governs α or β governs a tense γ and γ binds α.
    [paraphrasing (Enç 1987:647)]
(33) a. Where A is a past tense, B is a Comp with a temporal index, and B is a local Comp of A, \([A] < [B]\]
b. Where A is a present tense, B is a Comp with a temporal index, and B is a local Comp of A, \([A] = [B]\]
[paraphrasing Enç (1987:642)]

Enç’s account of the simultaneous reading and the shifted reading associated with (29) starts with the following requirement (p. 642):

(34) Each tense must be anchored.

Enç (p. 643) also proposes the following conditions referred to as the “Anchoring Conditions”:

(35) a. Tense is anchored if it is bound in its governing category, or if its local Comp is anchored. Otherwise, it is unanchored.
b. If Comp has a governing category, it is anchored if and only if it is bound within its governing category.
c. If Comp does not have a governing category, it is anchored if and only if it denotes the speech time.

Let us now analyze (36) (= (29)) in terms of Enç’s proposal.

(36) John said that Mary was pregnant.

Put simply, Enç’s idea is that the complement tense in (36) can be anchored in two different ways, and these two possibilities result in two distinct readings.

Consider first one legal indexed structure of (36) given in (37).

(37) \([\text{IP John Past}_1 \text{ say } \text{CP that [IP Mary Past}_1 \text{ be pregnant]}])\]

The verb complement clause is governed by the lower Comp. Recall Enç’s assumption that when \(\alpha\) governs \(\beta\), \(\alpha\) also governs the head of \(\beta\). Thanks to this assumption, the Comp also governs the tense in the complement clause, which is assumed to be the head of the IP. Since the matrix clause is the minimal category of the right type (IP or NP)
that contains the embedded tense and its governor (the lower Comp), the matrix clause is the governing category for the tense. The tense in the complement clause is indeed bound within the matrix clause, hence it is anchored. The two occurrences of the same index indicate that they denote the same time interval. The matrix past tense in (37) has no governing category because there is no S or NP that contains the tense and its governor (i.e., the matrix Comp). Thus, it order for it to be anchored, its local Comp (= the matrix Comp) must be anchored (see (35a)). The matrix Comp has no governing category because it has no governor. Thus, it can only be anchored by denoting the speech time (see (35c)). Since the index 0 denotes the speech time in Enç’s system, the matrix tense in (37) is anchored. (33a) requires that the matrix past tense in (37) denote a past time, i.e., a time earlier than what its local Comp denotes. Note that according to the above definition of local Comp, the matrix Comp is a local Comp for the embedded tense as well as for the matrix tense. The embedded tense is a past tense and is required by (33a) to denote a past time. There is no problem here because the embedded tense is coindexed with the matrix tense, which is also required to denote a past time. Thus (37) is predicted to receive a simultaneous interpretation, as desired.

Let us move on to the shifted reading of the sentence in (36). According to Enç, this reading is based upon the following indexing:

(38) \[ ([C_0] [IP John Past_1 say [CP that_1 [IP Mary Past_2 be pregnant]]]]

The matrix clause tense is anchored because its local Comp denotes the speech time just as in (37). The difference between (37) and (38) lies in the way the complement tense is anchored. The complement tense is not bound in (38). Therefore, the embedded tense is anchored iff its local Comp is anchored (see (35a)). The matrix verb governs the embedded CP and its head (i.e., the embedded Comp). Thus, the governing category for the embedded Comp is the matrix clause, and the Comp is anchored iff it is bound within the entire matrix clause (see (35b)). This condition is satisfied in (38) because the embedded Comp is bound by the matrix tense. The embedded Comp denotes a past time because it is coindexed with the matrix past tense. The embedded past tense is in turn required by (33a) to denote a time earlier than the past time denoted by the embedded Comp. This results
in a shifted interpretation, in which the time of Mary’s pregnancy is earlier than the time of John’s saying.

Enç’s proposal correctly rules out the illegal indexing possibility for (39a) indicated by (39b).

(39)  
  a. John believes that Mary was pregnant.  
  b. Comp₀ John Pres₁ believe that Mary Past₁ be pregnant.

Since the matrix tense binds the tense in the complement, the matrix Comp, which is a local Comp for the matrix tense, is also a local Comp for the complement tense. Thus the embedded past tense is required to denote a past time relative to the speech time, which the matrix Comp denotes (see (33a)). On the other hand, the embedded tense is bound by the matrix tense and is therefore required to denote the same time as the matrix tense. The matrix tense is a present tense and is thus required to denote the speech time (see (33b)). This means that the embedded tense is required to denote the speech time as well as a time earlier than the speech time. It is clearly impossible for the embedded tense to satisfy both of these requirements. Thus, the binding option given in (39b) is correctly ruled out. However, it turns out that (32) creates a problem for Enç when we attempt to deal with sentences that contain multiple embeddings.

Enç’s article does not provide a formal mechanism for semantic interpretation. Therefore, I will propose a system that interprets Enç’s system in a precise way, regimenting the informal story given above. In order to discuss this topic, however, we need to turn to some philosophical and technical matters that concern the semantics of so-called propositional attitudes. Assume for now that the object of any attitude is a proposition.¹⁶ In the tradition of formal semantics, propositions are defined either as sets of worlds or as sets of world-time pairs. Enç’s proposal sketched above conforms to the position borne by those who take the object of belief to be a set of worlds, rather than a set of world-time pairs. Following Hintikka (1962), I posit for any individual a an accessibility relation $H_a$ from $W \times T$ into $W$ and write $<w,t>H_a w'$ to indicate that $w'$ is accessible from $a$ in $w$ at $t$. The intuitive content of this accessibility relation is given in (40a), and the lexical semantics of believe’ is provided in (40b) on the basis of this relation $H_a$. 

¹⁶

For any world \( w \), interval \( t' \), and individual \( a \), \(<w, t,Haw> \) iff \( w' \) is not ruled out as a world of the kind which \( a \) believes himself/herself in \( w \) at \( t \) to be in.

For any world \( w \), interval \( t \), individual \( a \) and proposition \( p \) (a set of words), \([\text{believe'}]_w(p)(a)(t)\) is true iff \( p \) is true in all worlds \( w' \) such that \(<w, t,Haw'>\).

We can propose the following meaning for \textit{say'} in terms of the lexical meaning for \textit{believe'} given in (40b):

\[
\text{(41) For any world } w, \text{ interval } t, \text{ individual } a \text{ and proposition } p \text{ (a set of words), } [\text{say'}]_w(p)(a)(t) \text{ is true iff } a \text{ talks in } w \text{ at } t \text{ as if } [\text{believe'}]_w(p)(a)(t) \text{ is true.}
\]

We can now discuss the semantic properties of the indexed structure given in (42a) (=37)):

\[
\text{In the notational system I adopt in this book, the symbol "^" is used to indicate abstraction over worlds, not over world-time pairs. Thus, the verb complement clause in (42a) translates into } IL \text{ as } ^[[\text{be-pregnant'}(t_1, m)]], \text{ which denotes a set of worlds. Note that the same variable is used in (42b) for the time of John's saying and the time of Mary's being pregnant. This directly mirrors the indexed structure (42a), which Enç's rules license. The details of the semantic mechanism are given as follows. Suppose that 8 P.M. is a past time in relation to the speech time of the sentence in (42a). Then, for this time to qualify as the denotation of } t_1 \text{ that makes the second clause in (42b) true, the following conditions must be satisfied: for every world } w' \text{ such that } <w_0, 8 \text{ P.M.}>H_{John}w' \text{ (where } w_0 \text{ is the actual world), } w' \in \{ w \mid \text{Mary is pregnant in } w \text{ at 8 P.M.} \}. \text{ (This informally reads: for every world } w' \text{ that is compatible with what John believes in } w_0 \text{ at 8 P.M., Mary is pregnant in } w' \text{ at 8 P.M.) Since the proposition to which John bears the saying relation is a set of worlds, the temporal argument of the predicate that occurs within the proposition is fixed as in the above example. This type of proposition is "temporally specific" (Kaplan}}
\]
1977:503, Kratzer 1978:55–61). According to this proposal, the simultaneous reading associated with (36) is accounted for in a straightforward way. Whether or not Mary is actually pregnant, the proposition concerns the time of John’s saying. We tentatively adopt the above characterization of attitudes, which is technically simple, and use it as a tool to examine the empirical predictions that Enç’s proposal makes.

The shifted interpretation associated with (36) is obtained via an indexed structure of the form (43a) (= (38)) and the translation given in (43b):

\[
\begin{align*}
(43) \quad & a. \quad [[C_0] [[IP \text{ John Past}_1 \text{ say } [CP [IP \text{ Mary Past}_2 \text{ be pregnant}]])]] \\
& b. \quad t_1 < s^* & \text{say}'(t_1, j, \wedge[t_2 < t_1 & \text{be-pregnant}'(t_2, m)])
\end{align*}
\]

The fact that the embedded Comp is coindexed with the matrix tense is indicated by the occurrences of the same variable \(t_1\). The clause “\(t_2 < t_1\)” shows that the time of Mary’s pregnancy is earlier than the denotation of \(t_1\). Let the variables \(t_1\) and \(t_2\) denote intervals \(i_1\) and \(i_2\), respectively. Formally, (43b) is true in \(w_0\) iff \(i_1\) precedes the speech time, and \([\text{say}]_{w_0} ([\{w \mid i_2 < i_1 & \text{Mary is pregnant in } w \text{ at } i_2\}](\text{John}) (i_1) = 1. This holds iff every world \(w\) that is compatible with what John believes in \(w_0\) at \(i_1\) is an element of \(\{w' \mid i_2 < i_1 & \text{Mary is pregnant in } w' \text{ at } i_2\}\). It is clear that the condition is satisfied only if \(i_2\) precedes \(i_1\).

Thus, (43b) correctly predicts a shifted reading for (36).

However, Enç’s proposal does not work when we turn to examples that involve multiple embeddings. Consider examples (44a–b), which are due to Abusch (1988) and C. L. Baker (personal communication), respectively.17

\[
\begin{align*}
(44) \quad & a. \quad \text{John decided a week ago that in ten days at breakfast he would say to his mother that they were having their last meal together.} \\
& b. \quad \text{I told Bill that you would say that you only had three magic tricks to do, but it looks as if you have brought enough equipment to do six or seven. [Assume that the addressee will entertain people with some magic tricks this evening at a party.]} 
\end{align*}
\]
(44a) shows that although the lowest verb complement clause is in the past tense, it can receive a simultaneous reading in relation to the time of John’s saying to his mother. Note that because of the temporal adverbials used in the sentence, this time must be in the future in relation to the speech time. (44b) also makes the same point, except that it has no overt temporal adverbials that indicate the temporal locations of the relevant events. I will demonstrate that if we assume the above syntax-semantics mapping relation, Enç’s proposal cannot account for the simultaneous interpretation of (44a) (or (44b)). (45a–c) show how (44a) is analyzed in terms of Enç’s proposal as I interpret it.

(45)  

a. S-str.: Comp₀ John Past₁ decide a week ago that₁ in ten days at breakfast he would₂ say to his mother that they Past₂ be having their last meal together.

b. LF: [CP Comp₀ John Past₁ decide a week ago [CP that₁ in ten days at breakfast he would₂ say to his mother [CP that they Past₂ be having their last meal together]]]

c. \[ t₁ < s* & decide'(t₁, j, ^[t₁ < t₂ & at-breakfast'(t₂) & say-to-his-mother'(t₂, ^[t₂ < t₁ & they-be-having-their-last-meal-together'(t₂))]) \]

The S-structure of (44a) is (45a). For the reading in which the time of their having their last meal is simultaneous with the time of his saying to his mother, we want the coindexing indicated in (45b). However, recall the definition of local Comp given in (32), which says that a local Comp of the binder is also a local Comp of the bindee. If we assume that the intermediate Comp is a local Comp of would and that would is required to denote a future time relative to the denotation of its local Comp, the lowest past tense is subject to two mutually contradictory requirements. On the one hand, since it is bound by would, it is required to denote t₂, which would denotes, and t₂ is located later than t₁. On the other hand, since the lowest tense is a past tense, it is required to denote a time earlier than t₁, which its local Comp (i.e., the intermediate Comp) denotes. These requirements cannot be satisfied simultaneously, as the occurrences of the clauses “t₁ < t₂” and “t₂ < t₁” in the IL translation in (45c) show.

On the other hand, if we made an exception to the binding rules and said that a future tense was allowed to bind any tense, overriding the...
local Comp requirement, we would also be in trouble because this generalization is incorrect. The present tense form of the future auxiliary, i.e., *will*, cannot bind a past tense. Consider the sentence in (46a) and its indexed LF representation given in (46b).

(46)   a. John decided a week ago that in ten days at breakfast he will say to his mother that they were having their last meal together.
       b. # John Past₁ decide a week ago that₁ in ten days at breakfast he Pres will₂ say to his mother that they Past₂ be having their last meal together

In (46a), *would* is replaced with *will*. As a result, the simultaneous reading for the lowest verb complement clause indicated by the binding of the lowest past tense by the future tense *will* in (46b) is illicit. That is, (46a) does not have the reading in which the time of their having their last meal is simultaneous with the time of John’s saying to his mother.

The descriptive generalization obtained from the data considered above is that a past tense morpheme can be bound by *would*, but not by *will*. Accepting this generalization, however, is tantamount to admitting that an SOT rule is at play here. Note that the generalization we have just reached can be paraphrased as follows: a past tense can be interpreted as a null tense when *would* is in a local commanding position but not when *will* is in this position. The SOT theory accounts for these facts straightforwardly. Morphologically, *would* is a past tense, whereas *will* is a present tense. Thus, it is not surprising that a past tense locally c-commanded by *would* behaves like a “dummy past tense,” whereas a past tense locally c-commanded by *will* behaves like a “real past tense.”

The moral of the above discussion is the following. Enç intends to show that the English past is unambiguous: it always has an interpretation of anteriority. It turns out that Enç’s proposal has empirical problems that cannot be corrected without adopting a system that resembles an SOT theory. This shows that an SOT rule or its equivalent is absolutely necessary to account for the English data.
3.5. ABUSCH (1988) ON TENSE, SCOPE, AND INTENSIONALITY

Abusch (1988) provides evidence for the view that an SOT rule must be posited in the syntax to account for the SOT phenomena. In doing so, Abusch shows that what she calls an “independent theory,” which assumes that any tense morpheme is evaluated with respect to the speech time, does not succeed in accounting for the behavior of tenses in verb complement clauses. She also provides some examples that show convincingly that there is an intricate interaction between the interpretation of tenses and intensional contexts.

The independent theory claims that the temporal interpretation of a tense morpheme is always determined in relation to the speech time. We might alternatively refer to the theory as an indexical theory or an absolute theory of tense. This simple theory seems to be good enough at first when we look at examples like (47a).

(47)  
   a. The man who I met on the street dated the girl who bought the scarf.
   b. \[ \exists x [ \forall y ([y is a man at s^* \& \exists t_2 [t_2 < s^* \& I meet y at t_2]) \leftrightarrow x = y] \& \exists z [\forall w ([w is a girl at s^* \& \exists t_3 [t_3 < s^* \& w buys the scarf at t_3]) \leftrightarrow w = z] \& \exists t_1 [t_1 < s^* \& x dates z at t_1]] \]

The temporal relations among the three tenses that occur in (47a) are completely free as the translation in (47b) shows. The only requirement is that all the times are located in the past in relation to the speech time. We find a problem with this view when we turn to verb complement clauses, as we saw above in connection with Enç’s proposal. Consider the following example again:

(48)  
   John said that Mary was pregnant.

If we assume that denotations of tenses are always determined in relation to the speech time, the time of Mary’s pregnancy can be later than the time of John’s saying as long as it precedes the utterance time of the entire sentence. However, this prediction is not borne out. This shows that a naïve independent theory of tense fails. To constrain the
denotations of tenses in a proper way, Enç proposes a set of constraints referred to as the “Anchoring Conditions” as I discussed above. In connection with this discussion, I cited Abusch’s example repeated here as (49) to show that Enç’s proposal does not work.

\[(49)\] John decided a week ago that in ten days at breakfast he would say to his mother that they were having their last meal together.

In this example, the time of their having their last meal together is located at a time later than the speech time. The past tense found in the lowest clause is semantically empty. This is a clear counterexample to Enç’s claim that all occurrences of English tenses have preterit interpretations. Abusch correctly points out this problem with Enç’s proposal and shows that we must posit an SOT rule. However, her SOT rule is not defined solely in syntactic terms. Instead, Abusch invokes the notion of intensionality as in (50) to define what she calls a “transposing context,” which in our terms is a context in which an SOT rule applies.

\[(50)\] In sentences with an embedded Tns\textsubscript{2}, Tns\textsubscript{2} is in a transposing context iff it is within an intensional argument of a past tense verb V\textsubscript{1}.

As the reader will soon find out, the SOT rule that I propose differs from Abusch’s in that it only refers to structural properties, not to intensional contexts.

Another important point that Abusch (1988) makes is that the interpretation of tense depends in part upon whether it is in an intensional context when interpreted. Abusch’s findings on this subject can be summarized as follows. First, we consider cases that involve embedded past tense morphemes.

\[(51)\]
\[
a. \text{John}_1 \text{ said that the man killed him}_1.
\]
\[
b. \text{John}_1 \text{ looked for the man who killed him}_1.
\]
\[
c. \text{John}_1 \text{ suspected that the man who killed him}_1 \text{ was behind the door.}
\]

(51c) is due to Abusch, and I constructed (51a–b) after her example.
The numerical subscripts indicate coreference. (51a) sounds contradictory. This fact is accounted for if we assume that the deictic center for the interpretation of the complement tense is the time of John’s saying. Under this assumption, the time of the man’s killing him must be prior to the time of John’s saying, which is pragmatically impossible since we normally assume that a dead person cannot speak. (51b–c) are also contradictory on their “de dicto” construals. On a de dicto reading for the relativized NP in (51b), John would describe to himself the object of his search in terms of the property of killing him. If the interpretation of the past tense in the NP can be determined relative to the utterance time, it appears that the NP can receive two distinct de dicto interpretations depending upon how the tense it contains is interpreted. They could be characterized as two alternative descriptions of the object of the search by John: “whoever killed me” or “whoever will kill me.”\textsuperscript{19} Abusch notes that the relativized NP in (51b) can only receive a whoever-killed-me interpretation on its de dicto construal. This results in a pragmatically implausible reading because a dead person cannot conduct a search. That is, the relativized NP cannot receive a whoever-will-kill-me interpretation. This shows that when a relativized NP receives a de dicto interpretation, the interpretation of the tense in the relative clause must be determined relative to the time of the intensional verb in the matrix. The same is true of (51c). The time of the man’s killing him must be in the past relative to the time of John’s suspicion if the relativized NP receives a de dicto interpretation. This is also a contradictory reading. In Abusch’s terms, the sentences in (51b–c) lack a “forward-shifted” de dicto reading for the NP. Note that both (51b) and (51c) can receive a coherent interpretation if the relativized NP receives a de re interpretation: John’s search or suspicion concerns some particular person (say Bill), who killed him at some time between then and now.\textsuperscript{20} The PTQ system or Ladusaw’s (1977) system accounts for the data in (51) straightforwardly, if augmented by a proper lexical semantics for attitude verbs. One concrete proposal for believe and say was provided above in (40b) and (41). Verbs like seek (or look for) will be discussed in Chapter 5.

Abusch also notes that if a present tense morpheme occurs at LF in an intensional context in the scope of a past tense, the resulting
sentence receives a double-access reading as shown by examples like (52a–b).

(52)  a. John looked for a man who understands the incompleteness theorem.
     b. John said that Mary is pregnant.

Abusch presents an example like (52a), which has an interpretation that resembles that of (52b). That is, (52a) can receive an interpretation in which the time of the man’s understanding the incompleteness theorem overlaps both the time of the search and the speech time of (52a). This is based upon a de dicto-like interpretation of the NP.21 In order to account for the fact that the English present “has access” to the utterance time in examples like (52a–b), Abusch posits the following rule for the English present:

(53) \[ \text{Pres } \phi_{w,t,s} = \text{true} (\text{where } w \text{ and } t \text{ are shiftable indices for world and time, respectively, and } s \text{ is a non-shiftable index for the utterance time}) \iff \text{[}\phi_{w,t,s} = \text{true and } t \text{ overlaps } s. \text{]} \]

(53) by itself does not explain the fact that (52a–b) receive double-access readings. We still need to be told why the present tense must also be interpreted in relation to the time of the main clause predicate.22

The sentences in (52) contrast very sharply with (54a), which seems unambiguous and does not receive a double-access reading. It only requires that the time of the man’s living in Seattle overlap the speech time. Of course, it is possible that the man in question lived in Seattle when John met him, but this is not part of its truth conditions. This point is established clearly by adding appropriate adverbials as in (54b).

(54)  a. John met a man who lives in Seattle.
     b. When John visited Japan, he met a man who now lives in Seattle.

Ladusaw’s proposal accounts for examples like (54a). Since the SOT rule is obligatory in Ladusaw’s proposal, the NP must have an S-level interpretation in order to prevent the SOT rule from affecting the tense
form in the relative clause. This means that the present tense refers to the utterance time. This we have seen above in connection with example (24b). On the other hand, since Abusch assumes that the SOT phenomena only obtain in intensional contexts, she must appeal to the special rule for the English present given above as (53) to predict this result. This has the same semantic effect as Ladusaw’s SOT rule. As far as examples like (54a) are concerned, Ladusaw’s proposal appears more elegant than Abusch’s proposal. However, as mentioned above, Ladusaw has problems with double-access sentences.

The problems associated with sentences like (52a–b) will be discussed in detail in Chapter 6. Abusch’s (1988, 1991) solution to the double-access problem will also be discussed there. I shall close this chapter with a descriptive generalization about double-access sentences obtained as a result of the above discussion.

(55) An English sentence of the form \[ S \ldots V \text{Past} \ldots \alpha \ldots \text{Pres} \ldots \] (where Past commands Pres) can receive a double-access interpretation when \( \alpha \) is the intensional argument of \( V \).

When \( \alpha \) is a sentential complement of \( V \) or when \( \alpha \) is an NP and receives a de dicto-like interpretation, the sentence obligatorily receives a double-access interpretation.

NOTES

1 (1c) can also receive a shifted interpretation when accompanied by an appropriate adverbial as in (i) and uttered in the right context.

(i) John said last week that Mary was sick a week earlier.

2 This structural description is due to Ross. I will adopt a different analysis of sentential subjects in which they are analyzed as CPs (= \( S’ \)).

3 The concept of “being in construction with” is almost the same as the concept of c-command proposed by Reinhart (1976):

(i) A c-commands B iff A does not dominate B & B does not dominate A & the first branching node that dominates A also dominates B.

4 This assumes that the sentential subject is in the subject position when the SOT rule applies.
The SOT rule to be proposed in Chapter 4 differs from (15) in that it requires that A locally command B. See Chapter 4 for some possible empirical consequences of this difference.

One theoretically possible option that I will not pursue for the purpose of this book is to adopt a syntactic structure that is appropriate for semantic interpretation at D-structure, S-structure, and at LF and to posit an SOT rule at PF that optionally copies a past tense onto the tense node that it locally commands. Since there is an interaction between NP scope and tense scope, this option makes some wrong predictions. I owe this observation to Mats Rooth (personal communication).


Dorit Abusch and I discussed the topics having to do with tenses in embedded clauses when she was a post-doctoral fellow at the center for cognitive science at the University of Texas at Austin during Spring of 1988. The results of my research were reported in my Ph.D. dissertation (Ogihara 1989).

Abusch (1991) is also an important piece of work, but its main focus is double-access sentences rather than the SOT phenomena. Therefore, I will discuss it separately in Chapters 4 and 6 in conjunction with my own proposal.

I do not see why Ladusaw defines the SOT rule in terms of asymmetric command, instead of (plain) command. As far as I know, there is no possibility that two tense morphemes command each other, and this extra requirement is unnecessary if not harmful.

Since Ladusaw assumes that there are only two tenses (i.e., present and past), we can assume that only when the lower tense is a present tense, the rule has a visible effect. In other words, when the lower tense is a past tense, the rule vacuously applies without producing any change.

The choice of the pronoun depends upon the gender of the head noun of the moved NP. The indexed pronoun he is chosen when the moved NP itself is he. See Ladusaw (1977:97) or Cooper (1975:35) for details.

Although this analysis of de re/de dicto ambiguity is subject to the criticism voiced by Quine (1956), this potential problem is independent of the issues that Ladusaw is concerned with in his paper, and we abstract away from it for the purpose of this discussion. The issues connected with de re attitudes will be taken up separately in Chapter 4, and a different proposal will be advanced, which is based upon Cresswell and von Stechow’s (1982) and Lewis’s (1979) proposals about attitudes.

Generating the NP in a VP-adjoined position would be even more problematic. The NP would be in the scope of the matrix tense and would receive a de re interpretation.

This definition of governing category is proposed in Chomsky (1981:188). Many other versions have been proposed in the literature. Enç (1987) adopts a more recent definition due to Chomsky (1986) that employs the term “complete functional complex,” but (30d) is adequate for our purposes.

I will eventually adopt the view that the object of an attitude is a property, a view expressed by Lewis (1979). See Chapter 4 for details.

Abusch attributes a similar example in French to Kamp and Rohrer (1984).

See the relevant discussions in Chapters 1 and 6.

A “whoever-is-killing-me” interpretation is also a theoretical possibility.
The *de re* reading simply requires that the time of the killing be before the speech time, but this time must be after the time of the matrix predicate to make the reading pragmatically plausible.

I say “*de dicto*-like” because, as I will demonstrate later, the tense contained in the NP receives a *de re* interpretation. The NP receives a *de dicto* interpretation as far as the “nominal part” is concerned.

The relativized NP in (52a) can also receive a *de re* reading, in which case the time of the man’s understanding the theorem does not have to overlap the search time.
CHAPTER FOUR

SEQUENCE-OF-TENSE PHENOMENA
IN COMPLEMENT CLAUSES

4.1. A TENSE DELETION RULE AND A *DE SE*
ANALYSIS OF ATTITUDES

In Chapter 3, I discussed the previous literature that deals with tenses in embedded clauses. Based upon that discussion, I will propose in Chapters 4 and 5 my own account of the SOT phenomena in English and the lack thereof in Japanese. In this chapter, I will concentrate upon complement clauses and will turn to adjunct clauses in Chapter 5. My account starts with a discussion of the semantics of indirect discourse verbs and so-called propositional attitude verbs. Let us recapitulate the discussion of the SOT phenomena by traditional grammarians and modern descriptive grammarians. As mentioned in Chapter 3, they generally describe the SOT phenomena either in terms of the direct speech vs. indirect speech correlation or in terms of structural relations between the trigger and the target. It is usually not clear how they would interpret those sentences in which the SOT phenomena occur. As far as syntax is concerned, I will follow Curme in saying that the rule (or the phenomenon) is defined in terms of structural properties of tenses alone. On the other hand, I will adopt the view that when *was* in (1) is used for a simultaneous interpretation, it is not the right tense form for semantic interpretation.

(1) John said that Mary was pregnant.

What we need, instead, is a “present tense” form or tenseless verb form that indicates simultaneity relative to the time of the matrix predicate.
In order to discuss the SOT rule in terms of modern theoretical linguistics, we must first regard it as a rule that relates two levels of linguistic structure, rather than one that relates two surface sentences. For the purpose of this book, I will adopt the organization of the grammar proposed by Chomsky and Lasnik (1977), the so-called “upside-down Y model.”

\[
\begin{array}{c}
\text{D-structure} \\
\mid \\
\text{S-structure} \\
/ \\
\text{Phonetic} \quad \text{Logical} \\
\\text{Form} \quad \text{Form}
\end{array}
\]

Let us articulate the conditions under which the SOT rule applies in this framework. Strictly speaking, there are (at least) three components to the description of the SOT rule: the trigger, the target (i.e., the linguistic element that undergoes a change), and the relation between the two. I tentatively assume that the trigger is always a past tense morpheme. This view will be modified later in this chapter, but it will do for now. I also assume for the time being that the expression affected by the SOT rule is a past tense morpheme. In this section, I will mainly discuss the third point: the relation between the trigger and the target. As mentioned earlier, Curme (1931) observes that a clause located immediately under a past tense is usually in the past tense. To the best of my knowledge, Ross (1967) was the first among the modern linguists to account for the SOT phenomena in terms of a syntactic rule that applies when some structural conditions are satisfied, not in terms of direct discourse vs. indirect discourse relations. For example, as I mentioned briefly in Chapter 3, Ross (1967:206) discusses a rule that can deal with SOT phenomena observed in sentential subjects like those in (3a–b), which do not have a direct discourse source.

\[
(3) \quad \begin{align*}
\text{a.} & \quad *\text{That the sun is out was obvious.}^1 \\
\text{b.} & \quad \text{That the sun was out was obvious.}
\end{align*}
\]

Costa (1972) also holds a view similar to Ross’s. All other things being equal, this way of construing the SOT phenomena has a number
of advantages over an alternative that restricts its application to verb
complements or to intensional contexts (Abusch 1988). One obvious
advantage is that we can refer only to structural properties, which
renders the condition on the application of the SOT rule simple and
elegant. This type of theory also predicts that the rule applies not only
to verb complements but also to other constructions such as relative
clauses. Whether or not this is an advantage is an empirical question. I
will show that this is in fact a desirable prediction and that the SOT
rule as proposed in this chapter applies to English relative clauses as
well. Although a detailed discussion of adjunct clauses will be
deferred until Chapter 5, I will briefly preview why this type of theory
is desirable, referring to both complements and adjuncts.

I first discuss how tense morphemes are interpreted in verb
complement clauses. In the upside-down Y model, an SOT rule is
assumed to turn the underlying structure given in (4b) into the one
given in (4c) for a surface sentence like (4a).

(4)  a. John said that Mary was pregnant.
    b. John Past say that Mary Past be pregnant
    c. John Past say that Mary Ø be pregnant

I assume that the SOT rule applies to (4b) and yields an LF
representation (4c), which is suited for semantic interpretation. The
symbol “Ø” represents a null tense node. This informally means that
the complement clause is tenseless when it is interpreted. We can thus
posit the following rule:

(5)  The SOT rule [first version]:
A past tense locally commanded by another past tense at LF
is optionally deleted. [N.B.: A commands B iff neither A
nor B dominates the other, and the minimal S that dominates
A also dominates B. (paraphrasing Langacker (1969)) Tense
A locally commands tense B iff A commands B and there is
no tense C such that A commands C and C commands B.]

At first, this appears to be a rule that is very different from what
the traditional grammarians had in mind: it is a rule that deletes a past
tense, not a rule that changes a present tense into a past tense.
However, this is because of the overall structure of the upside-down Y
model, and the rule is based upon the same idea as the preliminary proposal presented in Chapter 3. The rule given in (5) has (at least) five important properties. (i) The rule is defined in terms of the notion “command.” (ii) The rule is an optional rule. (iii) The rule applies within a local domain. (iv) A tenseless sentence is needed at LF for a simultaneous interpretation. (v) The rule applies to constructions other than verb complements as long as the structural requirement is satisfied. Let us consider them in turn.

First, I employ the term “command” adopted by Ross (1967) and Ladusaw (1977) in the definition of the SOT rule. This is necessary, given the syntax of tense morphemes and auxiliary verbs proposed in Chapter 2. The SOT rule must be specified in such a way that a tense that occurs within the subject NP (or perhaps CP) can undergo a change triggered by the tense of the matrix predicate. The case of sentential subjects is shown in (3b). I will also show that relative clauses and noun complements that appear within the subject NP position are also subject to the SOT rule. The structural relation between the trigger in the matrix clause and the target within the subject NP is described schematically as in (6).

\[
\begin{align*}
S \rightarrow &\text{NP (or CP) … Tense}_2 \ldots [T_P \text{Tense}_1 \text{VP}] \\
\end{align*}
\]

Notice that Tense$_1$ commands Tense$_2$ but does not c-command it. By adopting the definition of the SOT rule given in (5), we can account for the data in (3b), among others. Since the tense in the sentential subject in (7a) is locally commanded by the matrix tense, the SOT rule applies to yield (7b).

\[
\begin{align*}
(7) &\quad a. \quad [S[CP \text{ that } [S \text{ the sun Past be out}]] [T_P \text{ Past } [VP \text{ be obvious}]]] \\
&\quad b. \quad [S[CP \text{ that } [S \text{ the sun } \emptyset \text{ be out}]] [T_P \text{ Past } [VP \text{ be obvious}]]]
\end{align*}
\]

Concerning the second and third points, note that the preliminary version of the SOT rule proposed in Chapter 3 does not have these properties. The rule must now be an optional rule because we want to predict shifted readings for past-under-past sentences such as (8).

\[
(8) \quad \text{John said that Mary left.}
\]
Since the embedded past tense must be a “real past tense” at LF, it must not be deleted by the SOT rule. The rule must be defined in terms of “local command” because of an example like (9a).

(9)   a. John said that Mary will claim that she was sick.
      b. John Past say that Mary Pres woll claim that she Past be sick
      c. John Past say that Mary Pres woll claim that she Ø be sick

Let (9b) be the underlying structure of (9a). If the rule was not restricted to a local commanding tense, the lowest past tense could be deleted by the SOT rule because of the past tense in the matrix clause. If the null tense in (9c) is interpreted relative to the time of Mary’s claim, the time of Mary’s being sick is predicted to be simultaneous with the time of her claim. This is the wrong prediction.

Regarding the fourth point, I have already voiced the view that a past tense morpheme used for a simultaneous reading is semantically empty, so I will be brief. Essentially, the proposal is that what is conveyed by a verb complement clause is best “reconstructed” from the viewpoint of the agent at the time of the reported utterance. Take (10a) (= (4a)), for example. When it is used for a simultaneous reading, it can be assumed to report an utterance (10b) made by John at an earlier time.

(10)  a. John said that Mary was pregnant.
      b. John: “Mary is pregnant.”

Since John’s utterance is in the present tense and is used to convey some information about the time of his utterance, we should use the present tense to convey this information in a report if we want to be faithful to John’s perspective as he made the reported utterance. Japanese examples that involve verb complements support this position.

(11)   Taroo-wa [ zibun-wa byooki-da] to it-ta.
        Taro-TOP self-TOP be-sick-PRES that say-PAST
        ‘Taro said that he was sick.’ [simultaneous reading only]
As (11) shows, the verb complement clause is in the present tense and conveys a simultaneous reading. In Japanese, this is the only way of expressing a simultaneous interpretation in a verb complement clause. Given the English and Japanese facts in verb complement clauses (and given, also, the null hypothesis that the semantic mechanisms at work in the two languages do not differ from each other in the relevant respects), the only reasonable conclusion that we can draw from the above discussion is that the Japanese facts represent what we want for semantics, and the English surface tense form must be converted to the one that is interpretable.

I will try to substantiate the fifth point in an indirect way. Let us entertain a hypothesis that concerns the relationship between syntax and semantics. Suppose that a tense $\alpha$ in a verb complement clause is commanded by a tense $\beta$ in the matrix clause. This is a typical configuration in which the SOT rule applies. If my proposal is on the right track, whether or not the SOT rule applies to $\alpha$, $\alpha$ (either the original or the form that the SOT rule yields) is interpreted in relation to $\beta$. In other words, the (potential) target of the SOT rule is interpreted in relation to the (potential) trigger. This suggests a parallel between the syntactic scope of the SOT rule and the semantic scope of tense. This is not the only theoretical possibility. We could imagine a situation in which a null tense that results from the application of the SOT rule is interpreted in relation to the utterance time of the sentence in which it occurs, but no such case has been observed. Thus, we tentatively pursue the following hypothesis:

(12) In English, a tense $\alpha$ is interpreted in relation to another tense $\beta$ if their structural relation at LF is such that $\alpha$ and $\beta$ are a potential target and a potential trigger, respectively, of the SOT rule.

Keeping this hypothesis in mind, we briefly look at the case of relative clauses. Assume, in addition to (12), the following hypothesis:

(13) Save the difference with respect to the SOT phenomena, there is no difference between English and Japanese concerning which tenses are interpreted in relation to which others.
Given these two hypotheses, consider some Japanese examples. In Japanese, just as in verb complements, a present tense morpheme in a relative clause that occurs immediately under a higher past tense can receive a simultaneous reading, as in (14).

(14) Taroo-wa [ nai-te i-ru otoko]-ni at-ta.
    Taro-TOP cry-PROG-PRES man-DAT meet-PAST
    ‘Taro met a man who was crying.’ [simultaneous reading]
    or ‘Taro met a man who is crying now.’

Note that the relative clause is in the present tense and can receive a simultaneous reading with respect to the time of Taro’s meeting the man. This reading is analogous to the case of verb complements exemplified by (11) in that the time of the subordinate clause is simultaneous with the time of the main clause. We can hypothesize that (14) can receive a simultaneous reading because the relative clause is “in the scope” of the matrix past tense when interpreted. This analysis is supported by the fact that the present tense in the relative clause is locally commanded by the matrix tense, just as in the case of verb complements. These parallels between verb complements and relative clauses in Japanese and the two hypotheses given above as (12) and (13) strongly suggest that the SOT rule applies to relative clauses as well as verb complements in English. This line of reasoning predicts that (15a) can receive a simultaneous reading on a par with the Japanese example in (14).

(15) a. Taro met a man who was crying.
    b. Taro Past meet [a man who Past be crying]
    c. Taro Past meet [a man who Ø be crying]

As we saw in Chapter 3, this is the prediction that Ladusaw (1977) makes. The widest scope reading for the relativized NP predicts the possibility that the time of Taro’s meeting the man is simultaneous with the time of the man’s crying. Thus, the SOT rule appears to be unnecessary. However, Ladusaw (1977:96) regards the simultaneous reading as a distinct reading. I assume with Ladusaw that NPs are in general subject to scoping, and the SOT rule is defined in structural terms. There are some crucial examples that show that an SOT rule is
indispensable to account for the behavior of relative clause tenses in English. We will turn to such data in Chapter 5.

Let us now turn to a major question that concerns semantics. The question is this: how shall we produce the right semantic results from the output of the SOT rule proposed in (5)? Consider the example in (16a). According to (5), we expect that (16c), which the SOT rule yields by applying to (16b), is the structure to which the semantic rules apply.

(16) a. John said that Mary was pregnant.
    b. John Past say that Mary Past be pregnant
    c. John Past say that Mary Ø be pregnant

In order to show formally that (16c) is the structure we want for semantic interpretation, we need to make a concrete proposal about the semantics of so-called propositional attitude verbs (e.g., believe, think) and indirect discourse verbs (e.g., say, state). As I did in Chapter 3, I will assume that there is no major difference between indirect discourse verbs and propositional attitude verbs and will discuss the semantic properties of the former in terms of the proposal originally made for the latter.

In the tradition of formal semantics (Russell 1940), verbs like believe are referred to as propositional attitude verbs because they are believed to denote relations between persons and propositions. Assuming that this idea is correct, we must choose between the following two alternative formal interpretations of the concept “proposition”: a set of worlds or a set of world-time pairs. As a preliminary proposal, let us adopt the latter following Montague (1973). This means that indirect discourse verbs and propositional attitude verbs denote relations between persons and sets of world-time pairs. For example, (16c) translates into IL as in (17).

(17) $\exists t_1 [t_1 < s^* \& \text{say}'(t_1, j, ^\lambda t_2 [\text{be-pregnant}'(t_2, m)])]$

Since the embedded clause is tenseless at LF after the application of the SOT rule, it is natural to translate it as a lambda expression that denotes $\{<w, t> | \text{Mary is pregnant in } w \text{ at } t\}$. This is simply the intension of a tenseless sentence. As mentioned in Chapter 2, I will adopt a version of IL in which temporal terms as well as “normal”
individual terms are employed in the object language. Therefore, every predicate has an “extra” argument position reserved for a temporal term. Accordingly, propositions (i.e., sets of world-time pairs) are symbolized in a way different from PTQ. In PTQ, (the characteristic function of) the set \{<w, t> | Mary is pregnant in w at t\} is denoted by the expression \(^{\wedge}\text{be-pregnant}'(m)\). However, in our notational system, the same semantic content is expressed by the expression \(^{\wedge}\lambda t_2[\text{be-pregnant}'(t_2, m)]\), which is found in (17) above. Strictly speaking, \(^{\wedge}\lambda t_2[\text{be-pregnant}'(t_2, m)]\) does not denote (the characteristic function of) the set of world-time pairs that \(^{\wedge}\text{be-pregnant}'(m)\) denotes in PTQ. Rather, it denotes a function-valued function that conveys the same semantic content.

The next question is whether the symbolization given in (17) predicts a simultaneous reading. First, if we simply fix the semantic type of propositional attitude verbs or indirect discourse verbs, then we can only conclude that they denote subsets of \{<t, x, p> | t \in T and x \in A and p \subseteq W \times T\}. For example, if it turns out that \text{say}'(t_1, j, ^{\wedge}\lambda t_2[\text{be-pregnant}'(t_2, m)]) is true by virtue of the fact that \{<8 \text{ P.M.}, John, \{<w, t> | Mary is pregnant in w at t}\}\} is an element of the denotation of \text{say}' in the actual world \text{w}_0, this does not show that (16a) has a simultaneous reading. It reads informally, “At 8 P.M., John stands in the saying relation to the set of world-time pairs \{<w, t> | Mary is pregnant in w at t\}.” Since the denotation of the embedded sentence is a set of world-time pairs, this does not require that Mary in fact be pregnant in the actual world \text{w}_0 at 8 P.M., which is the time of John’s saying in the situation under discussion. This in fact is a virtue of the idea that verbs like \text{believe} denote relations between individuals and propositions. Intuitively, (16a) can be true on a “simultaneous interpretation” even if Mary was not pregnant at all at the time of John’s saying. What is crucial here is the content of John’s utterance: according to what John said, Mary was allegedly pregnant at the time of his saying. For example, (16a) can be followed by the sentence \text{But he was wrong}. Therefore, we must make sure that the sentence in (16a) on a simultaneous reading does not entail the truth of the embedded clause in the actual world at the time of John’s original utterance. However, it is equally important to explain why the symbolization (17) is adequate for the simultaneous interpretation of (16a).

Before trying to sharpen our intuitions about what we have been referring to as “simultaneous interpretations,” let us discuss
propositional attitudes in general. Let us recapitulate Hintikka’s (1962) proposal, which aims to constrain the lexical meaning of believe. Hintikka posits an accessibility relation $H_a$, a relation in $W$ (= a subset of $W \times W$) defined for an individual $a$, and writes $wH_aw'$ to indicate $<w, w'> \in H_a$. For any individual $a$ and worlds $w, w'$, if $wH_aw'$ holds, $w'$ is said to be a doxastic alternative of $a$ in $w$. The intuitive content of this accessibility relation is characterized as in (18).

(18) For any individual $a$, and worlds $w$ and $w'$, $wH_aw'$ iff $w'$ is not ruled out as a world of the kind which $a$ believes himself/herself in $w$ to be in.

In Chapter 3, this relation was invoked to provide Enç’s proposal with a mechanism for semantic interpretation. Given this relation, the lexical meaning of believe can be specified as follows:

(19) For any world $w$, individual $a$ and proposition $p$, $\llbracket \text{believe} \rrbracket_w(p)(a)$ is true iff $p$ is true in all worlds $w'$ such that $wH_aw'$.

By adopting this proposal, we can predict, for example, that no individual can believe two mutually contradictory propositions, such as (20a–b).

(20) a. Mary is pregnant.
    b. Mary is not pregnant.

I consider Hintikka’s attempt to constrain the meaning of verbs like believe to be on the right track and will extend it to deal with temporal examples. Hintikka’s proposal is based upon a system that has no times, and he naturally chooses sets of worlds to represent propositions. In order to modify it for a system that deals with times as well as worlds, we must decide how to interpret propositions. As mentioned above, there are two alternatives. One is to think of them as sets of worlds; the other is to regard them as sets of world-time pairs. Let us compare these two alternatives and their consequences.

I will first consider the preliminary proposal I have adopted above, namely the one that regards a proposition as a set of world-time pairs.
Proposal 1 [a proposition = a set of world-time pairs]:

a. For any worlds \(w, w', \) times \(t, t', \) and individual \(a, \)
\(<w, t>H_a<w', t'> \) iff \(<w', t'> \) is not ruled out as
world-time pair of the kind which \(a \) believes
himself/herself to be in \(w \) at \(t.\)

b. For any world \(w, \) interval \(t, \) individual \(a\) and
proposition \(p \) (a set of word-time pairs),
\([\text{believe}]_{w}(p)(a)(t) \) is true iff \(p \) is true at all
world-time pairs \(<w', t'> \) such that \(<w, t>H_a<w', t'>. \)

c. For any world \(w, \) interval \(t, \) individual \(a\) and
proposition \(p \) (a set of word-time pairs), \([\text{say}]_{w}(p)(a)(t) \)
is true iff \(a \) talks in \(w \) at \(t \) as if \([\text{believe}]_{w}(p)(a)(t) \) is
true.\(^{12}\)

According to this proposal, (17), repeated here as (22), is an
appropriate IL translation for (16a).

\[
(22) \ \exists t_1 [t_1 < s* & \text{say}'(t_1, j, ^\lambda t_2[\text{be-pregnant}'(t_2, m)])]
\]

As in the earlier case, suppose that (16a) is true and that John’s saying
takes place at 8 P.M. The truth condition for (22) is now stated as
follows: John talks in \(w_0 \) at 8 P.M. as if for every \(<w', t'> \) such that
\(<w_0, 8 \text{ P.M.}>H_{\text{John}}<w', t'>, \) Mary is pregnant in \(w' \) at \(t'. \) Suppose that
this truth condition is satisfied. This means that Mary is pregnant at all
world-time pairs that are “doxastic alternatives” for John in \(w_0 \) at 8
P.M. Given this description of the truth conditions for (16a), we can say
that if John speaks the truth at \(<w_0, 8 \text{ P.M.}>., \) then \(<w_0, 8 \text{ P.M.}> \) is an
element of \(\{<w, t> \mid \text{ Mary is pregnant in } w \text{ at } t \}. \) That is, Mary is
pregnant in \(w_0 \) at 8 P.M. This is the desired result.

Some readers might ask at this point why we need to employ this
convoluted way of representing what we refer to as “simultaneous
interpretations,” which appear to be simple and straightforward. Those
who question my approach might want to adopt the following
alternative, which assumes that a proposition is a set of worlds:
Proposal 2 [a proposition = a set of worlds]:

a. For any worlds \( w, w', \) interval \( t' \), and individual \( a \),
\( <w, t> H_a w' \) iff \( w' \) is not ruled out as a world of the
kind which \( a \) believes himself/herself in \( w \) at \( t \) to be in.

b. For any world \( w \), interval \( t \), individual \( a \) and
proposition \( p \) (a set of words) \([\text{believe}']_w(p)(a)(t)\) is
true iff \( p \) is true in all worlds \( w' \) such that \( <w, t> H_a w' \).

c. For any world \( w \), interval \( t \), individual \( a \) and
proposition \( p \) (a set of worlds), \([\text{say}']_w(p)(a)(t)\) is true
iff \( a \) talks in \( w \) at \( t \) as if \([\text{believe}']_w(p)(a)(t)\) is true.

\( H_a \) is a relation between world-time pairs and worlds here. Consider
the following formula that conforms to the lexical meaning of \textit{say}'
declared in (23c):

\[
\exists t_1 [t_1 < s^* \& \text{say}'(t_1, j, \text{be-pregnant}'(t_1, m))] \]

Suppose that \text{say}'(t_1, j, \text{be-pregnant}'(t_1, m)) is true in \( w_0 \) when the
variable \( t_1 \) is instantiated by an interval \( i_0 \). This means that the
following conditions are satisfied: \([\text{say}']_{w_0} (\{w \mid \text{Mary is pregnant in } w \text{ at } i_0\})(\text{John})(i_0) = 1 \) iff John talks in \( w_0 \) at \( i_0 \) as if every world \( w' \) such
that \( <w_0, i_0> H_{\text{John}} w' \) is an element of \( \{w \mid \text{Mary is pregnant in } w \text{ at } i_0\} \).
This corresponds to my rendition of Enç’s proposal given in Chapter 3.

In terms of the SOT theory I am defending, the binding of the variable
\( t_1 \) in the intensional context in (24) by the existential quantifier is
permitted iff the lower tense is a null tense. In this proposal, there is no
problem accounting for simultaneous readings because the proposition
is fully specified with respect to time. Given that the time of the
attitude and the time of Mary’s being pregnant are indicated by the
occurrences of the same variable, it is easy to see that (24) amounts to
a simultaneous interpretation because the sentence is true only if the
two occurrences of the same variable can be instantiated by the same
interval. The story is simple and straightforward. This is a prima facie
argument for Proposal 2. Despite this apparent plausibility of Proposal
2 given in (23), in order to deal adequately with various temporal
examples, Proposal 1 given in (21) must be adopted instead. In order
to understand why, we now turn to a different problem that concerns
attitudes.
Lewis (1979) proposes that attitudes (such as beliefs) should be viewed as relations between individuals and properties rather than between individuals and propositions. Lewis regards a proposition as a set of worlds, but even under our assumption that a proposition is a set of world-time pairs, Lewis’s argument is valid. The basic point that Lewis makes is that there are some beliefs (or attitudes in general) that cannot be stated or cannot be fully differentiated under the traditional assumption that they are relations between individuals and propositions. Consider the example in (25a), which is originally discussed by Perry (1977), and its two alternative renditions given in (25b–c). Recall that the up operator “^” is used in this book to indicate abstraction over worlds, rather than over world-time pairs. Note also that I have simplified the example by dropping the temporal argument.

(25) a. Heimson believes that he is Hume.
   b. believe′(Heimson, ^[Heimson = Hume])
   c. believe′(Heimson, ^λx[x = Hume])

(25a) is a case of mad Heimson, who believes himself to be Hume. He is wrong, but that is a perfectly possible state of affairs. If we render (25a) as (25b) as the traditional theory has it, then we would have to conclude that Heimson believes a necessarily false proposition because there is no world in which Heimson is Hume. Given the nature of belief relations we assume here, we would have to conclude that if (25b) is true, Heimson also believes all other contradictory propositions. This is counterintuitive. On the other hand, if we translate (25a) as (25c), we can avoid this undesirable conclusion. (25c) informally reads: Heimson self-ascribes the property of being Hume. That is, we now reinterpret belief as the process of self-ascribing some property.

Another interesting and influential example is one provided by Kaplan (1977).

(26) a. Kaplan believes that his pants are on fire.
   b. believe′(Kaplan, ^[Kaplan’s pants are on fire])
   c. believe′(Kaplan, ^λx[Kaplan’s pants are on fire])
   d. believe′(Kaplan, ^λx[x’s pants are on fire])
Suppose that Kaplan sees himself in the mirror and notices that the pants of the person he sees in the mirror are on fire. Some milliseconds later, he realizes that he himself is that person. These two different cognitive states of Kaplan cannot be distinguished by theories in which attitudes are relations between persons and propositions because they would both be symbolized as (26b). According to (26b), the embedded clause in (26a) simply denotes the proposition \{w | Kaplan’s pants are on fire in w\}. By contrast, if we adopt Lewis’s proposal, we can describe the meaning of (26a) in two different ways. (26c) is like (26b), except that the object of belief is not a proposition but a property. It says: Kaplan self-ascribes the property of being located in a world where Kaplan’s pants are on fire. This corresponds to believing the proposition that Kaplan’s pants are on fire. The situation where Kaplan realizes that his own pants are on fire is captured by (26d), which says that Kaplan self-ascribes the property of being someone whose pants are on fire. This clearly has different truth conditions than (26c). The situation where Kaplan realizes that the person he sees in the mirror is in trouble but does not realize that he himself is this person should probably be captured in a different way because this is intuitively a de re belief about Kaplan. De re readings will be formalized in a more appropriate way later in this chapter and also in Chapters 5 and 6. At this point, it suffices to recognize the fact that the new system that incorporates Lewis’s idea predicts that there are (at least) two ways of analyzing (26a) and that one of them provides a satisfactory way of analyzing a reading of (26a) that is otherwise inexplicable.

Given these arguments for taking properties as objects of belief, it is a short extra step to recognize a clear analogy between properties of individuals and properties of times. In my notational system, it is especially easy to see that a set of world-time pairs can be re-interpreted as a property of times. If we regard the object of an attitude as a set of worlds, rather than a set of world-time pairs, some problems will arise that concern the interpretation of some temporal expressions. Examples like the following are discussed by Perry (1977) and by Lewis (1979):

(27)  
   a. John believes that it is 4 P.M.  
   b. John: I believe that Mary is in Seattle now.
Suppose that (27a) is a true sentence and is uttered at 5 P.M. Somehow, John is confused about the current time and he believes that it is 4 P.M. This example is a temporal analogue of the mad Heimson example discussed above. If the object of belief is a set of worlds, (27a) translates as (28a). On the other hand, if the object of belief is a set of world-time pairs (or a property of times, if you like), it translates as (28b).

(28)  
   a. believe (5 P.M., j, ^[5 P.M. = 4 P.M.])  
   b. believe (5 P.M., j, ^\lambda t [t = 4 P.M.])

(28a) says that John believes at 5 P.M. a contradictory proposition: 5 P.M. is 4 P.M. This in turn requires that John believe all contradictory propositions at 5 P.M. This is counter-intuitive. On the other hand, (28b) only requires that John self-attribute at 5 P.M. the property of being located in a world at 4 P.M. This is not only conceptually plausible but is also technically sound. This distinguishes between the situation depicted above and another situation in which John thinks at 5 P.M. that it is 3 P.M. This clearly argues for the approach in which the object of belief is a set of world-time pairs rather than a set of worlds.

(27b) also substantiates the approach in which the object of belief is a set of world-time pairs, but this requires some special context. Assume the following story: Mary said this morning that her plane would arrive in Seattle at 4 P.M. John believed her. It is now 5 P.M. However, as in the above story, John mistakenly believes that it is now 4 P.M. On the basis of these two pieces of information, John believes at 5 P.M. that Mary is in Seattle then. To make the problem concrete, let us assume that John utters (27b) at 5 P.M. According to this scenario, (27b) conveys two separate beliefs on the part of John: he believes that Mary is in Seattle at 4 P.M.; he believes at 5 P.M. that it is 4 P.M. In order to describe accurately John’s cognitive state depicted here, we must render (27b) as (29a), rather than as (29b) or (29c).

(29)  
   a. believe (5 P.M., John, ^\lambda t [t = 4 P.M. & Mary is in Seattle at t])  
   b. believe (5 P.M., John, ^[5 P.M. = 4 P.M. & Mary is in Seattle at 4 P.M.])  
   c. believe (5 P.M., John, ^[Mary is in Seattle at 5 P.M.])
(29a) says that at 5 P.M. the speaker stands in the belief relation to the proposition \( \langle w, t \rangle \mid t = 4 \text{ P.M. and Mary is in Seattle in } w \text{ at } t \rangle. \) This is a contingent proposition unlike (29b) and is distinct from, say, \( \langle w, t \rangle \mid t = 6 \text{ P.M. and Mary is in Seattle in } w \text{ at } t \rangle. \) (29a) reads, “At 5 P.M. John believes himself to be located in a world \( w \) at a time \( t \) such that \( t = 4 \text{ P.M. and Mary is in Seattle at } t. \)” This is the desired result. On the other hand, adopting (29b) would mean that the object of John’s belief is a necessarily false proposition. We obviously cannot adopt (29c) because it misrepresents John’s cognitive state; he would certainly not describe the time of Mary’s being in Seattle as “5 P.M.”

So far, we asked two separate questions: (i) whether “normal” individuals should be incorporated into the object of attitudes, and (ii) whether times should be incorporated into the object of attitudes. Now we know that the answers to these two questions are both positive, we must put together the three parameters that bear on attitude reports (i.e., worlds, individuals, and times) and regard an attitude as relations between individuals and world-time-individual triples. This type of property is exploited in an example that involves a belief that is “doubly erroneous”: i.e., erroneous both with respect to times and with respect to individuals. Consider the following example:

(30) Mark Chapman thought with great satisfaction that he was John Lennon.

Assume the following scenario. Mark Chapman was a former mental patient who wanted to be John Lennon. He somehow came to believe that if the real John Lennon died, he would become John Lennon. He planted a time bomb in Lennon’s apartment and set it so that it would go off on December 8. Chapman somehow failed to keep track of the date and thought on the 7th that it was the 8th. When the time came for the bomb to explode, Chapman thought with great satisfaction that he was John Lennon. According to the theory we are defending, this doubly erroneous belief on the part of Chapman can be symbolized as in (31).\(^{13}\)

\[
\exists t_1 [t_1 \subseteq 7\text{th} \& \text{ believe}'(t_1, \text{ Chapman}, \lambda t_2 \lambda x[t_2 \subseteq 8\text{th} \& x \text{ is Lennon at } t_2])] \]

Put informally, (31) says that at some time on the 7th, Chapman self-
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ascribes the property of being John Lennon and of being located within the 8th. This is a perfectly plausible state of affairs. Of course, we do not have to appeal to an example like (30) that involves doubly erroneous belief to substantiate my position. Since we must decide once and for all the lexical semantics of attitude verbs, we should choose sets of world-time-individual triples as objects of attitudes because this would give us the maximal empirical coverage.

On the basis of the discussion so far, I posit the following lexical meaning for believe, which incorporates Lewis’s idea that the object of belief must be sensitive to individuals and times, not just to worlds:

\[(32) \text{For any world } w_0, \text{property } P_0 \text{ in } D_{s, e, t}>, \text{individual } a_0, \text{and interval } t_0, [\text{believe}']_{w_0}(P_0)(a_0)(t_0) \text{ is true if and only if at } <w_0, t_0> a_0 \text{ self-ascribes the property } P_0. \text{That is, every doxastic alternative } <w', t', x'> \text{ of } a_0 \text{ in } w_0 \text{ at } t_0 \text{ is an element of } \{<w'', t'', x''> | P_0(w'')(t'')(x'') = 1\}.\]

I will refer to this approach as a de se analysis of attitudes; it regards attitudes as the subject’s self-ascribing properties. This approach presupposes an accessibility relation between two sets of triples drawn from \(W \times T \times A\). If \(<w_2, t_2, a_2>\) is accessible from \(<w_1, t_1, a_1>\), then we say that \(<w_2, t_2, a_2>\) is a doxastic alternative of \(<w_1, t_1, a_1>\). The accessibility relation that determines doxastic alternatives is defined in terms of self-ascription of properties as follows, à la Cresswell and von Stechow (1982):

\[(33) \text{<w', t', x'> is a doxastic alternative of } <w, t, x> \text{ iff } \text{<w', t', x'> satisfies every property } x \text{ self-ascribes in } w \text{ at } t.\]

Thus, in order to provide various examples with the right semantics, we need to adopt Lewis’s (1979) idea that an attitude involves self-ascribing a property, a property that involves worlds and times as well as individuals. The system just introduced is general enough to deal adequately with the mad Heimson case and the temporal analogue of the mad Heimson case discussed above and “normal” attitudes that could be represented as relations between individuals and propositions.

Let us confirm that the new theory accommodates a “propositional belief,” a belief that could be accounted for in terms of the traditional idea that an attitude is a relation between individuals and propositions.
Consider first an example in which both the matrix and complement clauses are in the present tense.

(34) a. John believes that Mary is pregnant.
   b. believe′(s*, j, λx[be-pregnant′(t, m)])

(34b) reads informally that John self-ascribes the property of being located at some \(<w, t>\) where Mary is pregnant. Note that the expression that translates the verb complement clause has a lambda operator that does not bind any individual variable, i.e., \(λx\). The property is \({<w, t, x> | \text{Mary is pregnant in } w \text{ at } t}\). This means that individuals do not figure in defining the property in question. I will refer to this type of property as a propositional property, which is defined as follows:

\[
P_0 ∈ D_{s, e, t} \text{ is a propositional property iff there is a proposition } \forall w ∀ t ∀ x [P_0(w)(t)(x) ⇔ p_0(w(t))].
\]

(34b) is true in \(w_0\) iff \(\text{believe'}_{w_0}({<w, t, x> | \text{Mary is pregnant in } w \text{ at } t})(\text{John})(t_0) = 1\), where \(t_0\) is the denotation of \(s^*\). This holds iff every doxastic alternative of John in \(w_0\) at \(t_0\) is an element of \({<w, t, x> | \text{Mary is pregnant in } w \text{ at } t}\). If in \(w_0\) at \(t_0\), John happens to have the property he self-ascribes in \(w_0\) at \(t_0\), then it follows that Mary is pregnant in \(w_0\) at \(t_0\). This is how the simultaneous reading associated with (34a) is accounted for in the new proposal.

Let us now try to justify the representation (36b) for the simultaneous reading associated with (36a).

(36) a. John said that Mary was pregnant.
   b. John Past say that Mary Ø be pregnant
   c. \(∃t[t < s^* \& \text{say'}(t, j, λx[be-pregnant′(t, m)])]\)

In the translation (17) given earlier, I assumed that the embedded tenseless clause translates as a set of world-time pairs at which Mary is pregnant. I simply adapt this analysis to the current proposal, which assumes the object of belief to be a property (i.e., a set of world-time-individual triples). On the basis of this idea, we obtain the IL
translation given in (36c). In order to arrive at this formula in a compositional way, I posit the following translation rules:

\[(37) \quad \text{Rules for English:}\]
\[\text{a. } \emptyset \text{ (expression of syntactic category T) translates into } \lambda t \lambda t'[t = t'].\]
\[\text{b. } [\text{CP } C \quad S ] \text{ (where C does not contain a wh-element) translates into S.}\]
\[\text{c. } [\text{VP } V <<s, i, e, t>>>, <e, i, t>>] \text{ CP] translates into } V(\exists x (\text{CP}(t)(t')))\]
\[\quad \text{[N.B.: Bold-face symbols indicate IL translations. For example, } V = \text{ the IL translation of } V.]\]

Any English expression that belongs to a category whose label bears a subscripted type translates as an IL expression of this type. For example, the English word *say* is an expression of category $V <<s, i, e, t>>>, <e, i, t>>$ and translates as *say’, which is an expression of type $<<s, i, e, t>>>, <e, i, t>>$. In order to conform to the ways in which other tense morphemes are dealt with, a null tense translates as a relation between identical times as in (37a). (37b) shows that Comp (indicated by C) does not make any semantic contribution in finite clauses. (37c) shows how abstraction over individuals is introduced in the translation. If the complement clause contains a pronoun that is used *de se*, it must be bound by the lambda operator “$\lambda x$.” Since *de se* interpretations about normal individuals are not our primary concern, I will not provide a formal mechanism that distinguishes between individual variables that get bound by a lambda operator and those that remain free. I simply provide IL translations that are appropriate for the original English or Japanese sentences. (37c) thus treats the complement clause in (36b) as denoting $\{<w, t, x> | \text{Mary is pregnant in } w \text{ at } t\}$.

(36c) by itself does not produce a simultaneous interpretation. We must constrain the lexical meaning of attitude verbs (in this case, *say’) by positing an appropriate accessibility relation. As we saw in (32), the meaning of *believe’ is constrained in terms of doxastic alternatives of the subject of the attitude. Let us slightly modify it for *say’ and present it here as (38).
(38) For any world $w_0$, property $P_0$ in $D_{<s, t, e, r>>}$, individual $a_0$, and interval $t_0$, $\text{say'}_{<s, t, e, r>>}(P_0(a_0)(t_0)$ is true if and only if at $<w_0, t_0>$ $a_0$ talks as if $a_0$ self-ascribes the property $P_0$. That is, $a_0$ talks in $w_0$ at $t_0$ as if every doxastic alternative $<w', t', x'>$ of $a_0$ in $w_0$ at $t_0$ is an element of $\{<w'', t'', x''> | P_0(w'')(t'')(x'') = 1\}$.\(^{16}\)

(38) assumes that $x$ says that $p$ roughly means that $x$ talks as if $x$ believes $p$. According to (38), (36c) is true in $w_0$ iff there is a past time $t_0$ such that $[\text{say'}]_{w_0}((<w, t, x> | \text{Mary is pregnant in } w \text{ at } t))(\text{John})(t_0) = 1$. The truth condition is stated in terms of an accessibility relation between two sets of triples drawn from $W \times T \times A$. That is, (36c) is true iff every doxastic alternative of John in $w_0$ at $t_0$ belongs to $\{<w, t, x> | \text{Mary is pregnant in } w \text{ at } t\}$. At this point, if the sentence is true and John happens to have in $w_0$ at $t_0$ the property he self-ascribes in $w_0$ at $t_0$, it follows that Mary is pregnant in $w_0$ at $t_0$, which is the time of John’s saying. This is how the simultaneous reading associated with (36a) is accounted for. The shifted reading associated with (36a) is explained along the same lines.

(39) a. John Past say that Mary Past be pregnant
   b. $\exists t < s^* \land \text{say'}(t, j, ^\land \lambda t_2^\lambda x \exists t_1[t_1 < t_2 \land \text{be-pregnant'}(t_1, m)])$

(39a) is the LF representation for a shifted interpretation, which results from not applying the SOT rule to (36a). Recall that the SOT rule defined above is an optional rule. (39b) is the IL translation of (39a), and the translation of the complement clause denotes $\{<w, t, x> | \text{there is a time } t' < t \text{ such that Mary is pregnant in } w \text{ at } t'\}$. This is a natural extension of the way a tenseless complement clause is translated in (36c). It is true in $w_0$ iff there exists a past time $t_0$ such that $[\text{say'}]_{w_0}((<w, t, x> | \text{there is a time } t' < t \text{ such that Mary is pregnant in } w \text{ at } t'))(\text{John})(t_0) = 1$. This condition holds iff every doxastic alternative of John in $w_0$ at $t_0$ has the property in question. If John happens to have in $w_0$ at $t_0$ the property he self-ascribes in $w_0$ at $t_0$, it follows that in $w_0$ there is a time $t_1$ earlier than $t_0$ such that Mary is pregnant at $t_1$. This amounts to what we call a “shifted interpretation.”
Finally, I would like to show without positing any ad hoc rules that my proposal accounts for the sentence with multiple verb complement clauses that Abusch (1988) discusses.

(40)  
\begin{itemize}
  \item a. John decided a week ago that in ten days at breakfast he would say to his mother that they were having their last meal together.
  \item b. S-str.: John Past decide a week ago that [in ten days at breakfast he Past woll say to his mother that [they Past be having their last meal together]]
  \item c. LF: John Past decide a week ago that [in ten days at breakfast he Ø woll say to his mother that [they Ø be having their last meal together]]
\end{itemize}

As mentioned in Chapter 3, Abusch correctly points out that Enç’s (1987) proposal cannot deal with (40a). (40c) is converted into the following IL translation:\textsuperscript{17}

(41)  
\[\exists t_1 [t_1 < s^* \& t_1 \text{ is a week before } s^* \& \text{ decide}^\prime(j, t_1, ^\wedge t_2 ^\lambda x \exists t_4 [t_4 \text{ is ten days later than } t_2 \& \text{ at-breakfast}^\prime(t_4) \& t_2 < t_4 \& \text{ say-to-his-mother}^\prime(t_4, j, ^\wedge t_3 ^\lambda x [\text{they-be-having-their-last-meal-together}^\prime(t_3)])] \]

The model-theoretic interpretation of (41) is also straightforward. For the purpose of exposition, I simply ignore the difference between decide and believe.\textsuperscript{18} (41) is true in \(w_0\) iff there is a past time \(i_1\) such that \(i_1\) is located one week before now and \[\text{decide}^\prime(j, t_1, ^\wedge t_2 ^\lambda x \exists t_4 [t_4 \text{ is ten days later than } t_2 \& \text{ at-breakfast}^\prime(t_4) \& t_2 < t_4 \& \text{ say-to-his-mother}^\prime(t_4, j, ^\wedge t_3 ^\lambda x [\text{they-be-having-their-last-meal-together}^\prime(t_3)])] \]

This is the case iff every doxastic alternative of John in \(w_0\) at \(i_1\) is an element of the property in question. If in \(w_0\) at \(i_0\) John has the property he self-ascribes at \(<w_0,i_0>\), it follows that there is a time \(i_2\) such that \(i_2\) is ten days later than \(i_1\) and \(i_2\) is breakfast time in \(w_0\) and \[\text{say-to-his-mother}^\prime(w_0) ([<w″, t″, x″> \& \text{they are having their last meal together in } w″ \text{ at } t″]) (\text{John})(i_2) = 1\). This condition is satisfied iff John talks at \(<w_0, i_2>\) as if every doxastic alternative of John is an element of the property \([<w″, t″, x″> \& \text{they are having their last meal together in } w″ \text{ at } t″]\). If John has this property in \(w_0\) at \(i_2\), they are indeed having their
last meal together in \( w_0 \) at \( i_2 \). This correctly predicts a simultaneous reading. In this way, my proposal, which combines an SOT rule encoded in the form of a tense deletion rule in the syntax with a *de se* analysis of attitudes (Lewis 1979) in the semantics, successfully accounts for the SOT phenomena in verb complement clauses, including those that are problematic for Enç’s proposal.

Let us briefly discuss the case of Japanese. Since the present theory is based upon the idea that the surface tense forms of Japanese are the “right forms” for the purpose of semantic interpretation, the theory applies to Japanese data straightforwardly. Consider (42a–b).

(42) a. Taroo-wa \( [\text{CP}\{S\ \text{Hanako-ga}\} \text{Taro-TOP Hanako-NOM}\) 
be-sick-PRES that say-PAST
‘Taro said that Hanako was sick [at that time].’

b. Taroo-wa \( [\text{CP}\{S\ \text{Hanako-ga}\} \text{Taro-TOP Hanako-NOM}\) 
be-sick-PAST that say-PAST
‘Taro said that Hanako had been sick.’

The relevant rules for Japanese are essentially the same as the rules for English given in (37b–c), save for the syntactic differences between the two languages.

(43) Rules for Japanese:

a. \( [\text{CP } S \ C] \) (where \( C \) does not contain a *wh*-element) 
translates into \( S \)

b. \( [\text{VP } \text{CP} \ V (<s, i, e, t>, <e, i, t>)] \) translates into
\( V(\gamma t \lambda x \exists t'[\text{CP}(t)(t')]) \)

(42a–b) translate as (44a–b), respectively, based upon the assumption that at LF the Japanese present is like the English null tense and the Japanese past is like the English past.

(44) a. \( \exists t [t < s^* \& \text{say}'(t, \text{Taro, } \gamma t_1 \lambda x [\text{be-sick}'(t_2, \text{Hanako})])] \)

b. \( \exists t [t < s^* \& \text{say}'(t, \text{Taro, } \gamma t_1 \lambda x \exists t_2 [t_2 < t_1 \& \text{be-sick}'(t_2, \text{Hanako})])] \)
The interpretations of (44a–b) are analogous to those of (36c) and (39b). This is exactly what we want.

4.2. THE FUTURE TENSE

Before we consider complements that are not finite verb complement clauses, let us extend the definition of the SOT rule to cover present tense as well as past tense. Consider the following examples in which a present tense appears immediately under a future tense (Stump 1985:110):

(45)  a. Next year, John will claim that Mary is his wife.
    b. John will claim that Mary is hitting Bill.

According to Stump, (45a) means that John will claim that Mary is his wife at the time of his claim and cannot describe a case in which Mary is his wife now. On the other hand, Stump reports that for most speakers (45b) means that Mary is hitting now, not at the time of John’s claim. I take this reading to be an instance of a double-access reading. I believe that given the right context, any sentence of this type can receive at least a simultaneous reading and perhaps a double-access reading as well. Let us now concentrate upon the simultaneous reading of (45a). In Chapter 2, I presented the view that the English present is inherently utterance time sensitive. In Chapter 3, I discussed some examples of so-called double-access (i.e., present-under-past) sentences in connection with Abusch’s work and pointed out that they do not receive purely simultaneous readings. Thus, it is somewhat surprising that a present tense that occurs under a future tense can receive a purely simultaneous reading. I believe that the simplest and most elegant way of accommodating this fact is to let the SOT rule delete a present tense under identity with a locally commanding present tense. This is possible since the future tense *will* is morphologically analyzed as *Pres + woll*. Hence, I propose the following revision of the SOT rule introduced earlier:
The SOT rule [second version]:
If a tense A is locally commanded by another tense B at LF and A and B are occurrences of the same tense (i.e., either present or past), A is optionally deleted.

Thanks to this revision, the purely simultaneous reading of (45a) is accounted for as follows. First, the SOT rule applies to (45a) and the present tense in the complement is deleted as in (47)

(47) S-str: John Pres woll claim that Mary Pres be his wife
    LF: John Pres woll claim that Mary Ø be his wife

Then this LF representation translates as in (48).

(48) \( \exists t [s^* < t \& \text{claim}'(t, j, ^\lambda t _1 ^\lambda x[\text{be-his-wife}'(t_1, m)])] \)

The reader should be able to verify that (48) amounts to a simultaneous reading where the time of Mary’s being John’s wife is simultaneous with the time of his claim. The alleged double-access reading associated with (45b) will be discussed in Chapter 6.

4.3. THE SOT PHENOMENA IN VARIOUS TYPES OF COMPLEMENT CLAUSES

4.3.1. Adjective Complement Clauses

Some predicative adjectives such as aware and afraid can take sentential complements on a par with attitude verbs like believe and indirect discourse verbs like say. Consider the following examples:

(49) a. John was aware that Mary was pregnant.
    b. John was afraid that Mary was angry.

In (49a), aware is like know in that the complement clause is required to be true in the actual world. The past tense in the complement clause
is interpreted as a “dummy” past tense, at least in its default interpretation. That is, the time of Mary’s pregnancy is understood as the same time as the time of John’s being aware of it. In (49b), afraid roughly means “believe something that has a negative content.” The complement clause is subject to the SOT rule and receives a simultaneous interpretation. In fact, if we assume that be aware or be afraid constitutes one predicate, the rest is exactly the same as regular attitude verbs. Having said so, I will not discuss such predicative adjectives in the rest of the book.19

4.3.2. Sentential Subjects

I have already discussed Ross’s (1967) claim that sentential subjects are subject to the SOT rule. My proposal incorporates his claim and takes care of his example repeated here in (50).20

(50) [S[CP That [S the sun was out]] was obvious]

In this section, I will show that the semantic mechanism proposed above can accommodate this syntactic proposal. First, I propose a translation rule for this construction.

(51) Rule for English:
[S CP TP] translates into
TP(λPλt∃y[P(t, y) & NOM(y, ^λt1λx∃t2[CP(t1)(t2)])])

[N.B.: NOM is an IL expression of type <<s,<i,<?e,t>>,>, and for any w ∈ W, k ∈ D,<s,<i,<?e,t>>,>, a ∈ A, [NOM]w(k)(a) = 1 iff a is the individual correlate of k.]

According to this proposal, (50) translates as follows:

(52) LF: [S[CP that [S the sun Ø be out]][TP Past be-obvious]]
1. [CP that [S the sun Ø be out]] ⇒
   λt1λt2[t1 = t2 & be-out’(t2, the-sun)]
2. [TP Past be-obvious] ⇒
   λt(λt[φ(λt xCP(t < t’ & t ≤ tRT & be-obvious’(x)(t’)))]
3. \( [S[CP \text{ that } [S \text{ the sun } \emptyset \text{ be out}]]_{TP} \text{ Past be-obvious}] \Rightarrow \lambda \varphi \lambda t'[\varphi(\lambda x \lambda t[t < t' \& t \subseteq t_{RT} \& \text{be-obvious}'(x)(t)])]((\lambda P\lambda y \exists y[P(t, y) \& \text{NOM}(y, \^\lambda t_1 \lambda x[\text{be-out}'(t_1, \text{the-sun})])]))\)

4. \( \lambda t' \lambda t \exists y[t < t' \& t \subseteq t_{RT} \& \text{be-obvious}'(y)(t) \& \text{NOM}(y, \^\lambda t_1 \lambda x[\text{be-out}'(t_1, \text{the-sun})])]\)

5. \( \exists t \exists y[t < \ast \& t \subseteq t_{RT} \& \text{be-obvious}'(y)(t) \& \text{NOM}(y, \^\lambda t_1 \lambda x[\text{be-out}'(t_1, \text{the-sun})]) \) (Truth Definition)

The symbol “\( \varphi \)” is used as a variable of type \( <<e, <i,t>>, <i,t>> \). The final translation in (52) says that the property \{ \(<w, t, x> \mid \text{the sun is out at } t \text{ in } w \} \text{ is obvious at some past time. I posit the following lexical semantics for } \text{be-obvious}' \text{ to obtain the right semantic result.}

\[
(53) \quad \text{For any } a \in A \text{ and } t \in T, [\text{be-obvious}']_{w,c}(a)(t) = 1 \text{ iff the agent of } c \text{ (i.e., the speaker) self-ascribes with confidence the property } k \text{ in } w \text{ at } t, \text{ where } k \text{ is such that } [\text{NOM}']_{w,c}(k)(a) = 1.
\]

According to (53), (52) says roughly that the speaker firmly believed in the past that the sun was out at that time. What I did was to assume that \( \text{be-obvious}' \) is semantically analogous to attitude verbs, taking the sentential subject as the expression that denotes the object of this attitude. Then the implicit attitude bearer is supplied by the lexical meaning of \( \text{be-obvious}' \). On these assumptions, our account of attitude reports carries over into the case of sentential subjects.

Sentential subjects in Japanese are just like other clausal complements discussed above in that they are interpreted as embedded in the scope of locally commanding tenses. Unlike verb complements, sentential subjects require a nominalization marker (\( no \) or \( koto \)), as in (54a–b). Note that CP complements of verbs (e.g., (54c)) and plain sentences (e.g., (54d)) cannot appear in the subject position in Japanese.
Based upon this morphological evidence, I assume that Japanese sentential subjects are NPs. Note that the clausal subject is "in the scope" of the matrix tense.

Despite the fact that they are NPs, Japanese sentential subjects cannot escape the scope of the matrix tense. In other words, they cannot be interpreted as unembedded. This is true of sentential subjects in English as well, but this is not problematic because English clausal subjects can be regarded as CPs. Let us examine the examples in (55).

(55)  a.  [CP that [S John accepted the offer]] was obvious.
     b.  [NP[S John-ga mooside-o ukeire-ta]-no]-wa  
        John-NOM offer-ACC accept-PAST-NOM-TOP  
        akirakadat-ta.  
        be-obvious-PAST  
        ‘That John accepted the offer was obvious.’

In both (55a) and (55b), it is impossible to locate the time of accepting the offer between the time of being obvious and the utterance time. This clearly shows that sentential subjects must be in the scope of the
matrix tense. This means that in connection with the scope theory of NPs that I will propose in Chapter 5, I must stipulate that the rule for Quantifier Raising (May 1977) does not apply to Japanese sentential subjects.

4.3.3. Verb Complements that Are Infinitives

In this section, I will discuss infinitival clauses used as verb complement clauses. Infinitive clauses of the form “(for NP) to V-infinitive” can have a simultaneous reading as in (56a), a futurate reading as in (56b), or even a preterit interpretation as in (56c) in relation to the higher predicate.

(56) a. John believed Bill to be a happy person.
    b. John promised to call me.
    c. I remember John to be the smartest.

(56a–c) can be paraphrased as (57a–c), respectively, in terms of finite complement clauses.

(57) a. John believed that Bill was a happy person.
    [with a simultaneous reading]
    b. John promised that he would call me.
    c. I remember that John was the smartest.

The examples in (56) and (57) show that believe induces simultaneous readings, promise future-oriented readings, and remember preterit readings. Note also that the perfect can be used in an infinitive clause to talk about a past time situation, as in (58).

(58) John believed Bill to have committed a crime.

(58) puts Bill’s committing a crime before John’s believing. An important generalization to be drawn from the above examples is that the temporal interpretation of an infinitive clause is always determined in relation to the higher predicate. However, the interpretation of the
perfect in an infinitival clause requires some extra care. Consider the following example:

(59) John promised to visit Mary on December 15th.
He also promised to have finished the assigned task by then.

Suppose that John works for Mary and that she had asked him to complete some task by December 15th. As the second sentence in (59) shows, what John promised was not that he had already finished the task at the time of promising. It was rather that he would finish the task before December 15th. This sentence shows that the inherent temporal orientation of the infinitive clause is not lost when it is a perfect. What happens is that the infinitive as a whole behaves like a future perfect finite clause. (58) should be seen in the same light. The infinitive has a null-tense-like meaning, and the perfect pushes the episode into the past.

Notice also that when an infinitive occurs immediately under a past tense (Past₁) and immediately above another past tense (Past₂) as in (60), the lower past tense can be deleted at LF because of the presence of the higher past tense.

(60) [ … Past₁ … [ … infinitive … [ … Past₂ … ]]]

Consider the following examples:

(61) a. John thought that Bill will claim that he did not know anything about the crime.
b. John thought that Bill would claim that he did not know anything about the crime.
c. John asked Bill to claim that he did not know anything about the crime.

In (61a), the intermediate clause is in the future tense (or the present tense morphologically), and, therefore, the past tense in the lowest clause cannot be interpreted as an empty past tense. In other words, the time of Bill’s not knowing anything about the crime cannot be simultaneous with the time of Bill’s claim; it has to be prior to Bill’s claim. On the other hand, (61b) allows an interpretation in which the time of Bill’s claim is simultaneous with the time of Bill’s not
knowing about the crime thanks to the past tense suffixed to *woll*. Compare these facts with (61c). An infinitival clause subordinate to the verb *ask* has a future meaning in that the time of Bill’s claim is located in the future relative to the time of John’s asking Bill. It turns out that (61c) allows Bill’s not knowing anything about the crime to be simultaneous with the time of his claim, just as (61b) does. This means in our terms that a past tense can be deleted under identity with the matrix tense even if an infinitival clause intervenes between them. Since infinitival clauses do not contain overt tense morphemes, the formulation of the tense deletion rule is not affected by infinitival clauses. That is, one can preserve the generalization that a tense $\beta$ is optionally deleted iff $\alpha$ and $\beta$ are occurrences of the same tense, and $\alpha$ locally commands $\beta$. After the tense deletion rule has applied, we obtain an LF structure for (61c), roughly in the form of (62), which predicts the desired interpretation.

\[ 62 \quad \text{John Past ask Bill to claim that he } \emptyset \text{ do not know anything about the crime} \]

At this point, I do not give the precise details of the LF structure for (62) nor its interpretation. We will take up the perfect again in the next section, where we discuss triggers of the SOT phenomena.

### 4.4. TRIGGERS OF THE SOT PHENOMENA

So far, I have tried to establish the claim that the SOT phenomena occur in a configuration where some tense A locally commands another tense B, and A and B are occurrences of the same tense (i.e., present or past). This means that the trigger of an SOT phenomenon is a tense morpheme suffixed to a verb. This is an adequate generalization for the examples considered so far. However, when we turn to other SOT examples, we realize that other expressions can also serve as triggers.
4.4.1. The Perfect

The perfect by itself can trigger the SOT phenomena. Consider the following examples:

(63)   a. John believes Mary to have claimed that she was innocent.

   b. Having realized that she was in the wrong, Mary is now trying to change.

In (63a), the main clause is in the present tense. Despite this fact, the time of Mary’s being innocent can be understood to be the same time as the time of her claim. Thus, this fact can only be accounted for by assuming that the perfect have+en serves here as a trigger. The same is true of (63b). The perfect occurs as part of a participial clause, which is by definition tenseless. Moreover, the main clause is in the present tense. Thus, there is no past tense morpheme as such that serves as a trigger. Despite this fact, the time of Mary’s realization and the time of her being in the wrong can be simultaneous. Thus, the perfect serves as a trigger here. It is not difficult to understand why the perfect can serve as a trigger: its semantic contribution is to introduce an episode that obtains earlier than the time associated with the immediately higher predicate. This shows that triggers of the SOT phenomena are not necessarily tense morphemes but expressions that receive preterit interpretations. This hypothesis is confirmed when we consider the behavior of common nouns.

4.4.2. Noun Complements

Some common nouns optionally take sentential complements, and given that some conditions are satisfied, SOT phenomena are observed in noun complements as well. The observations reported in this section are originally due to Irene Heim (personal communication). Let us look at the following examples:
In (64a–c) past tense morphemes are used to refer to an episode that is simultaneous with the situation referred to by the common noun of which the tensed clause is the complement. These are completely parallel to other instances of the SOT phenomena. Some restrictive adjectives like *earlier* and *later*, which I shall refer to as temporal adjectives (abbreviated as TAdj), can be used to indicate the time of the situation named by the common noun, but this is by no means obligatory.22 In (64b), it is possible to assume that the time of the announcement is located in the past relative to the speech time and that the time of his having cancer is simultaneous with it. Note that this is not guaranteed simply by the fact that the noun complement is in the past tense. On the reading in which John’s announcement is located in the past relative to the speech time, the time of his having cancer must be either simultaneous with or earlier than the announcement. This is exactly like the SOT phenomena in verb complement clauses. Thus, the data in (64) cannot be explained away by assuming that a past tense morpheme can be interpreted as if it is unembedded.

Note that in contrast to preterit interpretations, the future reading of a common noun alone is not sufficient to yield a simultaneous reading with a noun complement clause in the present tense. Consider the example in (65a) and compare it with (65b).

(65)  

a.  ?John expected Mary’s claim that she is drunk.  
b.  John expected that Mary will claim that she is drunk.

The intended interpretation of (65a) is that Mary’s claim will be made in the future relative to the utterance time and her claim is that she is drunk then. However, native speakers report that it is hard to interpret this sentence. By contrast, (65b) receives a simultaneous interpretation. In our terms, this means that the futurate meaning of *claim* does not have a crucial property needed to license the deletion of the present tense in the noun complement clause.
The Japanese facts that concern noun complements are just like the English facts, except for the predictable difference having to do with the SOT phenomena. Consider the following examples:\(^{23}\)

\[(66) \quad \text{(a) } [\text{NP} \{\text{CP} \, \text{Mary-ga muzituda-to iu}\} \, \text{[Adj John-no]} \, \text{Mary-NOM be-innocent-PRES John-GEN} \\
\quad \quad \quad \quad \quad \quad \text{[TAdj izen-no] syutyoo]-wa yoku si-rare-te i-ru.} \\
\quad \quad \quad \quad \quad \quad \text{earlier claim-TOP well be-known-PRES} \\
\quad \quad \quad \quad \quad \quad \text{‘John’s earlier claim that Mary was innocent (at that time) is well-known.’} \\
\text{(b) } \text{Taroo-wa [NP \{\text{CP} \, \text{zibun-ga muzituda-to iu}\} \, \text{Taro-TOP self-NOM be-innocent-PRES Hanako-no syutyoo]-o yoku oboe-te i-ru.}} \\
\quad \quad \quad \quad \quad \quad \text{Hanako-GEN claim-ACC well remember-PRES} \\
\quad \quad \quad \quad \quad \quad \text{‘Taro vividly remembers Hanako’s claim that she was innocent [then].’} \]

In (66a), the noun complement is in the present tense, and the time of Mary’s being innocent is understood as simultaneous with the time of John’s claim. This means that the complement clause is in the scope of the noun syutyoo ‘claim’. As (66b) shows, this ‘preterit interpretation’ of the noun syutyoo ‘claim’ can obtain without the presence of a temporal adjective like izen-no ‘earlier’.

Now, if it is not necessary to find overt triggers for the SOT phenomena, what licenses them? It is a preterit interpretation of some expression. In the case of a noun complement, an SOT phenomenon is licensed if its head noun receives a preterit interpretation. On the other hand, a present tense can be deleted only in the presence of a higher present tense. For the purpose of this book, I will encode the information about triggers in terms of syntactic features. For example, I assume that a noun like claim is associated with [+past], [-past] or [+fut]. The perfect discussed in the previous section is then assumed to have the feature [+past]. To enable the SOT rule to refer to features instead of tense morphemes, tense morphemes are also associated with features. The past has the feature [+past], and the present has the feature [+pres]. The presence of [+past] results in a preterit interpretation, [-past] a simultaneous reading, and [+fut] a futurate reading. We will refer to [+past] and [+pres] as the tense features. The SOT rule is only sensitive to these two features. The other two features
(i.e., [-past] and [+fut]) are relevant to the semantic rules but are ignored by the SOT rule. This discriminatory treatment of the features is motivated by the fact that a preterit meaning of a common noun is capable of triggering an SOT phenomenon, but a futurate meaning of a common noun cannot.

Another important modification concerns the domain within which the SOT rule applies. We now must allow for the possibility that a tense feature on a common noun serves to delete a tense feature (and a tense morpheme) in its complement clause. We now have two possible local domains: NP or S. Since the perfect also carries a tense feature, we now must say that the trigger and the target stand in an asymmetric relation with each other. Taking these factors into consideration, the SOT rule is revised as follows:

(67) The SOT rule [definitive version]:
If a tense feature B is the local tense feature of a tense feature A at LF, and A and B are occurrences of the same feature (i.e., either [+past] or [+pres]), A and the tense associated with A (if any) are optionally deleted. N.B.: (i) The tense features include [+past] and [+pres] and nothing else. (ii) A tense feature A is “in the scope” of a tense feature B iff B is associated with a common noun and asymmetrically c-commands A, or B is associated with a tense or a perfect and asymmetrically commands A. (iii) A tense feature B is the local tense feature of a tense feature A iff A is “in the scope” of B and there is no tense feature C “in the scope” of B such that A is “in the scope” of C.

4.5. A NEW ANALYSIS OF THE SOT PHENOMENA AND SOME SAMPLE DERIVATIONS

Let us show how the revised SOT rule accounts for the data examined so far. Consider (68a) first, which involves the perfect that serves as a trigger of the SOT phenomena.
(68)  a. John believes Mary to have claimed that she was innocent.
b. S-structure:
   John Pres believe [Mary to have claim
   [+pres]                                  [+past]
   [that she Past be innocent]]
   [+past]
c. LF structure (after the SOT rule has applied):
   John Pres believe [S Mary to have claim
   [+pres]                                  [+past]
   [that she Ø be innocent]]

As (68c) shows, the past tense in the complement clause of *claim* and
the feature associated with it are deleted because they are locally
commanded by a [+past] feature. Before translating (68c) into *IL*, let
us discuss the semantics of infinitives.

I assume with Stowell (1982) that the temporal orientation of an
infinitive clause is predictable either from the lexical semantics of the
higher predicate (*believe* in the case of (68a)) or from the structure of
the infinitive clause. For example, *believe* requires that its complement
receive a simultaneous reading. Infinitival clauses that involve so-
called “control structures” invariably receive futurative interpretations.
Stowell argues that the latter are of the structure [CP [C e][S PRO to
VP]], which are exemplified by (69a–b).

(69)  a. John convinced Mary [CP [S PRO to leave]].
b. Sally persuaded Ellen [CP [S PRO to buy the camera]].

If we adopt Stowell’s analysis of infinitival clauses, it is not necessary
to posit explicit markers of their temporal orientation at LF. The
structure (68c) translates into *IL* as in (70a) on the basis of the lexical
semantics for *believe* given in (70b) and the translation rule given in
(70c).
(70)  a. believe′(s*, j, ^\lambda t \lambda x \exists t_1 [t_1 < t & t_1 \subseteq t_{RP} & \\
claim′(t_1, m, ^\lambda t_2 \lambda x [be-innocent′(t_2, x)])])

b. Lexical Rule for English: believe [+V] [ _____ S ] translates into believe′

[-fin]

c. Translation Rule for English: [VP V S ] translates into V(\^\lambda t \lambda x \exists t′[S(t′)])

[-fin]

Let us consider other types of infinitive clauses as well. I posit a translation rule for infinitival TP in (71). (72)–(73) deal with expect, which is future oriented, and remember, which is past oriented.

(71)  Translation Rule for English: [TP to VP] translates into \lambda \Phi \lambda t′[\emptyset \Phi(\lambda x \lambda t[t = t′ & VP(x)])]

[-fin]

(72)  a. I expect [ S John to win the race].

[-fin]

b. expect′(s*, I, ^\lambda t \lambda x \exists t_1 [t < t_1 & t_1 \subseteq t_{RP} & \\
win-the-race′(t_1, j)])

c. Lexical Rule for English: expect [+V] [ _____ S ] translates into 
\lambda P[expect′(\^\lambda t_1 \lambda y \exists t_2 [t_2 < t_2 & t_2 \subseteq t_{RP} & \emptyset P(t_2)(y)])]^{27}

[N.B.: P is a variable for type <s,<i,<e,t>>,>.

(73)  a. I remember [ S John to be the smartest].

[-fin]

b. remember′(s*, I, ^\lambda t \lambda x \exists t_1 [t_1 < t & \\
be-the-smartest′(t_1, j)])

c. Lexical Rule for English: remember [+V] [ _____ S ] translates into 
\lambda P[remember′(\^\lambda t_1 \lambda y \exists t_2 [t_2 < t_1 & t_2 \subseteq t_{RP} & \emptyset P(t_2)(y)])]

(72) and (73) show that I have chosen to represent the temporal orientation of the verbs that require infinitival complements in the translation of the higher verbs. (74a) is an example of an infinitive with a control structure, and it translates into IL as in (74b) on the basis of the rules (74e–d).
(74)  a. John convinced Mary [CP PRO to leave].
     b. $\exists t[t < s^* \& t \subseteq t_R \& \text{convince}'(t, j, m, ^\land \lambda t_2 \lambda x \exists t_1[t_2 < t_1 \& t_1 \subseteq t_R \& \text{leave}'(t_1, z)])$]
     c. Lexical Rule for English:
        convince [+V] [ ___ NP CP ] translates
        as convince'
     d. Translation Rule for English:
        [CP C S ] (where C does not contain a wh-element)
        translates into $\lambda t_1\lambda t_2[t_1 < t_2 \& t_2 \subseteq t_R \& S(t_1)(t_2)]$

In (74d), in the spirit of Stowell’s analysis of infinitival clauses with a PRO subject, I let the Comp be responsible for introducing a future-oriented meaning for the infinitival clause in (74a).

I now return to noun complements. Let us deal with the example in (75a), which is roughly synonymous with (75b).

(75)  a. John’s (earlier) claim that he was innocent is well-known.
     b. It is well-known that John claimed that he was innocent.

In order to deal with the proposition-like meaning of the subject NP in (75a), I will propose the rules in (76).

(76)  Rules for English:
     a. [Det NP Poss] translates into Poss(NP)
     b. [NP Det N′] translates into Det(N′)
     c. [N′ N<<s, i, s, e, t>>, s<<s, i, e, t>> CP] translates into $N_{s, i, s, e, t} <<[\lambda t_1\lambda t_2 )(\text{CP}(t)))]$
     d. Poss translates into $\lambda \phi \lambda P \lambda Q \exists y[\forall x[[P(x)(t) \& \phi(\text{POSS}(x))(t)] \leftrightarrow x = y] \& Q(y)(t)]$

[N.B.: Bold-face symbols represent IL translations.]

As for common nouns that optionally take a sentential complement, I assume that they are associated with one of the following three features: [+past], [-past], or [+fut]. Recall that [+past] is the only tense feature among them. These features have the effect of introducing
tense-morpheme-like information into the translation of common nouns. For example, when \textit{claim} is associated with the feature [+past] at LF, it receives a preterit interpretation.

\begin{align*}
(77) \quad \text{Rule for English:} \\
\text{Lexicon: } \textit{claim} [+N] \text{ translates into } [+past] \\
\lambda P \lambda x \lambda t \exists t' [t' < t \& t' \subseteq t_{RT} \& \textit{claim}'' \langle s, i, e, t' \rangle, \langle s, i, e \rangle(P)(t') = x]
\end{align*}

I assume that temporal adjectives such as \textit{earlier} and \textit{later} that optionally accompany common nouns also bear one of the above three features, and a temporal adjective is licensed only if the feature it bears agrees with the feature of the common noun. The lexical information of the \textit{IL} constant \textit{POSS} used in the translation of the possessive morpheme Poss is provided in (78).

\begin{align*}
(78) \quad \textit{POSS} \text{ is an IL expression of type } <e, e, i, t>> \text{ and for any } w_0 \in W, a_0, a_1 \in A \text{ and } t_0 \in T, |\textit{POSS}^e_{w_0}(a_0)(a_1)(t_0) = 1 \text{ iff in } w_0 \text{ at } t_0, a_0 \text{ is related to } a_1 \text{ in a non-trivial way. One possibility is that } a_1 \text{ owns } a_0. \text{ Another is that } a_1 \text{ is the agent of the “event” } a_0.
\end{align*}

In the proposal I have delineated, \textit{A’s B-ing is C} is rendered roughly as follows: the unique event \(x\) such that \(A\) is the agent of \(x\) and \(x\) is an event of \(B\)-ing is \(C\). Given these technical tools, let us re-examine (75a). Note that the past tense in the noun complement gets deleted because it is locally c-commanded by the feature [+past] associated with the noun \textit{claim}.

\begin{align*}
(79) \quad \text{S-str.: John’s earlier claim that he Past be innocent Pres} \\
\quad [+past] [+past] [+past] [+pres] \text{ be well-known.} \\
\text{LF: John’s earlier claim that he Ø be innocent Pres} \\
\quad [+past] [+past] \text{ be well-known} \\
1. \quad \text{John’s } \Rightarrow \lambda P \lambda Q \exists y \forall x [P(x)(t) \& \textit{POSS}(x)(j)(t)] \leftrightarrow x = y ] \& Q(y)(t)]
\end{align*}
2. claim that he Ø be innocent ⇒
   \[\lambda x \lambda t \exists t'[t' < t & t' \subseteq t_{RT} & \text{claim'}_{<<s,s,<<e,s>>,i,e>>}
   (t', ^t \lambda t \lambda z[\text{be-innocent}'(t_1, z)]) = x]\]

3. John’s claim that he Ø be innocent ⇒
   \[\lambda Q \lambda \exists y \forall x[\exists t'[t' < s^{*} & t' \subseteq t_{RT} & \text{claim'}_{<<s,s,<<e,s>>,i,e>>}(t_1, z)] = x] \& \text{POSS}(x)(y)(t)\]

4. Pres be well-known ⇒
   \[\lambda \rho \lambda t_0[\rho(t_0) = s^{*} \& \text{be-well-known}'(x)(y))]]\]

5. John’s earlier claim that he Ø be innocent Pres
   \[\lambda Q \lambda \exists y \forall x[\exists t'[t' < s^{*} & t' \subseteq t_{RT} & \text{claim'}_{<<s,s,<<e,s>>,i,e>>}(t_1, z)] = x] \& \text{POSS}(x)(y)(t)\]

   (Truth Definition)

The final translation says that the event of claiming in the past that he was innocent then such that John “possesses” this event is well-known now. In order to make sure that it is roughly equivalent to It is well-known that John claimed that he was innocent, I posit the following constraint on the lexical meanings of claim’_{<<s,s,<<e,s>>,i,e>>}, POSS, and claim’_{<<s,s,<<e,s>>,i,e>>}:

(80)  For some \(w \in W, P \in D_{<<s,s,<<e,s>>,i,e>>>}, a_0, a_1 \in A\) and \(t \in T\) if
   \[\text{[claim'}_{<<s,s,<<e,s>>,i,e>>}]_w(P)(t) = a_0\] and there is some
   \(t' \in T\) such that \([\text{POSS}]_w(a_0)(a_1)(t') = 1\), then \(a_1\) self-ascribes
   the property \(P\) in \(w\) at \(t\). In other words,
   \[\text{[claim'}_{<<s,s,<<e,s>>,i,e>>}]_w(P)(a_1)(t) = 1\].

A Japanese example that involves a noun complement clause is also examined here. As mentioned above, there is no new semantic issue here. The main problems having to do with Japanese noun complements concern their syntactic properties. If the putative noun complement is in fact a noun complement, it is assumed to be a sister of the head noun according to X-bar theory. However, optional expressions like Taroo-no ‘Taro’s’ and izen-no ‘earlier’ can intervene
between the CP and the head noun. Perhaps, this type of phenomenon can be dealt with adequately in terms of transformational operations such as scrambling (e.g., Saito 1985), but I simply present one possible word order among such expressions in the form of a phrase structure rule schema as in (81).

(81) Rule for Japanese:
\[ N' \rightarrow (CP)(NP)(TAdj) N \]

Then I offer the translation rules (82a–b) and the lexical rule (82c).

(82) Rules for Japanese:

a. \([N' \text{ CP NP TAdj N}]\) translates into 
\[ N(\lambda t_1 \lambda x \exists y [CP(t_1)(t_2)])[\text{NP}] \]

b. \([\text{NP } N']\) translates into 
\[ \lambda P \lambda x \exists y [N'(y)(t) & P(y)(t)] \] 
or 
\[ \lambda P \lambda x \exists y [N'(y)(t) \leftrightarrow x = y & P(y)(t)] \]  
(introduction of an empty definite/indefinite article)

c. syutyoo ‘claim’ [+N] [\text{CP NP TAdj __}] translates into 
\[ \lambda P \lambda t \exists x [N' (y) (t \prime) & P (y)(t)] \] 
or 
\[ \lambda P \lambda t \exists x [N' (y) (t \prime) & P (y)(t)] \]

(83) \([\text{NP } [\text{NP } \text{Hanako-ga muzituda-iu}] \text{ Hanako-NOM be-innocent-PRES}] \)

\[ \text{Hanako-NOM be-innocent-PRES} \]

[\text{NP Taroo-no}[\text{TAdj izen-no}]

\[ \text{Taro-GEN earlier} \]

[\text{NP syutyoo}]\]-wa yoku si-rare-te i-ru. 

\[ \text{claim-TOP well be-known-PRES} \]

‘Taro’s earlier claim that Hanako was innocent is well-known.’ [simultaneous reading only]

1. Hanako-ga muzituda iu ‘that Hanako be innocent’ \[ \lambda x \lambda t' [t' = t \prime & t \prime \subseteq t_{RT} \& \text{be-innocent'} (t', \text{Hanako})] \]

2. izen-no Hanako-ga muzituda to iu ‘Taro-no syutyoo

\[ \lambda t_5 \lambda x [t_5 \subseteq t_{RT} \& \text{be-innocent'} (t_5, \text{Hanako})] \]
3. (NP-level) $\Rightarrow \lambda P\lambda t_3[\exists y[t' < t_3 & t' \subseteq t_{RT} & claim'(t', y, Taro, ^\lambda t_1 \lambda y[t_1 \subseteq R_T & be-innocent'(t_1, Hanako))]) & P(t_3, y)]$

4. izen-no Hanako-ga muzituda to iu Taro-no syutyoo [+past] [+past] wa yoku sirare-te i-ru. ‘Taro’s earlier claim that Hanako was innocent is well-known.’ $\Rightarrow \exists y[\exists t'[t' < s^* & t' \subseteq t_{RT} & claim'(t', y, Taro, ^\lambda t_1 \lambda y[be-innocent'(t_1, Hanako))]) & be-well-known(s^*, y)]$

I posit the following constraint upon the lexical meanings of $claim' <<s,i,e,i,t>>,<<s,e,i,t>>,<<s,e,i,t>>,<<s,e,i,t>>$ and $claim' <<s,i,e,i,t>>,<<s,e,i,t>>,<<s,e,i,t>>,<<s,e,i,t>>$ in order to represent our intuition that the final translation in (83) entails (85):

(84) For any $P \in D_{<<s,i,e,i,t>>,<<s,e,i,t>>,<<s,e,i,t>>,<<s,e,i,t>>}$, any $a_0, a_1 \in A$, and $t \in T$, if $\llbracket claim' <<s,i,e,i,t>>,<<s,e,i,t>>,<<s,e,i,t>>,<<s,e,i,t>> \rrbracket\llbracket w(P)(a_0)(a_1)(t) = 1$, then $a_1$ should be understood as the event of $a_0$’s self-ascripting $P$ in $w$ at $t$. (Thus, $\llbracket claim' <<s,i,e,i,t>>,<<s,e,i,t>>,<<s,e,i,t>>,<<s,e,i,t>> \rrbracket\llbracket w(P)(a_0)(t) = 1$.)

(85) Taro-TOP Hanako-NOM be-innocent-PRES that syutyooosi-ta. claim-PAST
‘Taro claimed that Hanako was innocent.’
[simultaneous reading only]

The examples that involve a future tense can still be dealt with in our revised system. This system differs with the previous proposal only in that the SOT rule is now sensitive to the [+pres] feature.

(86) S-str: John Pres woll claim that Mary Pres be his wife [+pres] [+pres]
LF: John Pres woll claim that Mary Ø be his wife [+pres]

This completes the survey of how my new proposal applies to various complement clauses that involve SOT phenomena. A grammar of a
fragment that contains all the rules introduced along the way is provided at the end of the book.

4.6. DE RE ATTITUDES AS A SPECIAL CASE OF DE SE ATTITUDES

I have shown in the preceding sections that the lexical meaning of attitude verbs involves the subject self-ascribing properties. However, the story does not end there. Once we decide to adopt Lewis’s approach to attitudes, the alternative proposal rejected above re-emerges as a viable proposal. In this section, I will present a revamped analysis of de re attitudes about temporal entities.

In the above discussion of the sentences (87a–b), the translations (88a–b) were ruled out as untenable.

(87)  
   a. Heimson believes that he is Hume.  
   b. John believes that it is 4 P.M.

(88)  
   a. believe’(Heimson, ^[Heimson = Hume])  
   b. believe’(5 P.M., j, ^[5 P.M. = 4 P.M.])

Regardless of whether proper names like Heimson and 5 P.M. are rigid designators (i.e., expressions that denote the same object across worlds (and times)) or directly referential expressions (Kaplan 1977), the embedded propositions in (88a–b) are necessarily false. For example, the denotation of Heimson is necessarily different from the denotation of Hume. However, (87a–b) may be re-analyzed as involving so-called de re attitudes about Heimson and 5 P.M., respectively. I will show that there are better ways of representing this intuition than the formulas in (88a–b).

An analysis of de re attitudes that involves quantifying into an intensional context was criticized by Quine (1956). Although the problem Quine discusses is different from the one associated with (88a–b), they both stem from the assumption that objects of attitudes are propositions. Moreover, the solution I will adopt for the problem Quine discusses also takes care of the problem with (88a–b). Thus, let us discuss Quine’s criticism here. (89a–c) are Quine’s celebrated examples that involve Ralph and Ortcutt.

(89)  
   a. Ralph believes that there is something that is true.  
   b. Ralph believes that there is no something that is true.

   c. Ralph believes that he believes that he believes that he believes that he believes that he believes that he believes that there is something that is true.

   d. Ralph believes that he believes that he believes that he believes that he believes that there is no something that is true.

   e. Ralph believes that he believes that he believes that he believes that there is something that is true.

   f. Ralph believes that he believes that there is something that is true.

   g. Ralph believes that there is something that is true.

   h. Ralph believes that there is something that is true.

   i. Ralph believes that there is something that is true.

   j. Ralph believes that there is something that is true.

   k. Ralph believes that there is something that is true.
(89)  
  a. Ralph believes that the man in the brown hat he glimpsed is a spy.
  b. Ralph believes that the gray-haired man who he saw at the beach is a spy.
  c. Ralph believes that Ortcutt is a spy.

Suppose that Ralph has glimpsed a man in a brown hat under questionable circumstances and believes that he is a spy. Suppose also that Ralph has glimpsed a gray-haired man at the beach and believes that he is a pillar of the community. Thus, Ralph certainly does not believe that he is a spy. It so happens that these two men Ralph glimpsed on two different occasions are one and the same: Bernard Ortcutt. If we render (89a) and (89b) as describing de dicto attitudes, then there is no problem here, as the translations in (90) show.29

(90)  
  a. believeʻ(Ralph, ∃x[∀y[[y is in the brown hat & Ralph glimpsed y] ↔ x = y] & x is a spy])
  b. believeʻ(Ralph, ∃x[∀y[[y is a gray-haired man & Ralph saw y at the beach] ↔ x = y] & x is a spy])

Since the two propositions that Ralph believes are different from each other, it is perfectly possible for Ralph to believe one without believing the other.

However, the two sentences (89a–b) can also receive so-called de re interpretations, which are said to involve a belief about an object (res). Let us now pursue this possibility here. Given the fact that the two individuals Ralph glimpsed on the two occasions are the same person, we can provide the following translations for (89a–b). This is the way de re readings are represented by Montague (1973).

(91)  
  a. 1. λP[∃z[∀y[[y is in the brown hat & Ralph glimpsed y] ↔ z = y] & P(z)]](λx[believeʻ(Ralph, x is a spy)])
     2. ∃z[∀y[[y is in the brown hat & Ralph glimpsed y] ↔ z = y] & believeʻ(Ralph, z is a spy)])
  b. 1. λP[∃z[∀y[[y is a gray-haired man & Ralph saw y at the beach] ↔ z = y] & P(z)]](λx[believeʻ(Ralph, x is a spy)])
     2. ∃z[∀y[[y is a gray-haired man & Ralph saw y at the beach] ↔ z = y] & believeʻ(Ralph, z is a spy)])
Since the unique individual in the brown hat that Ralph has glimpsed and the unique gray-haired individual Ralph has seen at the beach are one and the same, (91a) and (91b) have exactly the same truth conditions. This is problematic because these translations predict that (89a) is true on its de re interpretation iff (89b) is true on its de re interpretation. Since the individual in question is Ortcutt, the problem can be stated alternatively as follows: under this account of de re interpretations, the de re readings of both (89a) and (89b) are rendered as in (92), assuming that Ortcutt is a rigid designator or a directly referential expression.

\[(92) \quad \text{believe}'(\text{Ralph, } ^\lambda[\text{Ortcutt is a spy}])\]

We are therefore forced to conclude that Ralph has two mutually contradictory beliefs. Our intuitions about (89a–b) do not endorse this conclusion. This leads Quine to claim that the quantifying-in (i.e., scope) analysis of de re attitudes must be replaced by a different analysis. Quine (1956) introduces a representation that hints at the right analysis. For example, he suggests the following symbolization for the de re interpretations of (89a–b):

\[(93) \quad \text{Ralph believes } z(\text{z is a spy}) \text{ of Ortcutt.}\]

Intuitively, this notation represents our intuition that a de re interpretation involves attributing some property to an object. The symbolization \(z(\text{z is a spy})\) should be taken to be a property denoting expression, i.e., \(^\lambda z[\text{z is a spy}]\), and the prepositional phrase of Ortcutt signals the object to which this property is assigned.

Lewis (1979) and Cresswell and von Stechow (1982) take up the task of providing an explicit semantics for this type of representation. I will adopt Cresswell and von Stechow’s approach, but I will translate their notation into mine in order to facilitate the comparison between their approach and the analysis presented in (91). Following Cresswell and von Stechow, I propose the following definition of the lexical meaning of believe', which is designed specifically for de re attitudes:
For any \( w_0 \in W, P_0 \in D_{<s,i,e,t,>,<s,i,e,t,>,<e,i,t,>} \), \( a_1, a_2 \in A \), and \( t_0 \in T \),
\[
\lbrack \text{believe'}^{<s,i,e,t,>,<e,i,t,>} \rbrack_{w_0}(P_0(a_1)(a_2)(t_0)) = 1
\]
(which informally reads ‘in \( w_0 \) at \( t_0 \), \( a_2 \) ascribes the property \( P_0 \) to \( a_1 \)’ iff there is a “suitable relation” \( SR \in D_{<s,i,e,t,>} \) such that (i) \( a_1 \) is the thing to which \( a_2 \) bears \( SR \) in \( w_0 \) at \( t_0 \) (formally: \( \forall y[SR(w_0)(t_0)(y)(a_2)] = 1 \leftrightarrow y = a_1 \)), and (ii) for every doxastic alternative \( <w, t, x> \) of \( a_2 \) in \( w_0 \) at \( t_0 \) the thing to which \( x \) bears \( SR \) in \( w \) at \( t \) has property \( P_0 \) in \( w \) at \( t \) (formally: \( \exists y[P_0(w)(t)(y) = 1 \& \forall z[SR(w)(t)(z)(x) = 1 \leftrightarrow z = y]] \)).

One technical issue that my adaptation of Cresswell and von Stechow’s analysis gives rise to is that \text{believe’}, when it specializes for \textit{de re} readings, has one extra argument place for the object (\textit{res}) to which the attitude bearer assigns some property. This means that \text{believe’} for \textit{de dicto} readings and \text{believe’} for \textit{de re} readings are expressions of different types. This may not be elegant from the syntactic point of view but is good enough for our purposes. I distinguish various semantic types associated with \text{believe’} (or any other expression) by explicitly notating the type associated with a particular variant of \text{believe’}, as in (94). According to this analysis, (89a–b) have distinct truth conditions on \textit{de re} interpretations, as desired. Their interpretations are based upon the following \textit{IL} translations:

\[
\begin{align*}
\text{(95a)} & \quad \exists z[\forall y[(y \text{ is in the brown hat } & \text{ Ralph glimpsed } y) \leftrightarrow z = y] \& \text{believe'}(s, \text{ Ralph, } z, \lambda x \lambda t[x \text{ is a spy at } t])] \\
\text{(95b)} & \quad \exists z[\forall y[(y \text{ is a gray-haired man } & \text{ Ralph saw } y \text{ at the beach}) \leftrightarrow z = y] \& \text{believe'}(s, \text{ Ralph, } z, \lambda x \lambda t[x \text{ is a spy at } t])]
\end{align*}
\]

(89a–b) translate roughly as (95a–b), respectively. In the case of (95a), the suitable relation \( SR \) in question is \( <w, t, y, x> \) that is \( t' < t \) such that \( x \) glimpses \( y \) and \( y \) is in a brown hat in \( w \) at \( t' \). On the other hand, the suitable relation for (95b) is \( <w, t, y, x> \) that is \( t' < t \) such that \( x \) sees \( y \) at the beach \( y \) is a gray-haired man in \( w \) at \( t' \). (95a) is true on its \textit{de re} interpretation in \( w_0 \) at \( t_0 \) iff in \( w_0 \) at some time earlier than \( t_0 \) Ralph glimpses Ortcutt in the brown hat, and every doxastic alternative \( <w_1, t_1, x_1> \) of Ralph in \( w_0 \) at \( t_0 \) is such that there is a time
$t' < t_1$ and the unique man in the brown hat that $x_1$ glimpses in $w_1$ at $t'$ is a spy in $w_1$ at $t_1$. On the other hand, (95b) is true on its de re interpretation in $w_0$ at $t_0$ iff there is a time $t' < t_0$ at which Ralph sees Orncutt at the beach in $w_0$ and every doxastic alternative $<w_1, t_1, x_1>$ of Ralph in $w_0$ at $t_0$ is such that there is a time $t' < t_1$ and the unique gray-haired man that $x_1$ sees at the beach in $w_1$ at $t'$ is a spy in $w_1$ at $t_1$.

What I have just presented is de re interpretations re-analyzed as a special case of de se interpretations. According to this analysis of so-called de re attitudes, Kaplan’s example (96a) translates as (96b) on its de re interpretation.

(96) 

a. Kaplan believes that his pants are on fire.

b. believe’$(s^*, \text{Kaplan, Kaplan, } ^{\wedge} \lambda x \lambda t(\text{the pants of } x \text{ are on fire at } t))$

(96b) is true iff Kaplan ascribes to the unique man he sees in the mirror, who happens to be Kaplan himself, the property of being someone whose pants are on fire.

Cresswell and von Stechow (1982) propose that this de se-based de re interpretation can be extended to objects other than “normal” individuals, such as predicates. Abusch (1991) employs this technique and extends this analysis to intervals. As in the nominal cases, I reinterpret Abusch’s proposal within my framework as follows:

(97) For any $w_0 \in W, P_0 \in D_{<s, <i, i, t, t>>}, t_1 \in T, a_0 \in A$, and $t_0 \in T, [\text{believe’} <s, s, <i, i, t, t>>, <s, s, <i, i, t, t>>, s, s, <i, i, t, t>>, s_0](P_0(t_1)(a_0)(t_0)) = 1$ (which informally reads “in $w_0$ at $t_0$, $a_0$ ascribes the property $P_0$ to $t_1$”) iff there is a “suitable relation” $SR \in D_{<s, <i, i, e, t, t>>}$ such that (i) $t_1$ is the interval to which $a_0$ bears $SR$ in $w_0$ at $t_0$, and (ii) for every doxastic alternative $<w, t, x>$ of $a_0$ in $w_0$ at $t_0$, the interval to which $x$ bears $SR$ in $w$ at $t$ has the property $P_0$ in $w$ at $t$.

If we adopt this analysis of so-called de re readings, the proposal ruled out earlier may be revived. Let us reconsider the examples which we previously concluded must receive de se interpretations rather than de re interpretations.
(98)  a. John believes that it is 4 P.M.
    b. John believes that Mary is in Seattle now.

Instead of assigning (irreducible) *de* *se* interpretations to them, we could give them (*de* *se*-based) *de* *re* interpretations as in (99a–b).

(99)  a. believe′(5 P.M., John, 5 P.M., \(\lambda t' [t' = 4 \text{ P.M.}]\))
    b. believe′(5 P.M., John, 5 P.M., \(\lambda t' [\text{Mary is in Seattle at } t' \text{ & } t' = 4 \text{ P.M.}]\))

(99a) says that the speaker believes of 5 P.M. that it is 4 P.M. Put in a different way, the speaker ascribes to 5 P.M. the property of being 4 P.M. Following the definition of the denotation of believe′ given above, the truth conditions for (99a) in \(w_0\) are stated as follows: (i) there is a suitable relation \(SR\) that John bears to 5 P.M. in \(w_0\) at 5 P.M., and (ii) every doxastic alternative of John in \(w_0\) at 5 P.M. is an element of \(\{<w', t', x'> | \text{the interval to which } x' \text{ bears } SR \text{ in } w' \text{ at } t' \text{ is } 4 \text{ P.M. in } w' \text{ and } t'\}\). The analysis of (98b) proceeds in a similar manner on the basis of the translation given in (99b). Assuming that the utterance time of (98b) is 5 P.M., then it is true in \(w_0\) iff (i) there is a suitable relation \(SR\) that John bears uniquely to 5 P.M. in \(w_0\) at 5 P.M., and (ii) every doxastic alternative of John in \(w_0\) at 5 P.M. is an element of the following set of triples: \(\{<w', t', x'> | \text{the unique time } t \text{ to which } x' \text{ bears } SR \text{ in } w' \text{ at } t' \text{ is such that Mary is in Seattle at } t \text{ in } w' \text{ and } t \text{ is } 4 \text{ P.M.}\}\). The \(SR\) in both examples is presumably that of “being the time at which the agent is located at the time of the attitude.” This new rendition of so-called *de* *re* attitudes provides an intuitively appealing analysis of (98a–b).

Let us try to evaluate the outcome of our discussion so far. I have claimed that a *de* *se* analysis of attitudes can join forces with an SOT rule proposed for syntax to make the right predictions about the SOT phenomena. I have shown earlier in this chapter that *de* *se* analyses work better than *de* *re* analyses to account for certain non-propositional attitude reports. Thus, we have concluded that we should adopt a *de* *se* analysis of attitudes. However, we now find that it is possible to propose a legitimate reanalysis of *de* *re* attitudes as a special case of *de* *se* attitudes. Note, however, that both of these new approaches assume that attitudes involve properties rather than propositions. As far as I can see, there is no empirical difference
between the *de se* rendition and the *de re* rendition of simultaneous readings, unlike the case of nominals discussed by Kaplan.

For the purpose of this book, I will assume that whenever a “pure *de se* analysis” is possible, it takes precedence over any alternative analyses. A “pure *de se* analysis” refers to an analysis in which an attitude verb requires three arguments: a property, an individual (the subject), and a time. Only when this type of analysis does not provide enough legitimate readings, should we employ a *de re* analysis based upon the translation of an attitude verb that requires four arguments: a property, two individuals (the *res* and the agent), and a time. So far, we have not discussed any examples that require a *de re* reading about an interval; I only remarked that the examples that are accounted for by a pure *de se* analysis can be recast in terms of a *de re* analysis. In Chapter 6, however, we will discuss double-access sentences, which require a *de re* analysis of temporal expressions.

NOTES

1 The judgment is Ross’s. He considers (3a) to be bad probably because he does not consider the possibility that it is uttered while the state in question still obtains.

2 This is not the only possibility. In (12) I hypothesize that the trigger of the SOT rule serves as the deictic center for the temporal interpretation of the target tense. If we extend the hypothesis to non-local tenses, it is possible to claim that the null tense is interpreted relative to the time of John’s saying. This appears to give us an empirically correct interpretation. However, I believe that the SOT rule should be defined in terms of a local domain and, therefore, will not pursue this possibility. Although (9a) appears to have an interpretation in which the time of Mary’s being sick is simultaneous with the time of John’s saying, I do not believe that this is a distinct reading. This is merely a special case of a possible reading of the sentence where the lowest past tense is understood as a “real past tense” and is interpreted in relation to the future tense.

3 It is also important to note that (11) only has a simultaneous reading. Unlike present-under-past sentences in English, it does not appear to receive a double-access interpretation. Perhaps, it can receive a double-access reading, but it is not as conspicuous as in the case of English because the putative double-access reading always entails the simultaneous reading. See Chapter 6 for some discussion on this topic.

4 Replacing *if* with *iff* would be too strong in view of the proposal for infinitives given in Section 4.3.2.

5 It can also receive a reading in which the present tense in the relative clause is interpreted independently of the past tense in the matrix clause.

6 Later in this chapter and in Chapter 5, I will discuss in formal semantic terms what it means for a tense morpheme to be “in the scope” of another tense.
Ladusaw presents some examples that involve *would*. See the relevant discussion in Chapter 3.

Kratzer (1989) assumes that predicates can be distinguished in terms of whether they have a temporal-spatial argument place. For example, so-called individual-level predicates lack such an argument place. If she is right, even if we assume a system in which times are referred to in the object language, this does not mean that every predicate has an argument place for times. However, I will not adopt Kratzer’s proposal and, hence, will simply assume that every predicate has a temporal argument position and (in principle) has a time-sensitive extension.

"\( \lambda t^2 \) [be-pregnant \( (t^2, m) \)] \( M, w, t, g \) is the function \( h \) such that for any world \( w' \) and time \( t' \), \( h(w)(t) = 1 \) if \( [\text{be-pregnant} \( (t^2, m) \)] \( M, w', t, g \)

In general, we will assume that any two set-theoretic objects \( h \) and \( k \) that satisfy either of the following conditions have the same “cognitive status” and carry the same semantic content:

(i) \( h \in C^{A \times B} \) (\( h \) is a function from \( A \times B \) into \( C \)) and \( k \in (C^B)^A \) (\( k \) is a function from \( A \) into \( \{ f \mid f \) is a function from \( B \) into \( C \} \)), where \( A, B, C \) are any sets, such that for any \( x \in A \) and \( y \in B \), \( h(<x, y>) = [k(x)](y) \).

(ii) \( h \in C^{A \times B} \) (\( h \) is a function from \( A \times B \) into \( C \)) and \( k \in (C^A)^B \) (\( k \) is a function from \( B \) into \( \{ f \mid f \) is a function from \( A \) into \( C \} \)), where \( A, B, C \) are any sets, such that for any \( x \in A \) and \( y \in B \), \( h(<x, y>) = [k(y)](x) \).

The phrase “as if” is needed because this allows for the possibility that the agent lies or utters a sentence without intending to convey anything to anyone.

I ignore the semantic difference between *think* and *believe* here.

For any type \( a \), \( D_a \) is the set of possible denotations of expressions of type \( a \).

Lewis (1979) adopts the view that properties are simply world-individual pairs. This is because Lewis assumes that individuals inhabit only one world-time slice. I will assume that my proposal is a notational variant of Lewis’s.

This proposal about the lexical meaning of *say*’ has a clear bearing on the truth definition for matrix sentences. See p. 62 and p. 250.

I simplify here the treatment of pronouns *he* and *his* by substituting a name (i.e., *j*) for a pronoun or by incorporating *his* into a predicate (i.e., *say-to-his-mother*).

"\( x \) decides \( p \)" roughly means that \( x \) believes he has control over whether \( p \) holds and moreover believes that \( p \) does hold.

To the best of my knowledge, Japanese has no adjective that takes a complement sentence as well as a subject NP as its arguments. All English adjectives that take sentential complements translate into Japanese as verbs.

I assume that sentential subjects in English are CPs. See below for the relevant discussion.

This simple formulation of the tense deletion rule must be replaced by a more involved one when we consider SOT cases triggered by nouns and the perfect. However, such complications are independent of the point made here.
Although SOT phenomena observed in noun complements are discussed in my earlier work (Ogihara 1989), examples like (64b) are not presented there. An anonymous reviewer points out that the SOT phenomena that involve noun complements occur without overt temporal adjectives, and this point has been incorporated here.

Japanese noun complements are of the form S-to iu, which literally means ‘says that S’. So it appears that they are VP’s, rather than CP’s. But I will not pursue this possibility and simply label Japanese noun complements as CP’s in this book.

The features [-fut] and [-pres] will not be employed in the proposal.

A c-commands B iff A does not dominate B & B does not dominate A & the first branching node that dominates A also dominates B.

It is possible to rewrite the SOT rule in (67) in terms of the notion of government, etc. But I prefer not to complicate the syntactic terminology here and define the applicability of the SOT rule in terms of a disjunctive statement.

I use the symbol “tR” for the reference time that appears within the IL translation of a verb that takes infinitival complements.

As mentioned earlier, TAdj is ignored in the translation. Its feature, however, must match that of N. Thus, it is either licensed or ruled out syntactically.

Temporal arguments are not explicitly represented in the IL formulas given in (90)–(92).
5.1. THE PLAN FOR THIS CHAPTER

In this chapter, we will consider tense morphemes in adjunct clauses. We will study relative clauses and temporal adverbial clauses. As pointed out in Chapter 3, some traditional grammarians such as Jespersen (1931) discuss the SOT phenomena in terms of the direct speech vs. indirect speech contrast. They analyze the SOT phenomena in terms of a “rule” that relates direct speech to indirect speech. Since adjunct clauses have no “direct speech source,” the possibility that SOT phenomena are found in such clauses would not be considered under such a rule. On the other hand, Curme (1931) characterizes the phenomena in terms of syntactic properties of tense morphemes. Some modern linguists such as Ross (1967), Costa (1972), and Ladusaw (1977) adopt the latter perspective. The SOT rule proposed in Chapter 4 is in fact defined solely in structural terms and is not sensitive to the type of clause in which the target tense morpheme is found. In this chapter, I will apply this structural interpretation of the SOT rule to adjunct clauses and will present supporting evidence for it.

5.2. SEQUENCE-OF-TENSE PHENOMENA WITH NO “DIRECT DISCOURSE SOURCES”

We looked at the SOT phenomena in verb complement clauses in Chapter 4 and proposed the following rule to account for the SOT phenomena found there:
(1) The SOT rule [definitive version]:
If a tense feature B is the local tense feature of a tense feature A at LF, and A and B are occurrences of the same feature (i.e., either [+past] or [+pres]), A and the tense associated with A (if any) are optionally deleted. N.B.: (i) The tense features include [+past] and [+pres] and nothing else. (ii) A tense feature A is “in the scope” of a tense feature B iff B is associated with a common noun and asymmetrically c-commands A, or B is associated with a tense or a perfect and asymmetrically commands A. (iii) A tense feature B is the local tense feature of a tense feature A iff A is “in the scope” of B and there is no tense feature C “in the scope” of B such that A is “in the scope” of C.

Since the conditions for the rule are stated in structural terms, it should also apply to constructions other than complement clauses. For example, (1) predicts that the adjunct clauses in (2) are subject to this rule if we assume the underlying structures of these sentences given in (3).

(2) a. John met a man who was crying.
   b. The man who was waving his hand was trying to stop a taxi.
   c. Mary left before John arrived.

(3) a. [S John [TP Past meet [NP a man who Past be crying]]]
   b. [S[NP The man who Past be waving his hand][TP Past be trying to stop a taxi]]
   c. [S Mary [TP Past leave [PP before [CP[S John Past arrive]]]]]

In (3a) the relativized NP is a sister of the main verb and is within the “local domain” of the main clause tense. (3b) exemplifies a case in which a relativized NP occupies the subject position of the sentence. The tense within the relative clause is commanded by the matrix tense and is subject to the SOT rule. (3c) involves a temporal adverbial clause. The structure of the before-clause in (3c) follows Jackendoff (1977), who attributes his analysis to Klima (1965). Assuming this analysis, the tense in the before-clause is locally commanded by the tense in the matrix. I will show in this chapter that the structurally
defined SOT rule (1) predicts correctly that SOT phenomena are found in relative clauses. The data that involve temporal adverbial clauses in English are unfortunately not so straightforward, but we also find some evidence here that the behavior of English tense morphemes in temporal adverbial clauses are at least partially dependent upon structurally higher tenses.

In order to relate the applicability of the SOT rule to the semantic dependency between the (potential) trigger and the (potential) target, I will continue to pursue the following hypothesis suggested in Chapter 4:

\[ (4) \text{In English, a tense } \alpha \text{ is interpreted in relation to another tense } \beta \text{ if their structural relation at LF is such that } \alpha \text{ and } \beta \text{ are a potential target and a potential trigger, respectively, of the SOT rule.} \]

I will demonstrate that this indeed holds true of relative clauses.

5.3. RELATIVE CLAUSES

Let us start with a brief discussion of some Japanese data that involve relative clauses because it is clear that they can be interpreted as controlled by structurally higher tenses.

\[ (5) \text{Taro-wa [ nai-te i-ru otoko]-o mi-ta.} \]
\[ \text{Taro-TOP cry-PROG-PRES man-ACC see-PAST} \]
\[ \text{‘Taro saw a man who was crying [at the time of the meeting].’} \]

The default interpretation of (5) is that the time of the man’s crying is simultaneous with the time of Taro’s seeing him. Note that the relative clause is in the present tense. This parallels the case of verb complement clauses considered in earlier chapters. However, relative clauses differ from verb complement clauses in that they can also be interpreted independently of the structurally higher tenses. Consider the following examples:
(6a) shows that given some appropriate adverbials, a relative clause in the present tense can be interpreted independently of the matrix past tense. That is, the present tense in the relative clause refers to the speech time, and not to the time of Taro’s seeing the man. (6b) shows that the relative clause in the present tense cannot refer to a past time located between the time referred to by the matrix tense and the speech time. Thus, (5) and (6a–b) show that a relative clause in the present tense can only refer to two points that are temporally discontinuous. In order to make reference to a time located between the time of the matrix predicate and the speech time, the relative clause must be in the past tense instead, as shown in (6c).3

Note also that a relativized NP can be understood as “being in the scope” of the immediately higher tense regardless of its S-structure position within the sentence. For example, the NP in question could be a subject NP as in (7a) or an NP buried within a locative PP as in (7b).
(7) a. [ hasit-te i-ru hito]-ga sono otoko-o run-PROG-PRES person-NOM that man-ACC mituke-ta. find-PAST
   ‘A person who was running [at the time] found that man.’

b. Taroo-wa [ danboo-no nai Taro-TOP heating-GEN does-not-exist-PRES heya]-de benkyoo si-ta. room-at study-PAST
   ‘Taro studied in a room that had no heating.’

(7a–b) show that whether the NP in question is within the VP is unimportant in determining the temporal properties of tenses in Japanese relative clauses.

The simplest and most elegant way of accounting for the above data is to assume that a tense that is located within an NP is either scopally dependent on or independent of the higher tense, which is the matrix tense in a simple sentence. Since scoping of NPs is deemed necessary anyway (e.g., Montague 1973, May 1977), this mechanism is immediately available for accounting for the behavior of tenses in relative clauses. Thus, let us pursue this proposal unless it is shown to be inadequate. Since we are developing a theory within an upside-down Y model of grammar, the most natural method for representing scope possibilities of NPs is May’s (1977) Quantifier Raising (henceforth, QR). I will adopt this proposal and apply explicit model-theoretic interpretations to LF structures generated by QR. We will first focus on extensional transitive verbs such as meet. To simplify the structure of the proposed system, I will assume that they translate into IL as expressions of type $<e,<e,<i,t>>$. Let us initially adopt the following definition of QR:

(8) Rule for English and Japanese:

Quantifier Raising [first version]

A structure of the form $[\alpha \ldots NP_n \ldots]$ is obligatorily converted to $[\alpha NP_n [\alpha \ldots e_n \ldots]]$ at LF, where $\alpha$ is either S or VP and $n$ is a numerical index.
According to (8), two possible LF structures result from a sentence that contains one relativized NP as shown schematically in (9).

\[(9) \quad \begin{align*}
(a) & \quad [S \ldots Tense_1[V_P[N_P \ldots [S \ldots Tense_2 V_2 \ldots]]][V_P V_1 e_2 \ldots]]
(b) & \quad [S[N_P_2 \ldots [S \ldots Tense_2 V_2 \ldots]][S \ldots Tense_1 V_1 e_2 \ldots]]
\end{align*}\]

In (9a–b), Tense_1 is the main clause tense, and Tense_2 is the relative clause tense. The trace e_2 indicates an NP trace. In (9a), Tense_2 is interpreted in relation to V_1. On the other hand, when NP_2 is scoped to the matrix-S level and is structurally higher than Tense_1 as in (9b), Tense_1 and Tense_2 are interpreted independently of each other and in relation to the speech time.

We must also agree on the internal structure of relativized NPs. Unlike English counterparts, Japanese relative clauses do not have an overt wh-expression associated with the gap. I simply assume for the purpose of this book that an empty wh-element moves at LF to create an operator-variable configuration.

\[(10) \quad \text{Rule for Japanese:} \]
\[
\text{Empty Wh-movement} \\
[CP[S \ldots e \ldots]] \Rightarrow [CP[S \ldots e_n \ldots] \text{wh}_n], \text{ where } n \text{ is a numerical index.}
\]

Given these rules, the sentences in (11a–b) are turned into LF structures given below as (12a–b), respectively.

\[(11) \quad \begin{align*}
(a) & \quad \text{Taro-top cry-PROG-PRES man-ACC see-PAST} \\
& \quad \text{‘Taro saw a man who was crying.’}
(b) & \quad \text{Taro-top now there-at cry-PROG-PRES} \\
& \quad \text{man-ACC yesterday see-PAST} \\
& \quad \text{‘Yesterday Taro saw the man who is now crying over there.’}
\end{align*}\]
(12) a. $\text{[S Taroo-wa [VP[e₂ nai-te i Pres] wh₂] Taro-TOP cry-PROG PRES]}$
$\text{otoko]-o [VP e₁ mi] Past]}$
man-ACC see PAST

b. $\text{[S [NP₁ [CP[S ima asoko-de e₄ nai-te i Pres] wh₄] now there-at cry-PROG PRES]}$
$\text{otoko₄]-o [S Taroo-wa kinoo e₁ mi Past]]}$
man-ACC Taro-TOP yesterday see PAST

Note also that Japanese does not have articles, and NPs often look as if they are N’s (N-bars). I simply assume here and elsewhere in the book that a Japanese NP that contains a common noun is interpreted as if it has an article, either the or a. This is clearly controversial and should not be regarded as a definitive analysis of Japanese NPs. 7 We need the following new translation rules to obtain the IL translations (14)–(15) for (12a–b): 8

(13) Rules for Japanese:

a. $\text{[CP[S ... eₙ ... ] whₙ]}$ translates into $\lambda xₙ \lambda t[\mathbb{S}(t)(t')]$ (relative clause)

b. $\text{[N’ CP N’]}$ translates into $\lambda x \lambda t[\mathbb{CP}(x)(t) \& N'(x)(t)]$ ("relativized N")

c. $\text{[S NPₙ S]}$ translates into $\lambda t₁ \lambda t₂ [\mathbb{NP}_n(\lambda xₙ \lambda t[\mathbb{S}(t)(t₂)])(t₁)]$ (QR to S)

d. $\text{[VP NPₙ VP]}$ translates into $\lambda y[\mathbb{NP}_n(\lambda xₙ \lambda t[\mathbb{VP}(y)(t')]])$ (QR to VP)

[N.B.: n is a numerical index in the above rule schemata.]

Note that in (14) and (15), $P$ is used as a variable of type $<e,<i,t>>$, and $P_I$ as a variable of type $<i,t>$.  

(14) 1. $\text{[CP[S e₂ nai-te i Pres] wh₂] } \Rightarrow \lambda x₂ \lambda t₁ \exists t [t = t₁ \& t \subseteq RT \& \text{be-crying’}(t, x₂)]$

2. $\text{[N’ [S e₂ nai-te i Pres] otoko₂] } \Rightarrow \lambda x₂ \lambda t₁ \exists t [t = t₁ \& t \subseteq RT \& \text{be-crying’}(t, x₂) \& \text{man’}(t, x₂)]$

3. $\lambda x₂ \lambda t₁ [t₁ \subseteq RT \& \text{be-crying’}(t₁, x₂) \& \text{man’}(t₁, x₂)]$

(simplification)
The two logical translations predict the two readings correctly. First, when past tense has scope over a relativized NP as in (14), the relative clause is interpreted in relation to the main clause predicate. Since the relative clause is in the present tense, this means that the time of the man’s crying is simultaneous with the time of Taro’s seeing him. Recall that the Japanese present acts like the English null tense. On the other hand, when an NP has scope over a past tense as in (15), the relative clause is interpreted independently of the past tense. This means that the time of the man’s crying is the speech time.
When the relative clause is in the past tense, instead of the present tense, the narrow scope reading entails the wide scope reading. For example, (16a) is predicted to receive two interpretations symbolized by the IL translations (16b–c), and (16b) entails (16c).

\[(16)\]  
\begin{align*}
a. & \quad \text{Taro saw a man who was crying.} \\
& \quad \text{Taro-TOP cry-PROG-PAST man-ACC see-PAST} \\
& \quad \text{‘Taro saw a man who was crying.’} \\
\end{align*}

\begin{align*}
b. & \quad \exists y [\exists t_3 | t_3 < s^* \& t_3 \subseteq t_{RT} \& \text{see}’(t_3, \text{Taro, y}) \& \text{man}’(t_3, y) \& \exists t_2 | t_2 < t_3 \& t_2 \subseteq t_{RT}’ \& \text{be-crying}’(t_2, y)]] \\
\end{align*}

\begin{align*}
c. & \quad \exists y [\exists t_4 | t_4 < s^* \& \text{be-crying}’(t_4, y) \& \text{man}’(s^*, y) \& \exists t_2 | t_2 < s^* \& \text{see}’(t_2, \text{Taro, y})] ] \\
\end{align*}

These predications are empirically correct, but the “shifted reading” given here as (16b) is redundant. However, there is evidence that shifted readings for relative clause tenses exist. Consider (17).

\[(17)\]  
\begin{align*}
& \quad \text{The person who won tomorrow’s match gets a gold medal.’} \\
& \quad \text{‘The person who wins tomorrow’s match will get a gold medal.’} \\
& \quad \text{[Lit.] ‘The person who won tomorrow’s match gets a gold medal.’} \\
\end{align*}

In (17), the time of the person’s winning is clearly located at a future time as indicated by the adverb *asita* ‘tomorrow’. Yet, the past tense in the relative clause is licensed because the time of winning is located before the time of getting a gold medal.

Further evidence for shifted interpretations involving relative clauses can be found when we turn to intensional transitive verbs like *sagasu* ‘seek’.

\[(18)\]  
\begin{align*}
& \quad \text{Taro looked for a/the man who won a Nobel prize.’} \\
\end{align*}

\begin{align*}
& \quad \text{Taro-TOP Nobel-prize-ACC win-PAST man-ACC seek-PAST} \\
& \quad \text{‘Taro looked for a/the man who won a Nobel prize.’} \\
\end{align*}
Under the so-called *de dicto* reading of the object NP in (18), the time of the man’s winning a Nobel prize is placed before the time of the search. There is no such restriction when we take the *de re* reading of the NP. This is exactly like the English facts that Abusch (1988) discusses (see Chapter 3).

The above facts can be explained if we assume that the NP is in the scope of the intensional transitive verb on its *de dicto* reading and, therefore, it necessarily falls within the scope of the matrix tense, which has sentential scope according to my proposal. Thus, the tense contained in the NP is interpreted in relation to the main clause tense. Later in this chapter, I will provide a formal account of how the *de dicto* reading of a relative clause NP that contains a past tense results in a shifted reading for the relative clause. By contrast, when the NP receives a *de re* reading, it escapes the scope of the intensional transitive verb by being adjoined to the VP or to the matrix S. When the NP has matrix S scope, the tense in the relative clause is interpreted relative to the speech time. When the NP has VP-level scope, it has a shifted reading in that the time of the relative clause predicate is prior to the time of the matrix predicate. This reading entails the S-level scope *de re* reading. This supports the view that at least in Japanese tenses in relative clauses are like tenses in verb complements in that they are interpreted in relation to local commanding tenses at LF.

Let us consider the implications of the above Japanese facts. As mentioned above, the guiding principle in our investigation of the SOT phenomena in English is the following: when A syntactically affects B, A also semantically embeds B. We have just found that at least in Japanese tense morphemes in relative clauses are interpreted in relation to the immediately higher tense, just as in complement clauses. Moreover, the relative clause tense is locally commanded by the higher tense. This suggests that perhaps in English SOT phenomena obtain in relative clauses as well as in complement clauses. Let us look at some relevant English examples.10

At first, it appears that English relative clauses are different from Japanese relative clauses. For example, (19a–b) seem to show that the temporal properties of tense morphemes in English relative clauses are always determined in relation to the speech time.
(19)  a. John met a man who was crying in sorrow.
b. John met a man who is crying in sorrow.

(19a) simply requires that the time of the man’s crying be located in the past, whereas (19b) places the time of his crying at the speech time. If it is true that relative clause tenses in English are always speech time sensitive, there are two possible explanations. (i) NPs always have wider scope than structurally higher tenses. (ii) Tenses are speech-time-sensitive indexical expressions.

Instead I will pursue a more complex theory. Recall that the proposal I defended in Chapter 2 attributes an indexical meaning to the English present, but not to the English past. I supplement this proposal with the following two hypotheses about relative clauses. (i) Relative clause NPs take various scope options, just like any other NPs. (ii) The SOT rule is operative in relative clauses, as well as in verb complement clauses. These hypotheses are not stipulations; they simply follow from the rules proposed above. With regard to (19a), these hypotheses predict three different possibilities for the time of the man’s crying: (i) before the utterance time, (ii) before the time of John’s meeting the man, (iii) simultaneous with the time of John’s meeting the man. (ii) and (iii) entail (i) and are redundant. Regarding (19b), our assumption that the English present is an indexical is enough to predict that the time of the man’s crying is invariably the utterance time. Various scope options for the relativized NP are harmless but unnecessary. Note that an alternative proposal that says that relativized NPs always have maximal scope predicts the same range of readings for (19a–b). Thus, it appears that our proposal is not superior to the alternative account.

However, when we look at more complex examples, it turns out that our proposal has an empirical advantage over the alternative account. Consider the following examples:

(20)  a. John will meet a man who lost his money.
b. John will meet a man who is holding a copy of \textit{L&P} in his hand.

First, (20a) shows clearly that the relativized NP can be interpreted in the scope of the matrix tense, for the time of the man’s losing his money can be any time before the future time of John’s meeting him.
But this example does not involve an SOT phenomenon. (20b) is the type of example that shows that the SOT rule is needed to account for the interpretation of relative clause tenses. The relative clause of (20b), which is in the present tense, can be interpreted in relation to the future time referred to in the main clause. For example, one possible scenario is the following. John is visiting a different university to give a semantics talk, and someone will be there at the airport to meet him. Since they do not know each other’s faces the person from the host institution will be holding a copy of *L&P* there at the airport to identify himself. My proposal predicts that the future tense *will* and the present tense morpheme agree in tense features: they are both associated with a present tense, which has the feature [+pres]. Therefore if we assume that the relative clause NP can be located in a position locally commanded by the matrix [+pres] tense feature at LF, the present tense and the associated feature in the relative clause are deleted and the relative clause becomes tenseless. The rule of QR given in (8) allows NPs to adjoin to VPs, and this option results in such a configuration. Since the tenseless relative clause is semantically controlled by the higher tense, the simultaneous reading associated with (20b) is predicted. The relevant LF structure is given in (21).

(21)  [S at the airport, John [TP Pres [MP woll [VP[NP2 a man who Ø be holding a copy of *L&P* in his hand][VP meet e2]]]]]

The relative clause in (20b) can also receive a reading, in which the time of the man’s holding a copy of *L&P* is the speech time. This is predicted on the basis of the wide scope configuration for the relativized NP in (22).11

(22)  [S[NP, a man who Pres be holding a copy of *L&P* in his hand][S at the airport, John Pres woll meet e2]]

What is appealing about this analysis is that it accounts for the asymmetry between the past-controlling-present cases vs. the future-controlling-present cases. As mentioned above, when a sentence in the present tense occurs immediately under a past tense, purely simultaneous readings do not obtain (e.g., (19b)). This was accounted for by the stipulation that the English present is an indexical whose interpretation is always speech time sensitive. Given this stipulation,
we can explain in terms of the SOT rule why purely simultaneous readings are possible in the future-controlling-present examples but not in the past-controlling-present examples. In (19b), since the matrix tense is a past tense, the SOT rule does not apply. Therefore, the present tense in the relative clause cannot be deleted, and the sentence cannot receive a simultaneous reading. On the other hand, in (20b), the matrix clause has a present tense. Thus, the SOT rule can delete the lower present tense. This gives rise to the simultaneous reading associated with (20b). Needless to say, this does not give us the whole story because the peculiar reading associated with a double-access sentence such as (23) has not received any account. 12

(23) John said that Mary is pregnant.

Our story can only explain why (23) cannot receive a purely simultaneous reading. We will discuss double-access sentences in detail in Chapter 6.

Let us examine some more relevant examples.

(24) a. John met a man crying in sorrow.
    b. John said a week ago that in ten days he would buy a fish that was still alive.

(24a) shows that the time of the participial modifier crying in sorrow is naturally understood as simultaneous with the time of John’s meeting the man, which is located in the past. Just as in (20a–b), this reading is predicted only if the participial modifier is semantically under the matrix tense’s control when it is interpreted. This cannot be accounted for by a theory that claims that the temporal interpretation of NPs is always determined independently of structurally higher tenses.

Finally, let us discuss (24b), which is a solid piece of evidence for the SOT-rule-based theory. It can receive an interpretation in which the time of John’s buying the fish is in the future and, moreover, coincides with the time of the fish’s being alive. Note that we cannot obtain this reading on the assumption that the NP receives wider scope than the tense in the verb complement clause. The reading can be predicted only if we assume that the NP is adjoined to the lowest VP and that the SOT rule applies to the tense in the relative clause. The
LF representation of (24b) after the application of the tense deletion rule is the following:

(25) \[ S \text{ John Past say that } S \text{ he } \varnothing \text{ woll } [VP \text{ a fish that } e_3 \text{ } \varnothing \text{ be still alive}] [VP \text{ buy } e_2]]\]

Assuming the *de se* analysis of attitudes presented in Chapter 4 and the interpretation of relative clauses given in this chapter, it is clear that the relative clause in the LF structure (25) receives a simultaneous interpretation. Note that if the past tense in the relative clause in (24b) is a “real past tense” and is interpreted in relation to the utterance time, the time of the fish’s being alive is required to be prior to the speech time.

I hope to have established the necessity of the SOT rule for the interpretation of English relative clauses. Let us now reexamine the above examples in terms of formal semantic techniques. We first consider (19a–b). On the proposal I am now defending, (19a) is interpreted on the basis of the following three distinct LF structures:13

(26)

a. \[ S \text{ John Past } [VP[NP_1 \text{ a man who } \varnothing \text{ be crying] meet } e_1]]\]

b. \[ S \text{ John Past } [VP[NP_1 \text{ a man who Past be crying] meet } e_1]]\]

c. \[ S[NP_1 \text{ a man who Past be crying][S John Past meet } e_1]]\]

The following new rules are introduced here for English:

(27) Rules for English:

a. \[ CP \text{ wh}_n [S \ldots e_n \ldots ] \text{ translates into } \lambda x_1 \lambda t \exists t'[S(t)(t')]\]

b. \[ N', N' CP \text{ translates into } \lambda x \lambda t'[CP(x)(t) & N'(x)(t)] \text{ (relativized N')}\]

c. \( \alpha \text{ translates into } \lambda P \lambda Q \lambda d \exists y[P(y)(t) & Q(y)(t)]\]

d. \[ S \text{ NP}_n S \text{ translates into } \lambda t_1 \lambda t_2[NP_n(\lambda x_1 \lambda t'[S(t)(t'2)](t_1)) \text{ (QR to S)}\]

e. \[ VP \text{ NP}_n \text{ VP } \text{ translates into } \lambda x[NP_n(\lambda x_1 \lambda t'[VP(x)(t')])] \text{ (QR to VP)}\]

[N.B.: \( n \) is a numerical index in the above rule schemata.]

The *IL* translations of (26a–c) proceed as in (28)–(30), respectively.
(28) LF: [S John Past [VP [NP, a man who e2 Ø be crying] meet e1]]
1. a man who2 e2 Ø be crying ⇒ λPλt∃x([man′(t, x) & be-crying′(t, x) & P(t, x)]
2. [VP [NP, a man who Ø be crying] meet e1] ⇒ λzλt′∃x([man′(t′, x) & be-crying′(t′, x) & meet′(t′, z, x)])
3. [S John Past[VP [NP, a man who Ø be crying] meet e1]] ⇒ ∃t6[t6 < s* & t6 ⊆ t_RT & ∃x([man′(t6, x) & be-crying′(t6, x) & meet′(t6, j, x)]) (Truth Definition)

(29) LF: [S John Past [VP [NP, a man who2 e2 Past be crying] meet e1]]
1. [S John Past meet e1] ⇒ λt′λt[t < t′ & t ⊆ t_RT & meet′(t, j, x1)]
2. [S [NP, a man who Past be crying][S John Past meet e1]] ⇒ ∃t9[t9 < s* & t9 ⊆ t_RT & ∃y([man′(t9, y) & ∃t3[t3 < t9 & t3 ⊆ t_RT & be-crying′(t3, y) & meet′(y)(j)(t9)])] (Truth Definition)

(30) LF: [S[NP, a man who2 e2 Past be crying]
S John Past meet e1]]
1. [S John Past meet e1] ⇒ λt′λt[t < t′ & t ⊆ t_RT & meet′(t, j, x1)]
2. [S[NP, a man who Past be crying][S John Past meet e1]] ⇒ ∃t2 [man′(s*, x) & ∃t3[t3 < s* & t3 ⊆ t_RT & be-crying′(t3, x)] & t2 < s* & t2 ⊆ t_RT & meet′(t2, j, x)] (Truth Definition)

(28) predicts that the man’s crying is simultaneous with the time of John’s meeting him; (29) predicts that the time of the man’s crying precedes the time of the meeting; (30) says that the crying time and the meeting time are both past times, with no order specified between them. As can be easily verified, (28) and (29) entail (30). In other words, the situations in which (30) is true completely contain the situations in which (28) or (29) is true. Thus, the readings predicted by
(28) and (29) are redundant. However, these extra options are absolutely necessary in cases like (24b).

The simultaneous reading associated with the crucial example (24b) is obtained as in (31).

(31) LF : \[ S \text{ John Past say that } [ S \text{ he } \emptyset \text{ woll } [ VP [ NP_2 \text{ a fish that } e_3 \emptyset \text{ be still alive}] [ VP \text{ buy } e_2 ]]] \]
1. \[ [a \text{ fish that } e_3 \emptyset \text{ be still alive}] \Rightarrow \lambda P \lambda t \exists x \text{fish}^\prime(t, x) \& \text{be-alive}^\prime(t, x) \& P(t, x) \] 
2. \[ [VP[NP, \text{ a fish that } e_3 \emptyset \text{ be still alive}]] \Rightarrow \lambda x \lambda \exists x \text{fish}^\prime(t, x) \& \text{be-alive}^\prime(t, x) \& \text{buy}^\prime((x)(t)) \]
3. \[ [\text{MP woll } [ VP[NP, \text{ a fish that } e_3 \emptyset \text{ be still alive}]] \Rightarrow \lambda \emptyset \lambda t_1 \emptyset \lambda t \emptyset \exists x \text{fish}^\prime(t, x) \& \text{be-alive}^\prime(t, x) \& \text{buy}^\prime((x)(t))] \]
4. \[ [S \text{ he } \emptyset \text{ woll } [ VP[NP, \text{ a fish that } e_3 \emptyset \text{ be still alive}]] \Rightarrow \lambda t_1 \lambda t_2 \exists x t_1 = t_2 \& t_1 < t \& t \subseteq t_{RM} \& \exists x \text{fish}^\prime(t, x) \& \text{be-alive}^\prime(t, x) \& \text{buy}^\prime((x)(t))] \]
5. \[ [S \text{ John Past say that } [ S \text{ he } \emptyset \text{ woll } [ VP[NP_2, \text{ a fish that } e_3 \emptyset \text{ be still alive}]] \Rightarrow \exists t \text{ t } \emptyset < t^* \& t \subseteq t_{RT} \& \text{say}^\prime(t, j, \lambda x \emptyset \exists x t_1 < t \& t \subseteq t_{RM} \& \exists x \text{fish}^\prime(t, x) \& \text{be-alive}^\prime(t, x) \& \text{buy}^\prime((t, y, x))] ] \]

(Truth Definition)

The last line says that at some past time, John self-ascribes the property \{< w', t', o', x' | there is a time t > t' such that x' buys in w' at t a fish that is alive at t in w'\}. This is precisely the interpretation of (24b) we are interested in.

The above computations show that there are three possible readings for surface structures of the form \([ S \ldots \text{ Past}_1 \ldots [\text{NP} \ldots \text{ Past}_2 \ldots ]\],\) where Past_1 locally commands Past_2. One possibility is to let the tense deletion rule delete the tense in the relative clause. In this case, we obtain a simultaneous reading. A second possibility is not to apply the SOT rule, but to interpret the tense in the relative clause in relation to the matrix tense. This option results in a shifted reading. The last possibility is to scope the NP to a position higher than the matrix tense. QR does not apply, and the past tense in the relative clause is interpreted independently. Note that there is one theoretical possibility that is not supported by the data. It is predicted by letting the SOT rule delete the past in the relative clause, and move the NP to a position
higher than the matrix tense so that the tenseless relative clause is interpreted independently of the higher tense. If this were possible, (19a) could receive an interpretation that is equivalent to what (19b) means. Since this possibility is in fact excluded, we must constrain the order in which the transformational rules apply at LF: *first, apply the QR rule, then the SOT rule*. Note also that this rule ordering is correctly predicted by the hypothesis (4).

In sum, I contend that the following three assumptions account for the behavior of tense morphemes in English and Japanese relative clauses: (i) NPs are subject to scoping and can take various scope options; (ii) English has an SOT rule that is defined purely in structural terms, while Japanese lacks this type of rule; (iii) QR applies at LF before the SOT rule does.

### 5.4. INTENSIONALITY, NP SCOPE, AND TENSE SCOPE

In the foregoing discussion, the fact that tenses in relative clauses can receive (at least) two interpretations was accounted for in terms of the scope properties of the NPs that contain them. By pursuing this hypothesis about the correlation between NP scope and the scope of relative clause tenses, we can make further predictions about tenses. So far, we have only been concerned with extensional verbs. Let us now consider NPs that occur in intensional contexts. It is often assumed in the formal semantics literature (e.g., Montague 1973, Ladusaw 1977) that an NP that occurs in an intensional context can bear two scope relations with respect to the expression that induces the intensional context. According to this theory, when an NP is interpreted within the intensional domain, this gives rise to a *de dicto* interpretation, whereas interpreting an NP as a quantifier that has scope over the intensional domain and binds variables located within the intensional domain yields a *de re* reading. An alternative proposal about *de re* interpretations introduced in Chapter 4, which is based upon Quine (1956), Lewis (1979) and Cresswell and von Stechow (1982), embraces a different idea. According to this new analysis of *de re* interpretations, (32a) translates into (32b) (ignoring tense), which reads “there is a person $x$ such that John ascribes to $x$ the property of being crazy.”
We will adopt this analysis of *de re* interpretations. Given an NP that occurs in an intensional context at S-structure, this analysis predicts the following three possible LF configurations after the application of QR and before the application of the SOT rule. Note that we cannot simply move an NP out of an intensional context unlike Montague’s (1973) or Ladusaw’s (1977) theory, and this complicates the LF structures.

What (33) shows is that the definition of the rule of QR given above in (8) is valid only for extensional constructions. We need some special conventions when an NP moves out of an intensional domain. We must also allow some NPs to be interpreted in situ. We re-define QR in the following way:

The second option given in (34) produces a structure needed for a *de re* reading of the moved NP. The index m is placed to left of β because
right-side subscripts will be used for indices indicating moved tenses. I will discuss this topic in Chapter 6. In (33a–c), \( \alpha \) represents an intensional domain created by the main clause predicate \( V_1 \). (33a) represents the case where the NP remains within the intensional domain and receives a \textit{de dicto} reading. Unlike an extensional transitive verb, an intensional transitive verb must translate as an IL expression of type \(<<s,<<e,<i,t>>,<<i,t>>,<<e,<i,t>>>>,<<e,<i,t>>>>,<<e,<i,t>>>>\) so that the object NP does not have to be moved from its surface position. (33b–c) are configurations appropriate for \textit{de re} readings. The difference between (33b) and (33c) is that the relative clause tense is commanded by the matrix tense in (33b), whereas the two tenses are structurally independent of each other in (33c). When the two tenses bear the same tense feature, (33a–b) generate two readings each because the relative clause tense is subject to the SOT rule and is optionally deleted. In (33b–c), the structure of the form \([_1\alpha \ldots e_3]\) is understood to be an abstraction over the gap \(e_3\). These LF configurations make some obvious predictions about the temporal properties of tense morphemes as well.

We have seen that these predictions are borne out in examples like (35a–b), as pointed out by Abusch (1988). As a follow-up to her proposal, I present here an explicit semantic proposal for \textit{de re} and \textit{de dicto} interpretations of such examples.

(35)  
\begin{itemize}
  \item a. John sought a person who saw \textit{Schindler’s List}.
  \item b. John suspected that a person who broke into his house was behind the door.
\end{itemize}

In (35a) the relativized NP occupies the direct object position of an intensional transitive verb \textit{seek}, whereas in (35b) the relativized NP is in the subject position of a verb complement clause. In both cases, the NP in question is in an intensional context. In example (35a), if we restrict our attention to the reading in which the search is guided by the description given in the relative clause (\textit{de dicto}), the time of seeing the film must be in the past relative to the time of John’s search. This follows because we assume that when an NP as a whole is interpreted in situ, the tense(s) it contains must be interpreted relative to the matrix predicate. On the basis of the translation rule given in (36), we can translate (35a) into IL for its \textit{de dicto} reading as in (37b).
At this point, we must define the lexical meaning of \textit{seek}' so that the temporal properties of the embedded NP are predicted correctly. Just as in the “propositional” attitude cases discussed in Chapter 4, I follow Lewis (1979) here and assume that \textit{seek}' denotes a relation between individuals and properties.

This lexical meaning of \textit{seek}' given in (38) incorporates Montague’s (1973) idea that \textit{seek} is synonymous with \textit{try to find} and Lewis’s (1979) claim that the object of any attitude (including belief and desire) is a property. I believe that \textit{seek} has two component meanings. One is that the seeker wants to find the object of the search. The other is that the seeker engages in some activity that he or she believes will lead to a successful conclusion of the search. These two ingredients are incorporated into (38). Suppose that Mary seeks a unicorn in \(w_0\) at \(t_0\). Then it follows that every \(<w, t, a> \in W \times T \times A \) such that \(a \in w\) at \(t\) has all the properties that she wishes to have in \(w_0\) at \(t_0\) (called “desiderative alternative”) has the property of finding at some future time a unicorn. Moreover, she engages in an activity that she feels is relevant in \(w_0\) at \(t_0\). If Mary has at \(<w_0, t_0>\) the property she wishes to have at \(<w_0, t_0>\), it follows that Mary will find a unicorn in \(w_0\) at some
time \( t > t_0 \). This seems to be an accurate description of the lexical meaning of seek′.

Let us see how this lexical meaning assigned to seek′ accounts for the temporal properties of the relativized NP in (37a). Its IL translation in (37b) is true in \( w_0 \) iff there is a past time \( t_0 \) such that every desiderative alternative of John in \( w_0 \) at \( t_0 \) is an element of \( \{ <w, t, x> \mid \) there is a person \( y \) such that in \( w \) at some time \( t_2 < t, y \) sees Schindler’s List and there is a time \( t_3 > t \) such that \( x \) finds \( y \) in \( w \) at \( t_3 \}, \) and John engages in some relevant activity in \( w_0 \) at \( t_0 \). If \( <w_0, t_0, \text{John}> \) is one of John’s desiderative alternatives in \( w_0 \) at \( t_0 \), John finds in \( w_0 \) at some future time with respect to \( t_0 \) someone who has seen Schindler’s List. I believe that this corresponds to the native speaker’s intuitions about the de dicto reading of the NP in (35a), which is predicted by the LF structure (37a).

Let us now try to analyze de re cases. Just as in the case of de re readings associated with “propositional” attitudes, I will avoid quantifying into an intensional context heeding Quine’s (1956) admonition. Following (34), the S-structure of (35a) given in (39a) is turned into its LF structure (39b). I posit the translation rule (39c) to obtain (39d).

\[
(39) \quad \begin{align*}
\text{a.} & \quad \text{S-str.: John Past seek} \ [\text{NP a person who}_4 e_4 \text{ Past see Schindler’s List}] \\
\text{b.} & \quad \text{LF:} \ [S \text{NP a person who}_4 e_4 \text{ Past see Schindler’s List}] \\
& \quad [S \text{ John Past seek } e_3 \ [\text{NP } e_2]]\\
\text{c.} & \quad \text{Translation Rule for English:} \\
& \quad [VP V <<s, <<e, <i, t>>, <e, <i, t>>, <e, <i, t>>, e_n mNP] \\
& \quad \text{translates into} \ V <<e, <<e, <i, t>>, <e, <i, t>>, <e, <i, t>>, e_n t>>>
\end{align*}
\]

\[
\begin{align*}
\text{d.} & \quad \exists x [\text{person}(s^*, x) \& \exists t’[t’ < s^* \& \text{see’}(t’, x, \text{Schindler’s List})] \& \exists t[t < s^* \& \text{seek’}(t, j, x, \lambda P \lambda \alpha \chi_2[P(t, x_2)])]]
\end{align*}
\]
For any world $w_0$, object $\exists$ in $D_{s, \langle s, e, i, t \rangle, \langle i, s, e, i, t \rangle}$, individuals $a_0$ and $a_1$, and interval $t_0$,

$[\text{seek}^\prime_{s, e, i, t} \langle s, e, i, t \rangle, \langle i, s, e, i, t \rangle, \langle s, e, i, t \rangle]_{w_0}(\exists)(a_1)(a_0)(t_0)$

is true if and only if in $w_0$ at $t_0$, $a_0$ bears some suitable relation $SR$ uniquely to $a_1$, and every desiderative alternative of $a_0$ in $w_0$ at $t_0$ is an element of $\{<w, t, y> | \text{the unique individual } x \text{ to which } y \text{ bears } SR \text{ in } w \text{ at } t \}$.

The lexical semantics of $\text{seek}^\prime_{s, e, i, t} \langle s, e, i, t \rangle, \langle i, s, e, i, t \rangle, \langle s, e, i, t \rangle$ given in (40) mimics the way Cresswell and von Stechow (1982) deal with de re attitudes involving believe. According to (40), the so-called de re reading associated with the $IL$ translation (39d) is explicated as follows: there is a person $x$ such that in the actual world $w_0$ at some past time $t_1$, $x$ sees Schindler’s List, and John bears some $SR$ uniquely to $x$ in $w_0$ at some past time $t_0$ and every desiderative alternative of John in $w_0$ at $t_0$ is an element of $\{<w, t, x> | x \text{ finds in } w \text{ at some time } t' > t \text{ the thing to which } x \text{ bears } SR \text{ in } w \text{ at } t \}$. Furthermore, John engages in a relevant activity in $w_0$ at $t_0$. This is the desired interpretation. Note that according to this interpretation, no order is specified between the time of the person’s seeing the film and the time of the search. Thus, it is possible for the time of the person’s seeing the film to fall between the time of the search and the speech time. This accords with the native speaker’s intuitions. The remaining interpretation for (35a), which conforms to the schema (33b), entails the reading given as (39d) and is not discussed here.

(41a) (= (35b)) involves a relative clause NP that is contained within a verb complement clause. First, the $de \ dicto$ reading associated with it is accounted for in the following way on the basis of the $IL$ translation (41c). I assume a $de \ se$ analysis of attitudes discussed in Chapter 4 due to Lewis (1979) and Cresswell and von Stechow (1982).
(41)  
  a. John suspected that a person who broke into his house was behind the door.
  b. LF: [S John Past suspect [CP that [S [NP, a person who [S e4 Past break into his house]] \(\emptyset\) be behind the door]]]
  c. \(\exists t_1 [t_1 < s^* \& \text{suspect}'(t_1, j, \lambda t_2 \lambda x \exists y \text{person}'(t_2, y) \& \exists t_3 [t_3 < t_2 \& \text{break-into-his-house}'(t_3, y) \& \text{be-behind-the-door}'(t_2, y))]]\]

Since the meaning of \textit{suspect} resembles that of \textit{believe}, I will simply disregard the semantic differences between them and use the lexical semantics of \textit{believe}' to examine the truth conditions for (41c). (41c) is true in the actual world \(w_0\) iff there is a past time \(t_0\) such that John self-ascribes the following property in \(w_0\) at \(t_0\): \(<w, t, x>\) there is a person who breaks into \(x\)'s house in \(w\) at some \(t' < t\) and who is behind the door in \(w\) at \(t\). Note that if we assume that John has in \(w_0\) at \(t_0\) the property he self-ascribes in \(w_0\) at \(t_0\), the time of the person's breaking into his house is earlier than \(t_0\). Thus, the tense in the relative clause is interpreted as embedded in the scope of the matrix past tense.

On the other hand, the translation rule posited in (42c) yields an IL translation (42d) for the so-called \textit{de re} reading of (42a) (= (35b)).

(42)  
  a. John suspected that a person who broke into his house was behind the door.
  b. LF: [S [NP, a person who [S e4 Past break into his house]] [S John Past suspect e5 [CP that e4 \(\emptyset\) be behind the door]]]
  c. Translation Rule for English:
    \[
    [\text{VP } V<\ll s, <i, <e, <j, \ldots > >, <e, <e, <i, >, \ldots > >] e_m \eta \text{CP}] \text{ translates into } V<\ll s, <i, <e, <j, \ldots > >, <e, <e, <i, >, \ldots > >>(\lambda t_3 \lambda x_4 \exists t_3 \lambda t_2 \exists y \text{person}'(t_2, y) \& \exists t_1 [t_1 < s^* \& \text{be-behind-the-door}'(t_2, x_4)])(x_m)
    \]
  d. \(\exists y \text{person}'(s^*, y) \& \exists t_3 [t_3 < s^* \& \text{break-into-his-house}'(t_3, y) \& \exists t_1 [t_1 < s^* \& \text{be-behind-the-door}'(t_2, x_4)]\]

This can be accounted for in terms of Cresswell and von Stechow's (1982) original proposal about \textit{de re} interpretations in belief contexts. I repeat here the lexical meaning of \textit{believe}' for \textit{de re} attitudes presented in Chapter 4.
(43) For any \( w_0 \in W, P_0 \in D_{s,i,e,t} \), \( a_1, a_2 \in A \), and \( t_0 \in T \),
[\text{\( \langle \text{\textsc{believe}}, \langle s,i,e,t \rangle, \langle e,e,i,t \rangle, \langle a_1, a_2 \rangle, \langle t_0 \rangle, \rangle \rangle, P_0, (a_1)(a_2)(t_0) = 1 \)}
(which informally reads ‘in \( w_0 \) at \( t_0 \), \( a_2 \) ascribes the property \( P_0 \) to \( a_1 \’)’)
iff there is a “suitable relation” \( SR \) such that (i) \( a_1 \) is the thing to which \( a_2 \) bears \( SR \) in \( w_0 \) at \( t_0 \), and (ii) for every doxastic alternative \( \langle w, t, x \rangle \) of \( a_2 \) in \( w_0 \) at \( t_0 \), the thing to which \( x \) bears \( SR \) in \( w \) at \( t \) has property \( P_0 \) in \( w \) at \( t \).

According to (43), (42c) is true in \( w_0 \) iff there is a person \( y \) and there is some past time \( t_3 \) such that \( y \) breaks into John’s house in \( w_0 \) at \( t_3 \) and in \( w_0 \) there is a past time \( t_1 \) at which John bears some suitable relation \( SR \) to \( y \) and, moreover, self-ascribes the property \( \{ \langle w, t, x \rangle \mid \text{the thing to which } x \text{ bears } SR \text{ in } w \text{ at } t \text{ is behind the door in } w \text{ at } t \} \). This is the right interpretation. Note here that the two tenses are interpreted independently of each other and in relation to the utterance time.

So far we have looked at examples that have an NP containing a relative clause in the simple past. As we have seen, the behavior of tense simply follows the behavior of the containing NP in the above examples. When we turn to the case of the simple present, we find that the situation is more complicated. Let us consider some of the examples that Abusch (1988) considers.17

(44) John looked for a student who understands the incompleteness theorem.

(44) gives rise to (at least) two distinct interpretations for the NP as a whole. One reading for the NP is relatively straightforward. It is predicted on the basis of the widest scope configuration for the NP, and the mechanism for \textit{de re} readings we have discussed above takes care of it. Its LF structure and \textit{IL} translation are given in (45).18

(45) a. LF: [\text{\( S \text{[NP, a student who}_2 [S e_2 \text{Pres understand the incompleteness theorem}] [S John Past look for e}_3 [\text{[NP e}_1]] \)}]

b. \( \exists x[s\text{[student’}(s^*, x) \& \text{understand’}(s^*, x, \text{the-incompleteness-theorem}) \& \exists t[s^* \& \text{seek’}(t, j, x, ^\lambda P^t \lambda t \lambda x_2[P(t, x_2)])] \) ]

(45b) is true iff there exists some student who understands the
incompleteness theorem at the speech time, say Bill, to whom John bears some acquaintance relation SR at some past time $t_0$, and every desiderative alternative of John in the actual world $w_0$ at the time of the search $t_0$ is an element of $\{w, t, x \mid x \text{finds in } w \text{ at some time } t' > t \text{ the thing to which } x \text{ bears SR in } w \text{ at } t\}$, and John engages in some relevant activity in $w_0$ at $t_0$. Note that the temporal property of the NP in this de re reading is correctly predicted by the analysis I have proposed. The time of the person’s understanding the theorem is the utterance time. When the NP is scoped to a position lower than the matrix tense but higher than look for, then it yields a de re reading that entails the reading I have just discussed.

The other reading is one in which John’s search is guided by the description given in the relative clause: the property of understanding the incompleteness theorem; his search is successful if he ends up finding someone who actually has this property, and he will be happy with anyone who satisfies the description. We are tempted to call this reading a de dicto reading, but the peculiar temporal property of this reading that I am about to explain tells us that we should proceed carefully and not prejudge the issue. If we put ourselves in John’s position at the time of the search, his cognitive state can be described as follows: “I want to find someone who understands the incompleteness theorem.” Thus, as far as John is concerned, the search is current time oriented in that he wants the person to understand the theorem when he finds him or her. However, just like a verb complement clause in the present embedded immediately under the matrix past, the de dicto-like reading of the NP in (44) seems to “have access” to the time of the search (or finding) as well as to the time of the speech. Regardless of how we characterize it formally, the reading is clearly different from the one predicted by a similar sentence that has a relative clause in the past tense, not in the present tense.

(46) John looked for a student who understood the incompleteness theorem.\(^{19}\)

(46) can receive a purely simultaneous interpretation. How then could we characterize the double-access reading that (44) has?

Before we make an attempt at any generalization on this issue, let us look at another type of sentence that can receive a similar interpretation, namely (47).
(47) John suspected that a man who is trying to kill him was behind the door.

On the one hand, (47) can receive a unproblematic *de re* reading on the basis of the widest scope configuration for the relativized NP. The present tense in the relative clause is interpreted independently of the matrix past tense and, therefore, refers to the utterance time. On the other hand, its *de dicto*-like reading is problematic in precisely the same way that (44) is. The reading in question is *de dicto*-like in that the description in the relative clause is part of John’s suspicion. John’s original suspicion is simultaneous: “I think a man who is trying to kill me is behind the door.” However, the sentence as a whole has a peculiar temporal property, unlike the “true *de dicto* reading” associated with (48) under its simultaneous reading of the relative clause.

(48) John suspected that a man who was trying to kill him was behind the door.

(47), as opposed to (48), says that the man’s trying to kill him is somehow “relevant” at the speech time.

At this point, let us show the similarities and differences between a prototypical double-access sentence (49a) introduced in Chapter 1 and the above two sentences repeated here as (49b–c).

(49) a. John said that Mary is pregnant.
   b. John looked for a student who understands the incompleteness theorem.
   c. John suspected that the man who is trying to kill him was behind the door.

The descriptive generalization about these three constructions is that they all involve a present tense which occurs in an intensional context and is locally commanded by a past tense. (49a) can only receive a double-access reading, whereas (49b–c) can also receive an interpretation in which the time of the relative clause episode is the utterance time. Going along with the proposal that we are now pursuing, we can reason as follows: the verb complement clause in (49a) is an intensional context, and there is no known syntactic
operation that allows the tense to be interpreted independently of the matrix tense. Thus, the present tense morpheme in the verb complement clause is interpreted in such a way that the time of the verb complement is at least partially controlled by the time referred to by the matrix. By contrast, although (49b) and (49c) also involve intensional contexts, the tense morphemes under discussion, the present tense in the object NP in (49b) and the present tense contained in the subject NP of the verb complement clause in (49c), have the option of escaping the scope of the matrix tense by adjoining to the matrix sentence. This difference between (49a) on the one hand and (49b–c) on the other accounts for the fact that (49b–c) are ambiguous, whereas (49a) is not. When the relativized NP in either (49b) or (49c) is interpreted within the intensional domain, the time of the relative clause “has access” to the time of the main predicate.

The source of the peculiar interpretations associated with (49a–c) is the present tense. This is clear when we consider the following Japanese sentences, which parallel the English examples in (44) and (46):

(50)  

a. Taroo-wa Tookyoo-ni sunde i-ru hito-o  
    Taro-TOP Tokyo-DAT live-PRES person-ACC  
    sagasi-ta.  
    seek-PAST  
    ‘Taro looked for a person who lived in Tokyo (at that time).’

b. Taroo-wa zibun-o koro-soo-to-si-te i-ru  
    Taro-TOP self-ACC kill-try-to-PROG-PRES  
    otoko-ga doa-no kage-ni hison-de i-ru  
    man-NOM door-GEN behind-DAT hide- PROG-PRES  
    to omot-ta.  
    that think-PAST  
    ‘Taro thought that a man who was [simultaneous] trying to kill him was behind the door.’

Note that the English glosses for the examples in (50) describe the de dicto interpretations associated with them. They can also receive de re interpretations. As is predicted by our proposal, both wide scope and simultaneous readings are available. Thus, we are tempted to blame the peculiar interpretations of (49a–c) on the indexical nature of the
English present. However, assuming that the English present invariably denotes the speech time is not enough to account for the peculiar reading associated with the above three types of sentences. An immediate problem for this view is that a present tense morpheme in a double-access sentence does not simply denote the speech time. It manages to convey some information about both the time of the higher predicate and the speech time. For some reason, the present tense is not completely dependent upon the structurally higher tense, nor is it completely independent. We will be concerned with this sticky problem throughout the rest of the book. I will pursue the following hypotheses: (i) the English present tense must denote the speech time; (ii) the double-access readings associated with (49b–c) are predicted on the basis of LF representations where the NP in question is in its S-structure position (thus within the intensional context). Setting aside the unsettling state of affairs regarding double-access sentences that involve the simple present tense, let us turn to an apparently independent problem, which I believe can be (and should be) subsumed under the double-access phenomena.

The problem that I am about to explain involves the future tense will. I have already introduced in Chapter 3 the problematic data Ladusaw (1977) discusses. I repeat them here as (51a–b).

(51)  
   a. Bill sought a man who will be leaving.  
   b. John wished to walk in a park that won’t be closed on Christmas.

They are analogous to examples like (49b–c) except that the relevant relative clauses are in the future tense (will). But note that will is analyzed into the present tense and woll in our proposal, and this already suggests that this problem may be related to the problem associated with (49b–c). The problem is that the scope properties of NPs do not always explain the interpretation of the tenses contained within these NPs. Ladusaw’s proposal predicts that (51a) only has a de re reading because the SOT rule is obligatory in his system and the future tense will in the relative clause is licensed only if it escapes the scope of the matrix tense. The same is true of (51b). However, Ladusaw observes that (51a) and (51b) can receive a de dicto interpretation.20 He does not explain the nature of the interpretation he thinks is possible. But I believe that it can be characterized roughly in
the following manner. On the "de dicto" reading of (51a), Bill’s search is guided by the description given by the relative clause: a person who leaves in the future. Moreover, Bill has a specific idea about when the leaving obtains, and the time that he has in mind lies not only in the future relative to the search time but also in the future relative to the speech time of the sentence (51a). Ladusaw cannot account for this reading, and I referred to the problem as Ladusaw’s scope puzzle in Chapter 3.

As explained in Chapter 3, Ladusaw’s SOT rule converts a form suited for semantic interpretation to a surface form. That is, it converts a present tense into a past tense when it is in the immediate scope of another past tense, and this rule obligatorily applies when the structural condition is satisfied. Thus, if the relative clause NPs in (51a–b) were located in the object NP position when the SOT rule applies, will would be converted to would obligatorily. My proposal makes a different prediction, which is shown in (52a–b).

(52) a. S-str.: Bill Past seek [NP a man who₁ e₁ Pres woll be leaving]
   LF: Bill Past seek [NP a man who₁ e₁ Pres woll be leaving] (No change in tense forms)

   b. S-str.: [S John Past wish PRO to walk in [NP a park that Pres woll be closed on Christmas]]
   LF: [S John Past wish [S PRO to walk in [NP a park that₂[S e₂ Pres woll be closed on Christmas]]]]
   (No change in tense forms)

(52a–b) show how the de dicto-like interpretations of (51a–b) are analyzed in my proposal. (52a–b) show that there is no tense deletion because the matrix tense and the lower tense do not match in features. On the other hand, Ladusaw’s analysis predicts that the present tense associated with woll is changed into a past tense. Thus, my proposal at least allows the relativized NP to appear in the in situ position at LF and predicts that it is subject to the semantic interpretation rules. Let us see if the LF structures given in (52) predict the right interpretations under my proposal. They translate into IL as in (53).
(53) a. \[ \exists t_2 [t_2 < s^* \& \text{seek}'(t_2, b, \lambda t \exists x [\text{man}'(t, x) \& \exists t_3 [s^* < t_3 \& \text{leave}'(t_3, x)] \& P(t, x)])] \]

b. \[ \exists t [t < s^* \& \text{wish}'(t, j, \lambda t \lambda x \exists t'[t < t' \& \text{park}'(t, y) \& \text{walk-in}'(t', x, y) \& \exists t''[s^* < t'' \& \text{Christmas}'(t'') \& \neg \text{be-closed}'(t'', y)])] \]

(53a) holds iff in the actual world \( w_0 \) at some past time \( t_0 \), every desiderative alternative of Bill’s is an element of \( \{< w, t, x > | \text{there is a man } y \text{ such that } y \text{ leaves at some } t_1 > s^* \text{ in } w, \text{ and } x \text{ finds } y \text{ at some time } t_2 > t \text{ in } w \} \), and Bill engages in a relevant activity in \( w_0 \) at \( t_0 \). This informally means that in every world where Bill’s current desires are satisfied, he finds in the future in relation to the search time someone who leaves at a future time in relation to the speech time. At first glance, this rendition seems to be satisfactory. But I think this account misrepresents Bill’s original attitude and must be replaced by a better account. The reason has to do with the characterization of the time of leaving, which is represented as a future time with respect to the utterance time. Since Bill does not have direct access to the utterance time, the indexical \( s^* \) that indicates the speech time should not appear as part of the translation of the NP. I will claim that this is an instance of a double-access sentence. The same point can be made with (53b). In Chapter 6, we will discuss various issues connected with double-access sentences and account for the above problematic data.

### 5.5. TEMPORAL ADVERBIAL CLAUSES

Next, let us consider temporal adverbial clauses. I will concentrate upon those that are headed by \textit{before} or \textit{after}. I will not discuss those that involve \textit{when}, \textit{while}, and others. Temporal adverbial clauses have been discussed by various researchers in the formal semantics literature, including Heinämäki (1974), Stump (1985), and de Swart (1991). As far as I know, very few researchers attempt to analyze temporal adverbial clauses from the viewpoint of SOT phenomena. Apart from a couple of examples that Curme (1931) presents (see Chapter 3), I am only acquainted with Smith’s (1975:72) claim that an embedded time adverbial may have any tense that occurs in the main sentence, which comes close to endorsing an SOT analysis of tense
morphemes in temporal adverbiacl clauses. At first glance, tenses in English temporal adverbiacl clauses look as though they are not in the scope of matrix tenses. Consider the following:

(54) a. John entered the room when Mary left.
    b. John entered the room before Mary left.
    c. John entered the room after Mary left.

The examples (54a–c) seem to show that the denotation the tense in a temporal adverbiacl clause is always determined in relation to the speech time. Pay attention in particular to (54b). If the before-clause is like a verb complement clause in that it is subject to the SOT rule and is interpreted in relation to the matrix predicate, we expect that a future auxiliary would occurs in it. But this is not the case.

The primary motivation for adopting the view that temporal adverbiacl clauses are also under the scope of matrix clause tenses comes from Japanese (see Ota 1973, Nakau 1976, and Ogihara 1994).

(55) a. Taro-wa [ Hanako-ni au mae-ni]
    Taro-TOP Hanako-DAT meet-PRES before
denwa-o si-ta.
    phone-ACC do-PAST
    ‘Taro called Hanako before he saw her.’

b. Taro-wa [ Hanako-ni at-ta ato-de]
    Taro-TOP Hanako-DAT meet-PAST after
denwa-o si-ta.
    phone-ACC do-PAST
    ‘Taro called Hanako after he saw her.’

c. Taro-wa [ Hanako-ni au mae-ni]
    Taro-TOP Hanako-DAT meet-PRES before
denwa-o su-ru.
    phone-ACC do-PRES
    ‘Taro will call Hanako before he sees her.’

d. Taro-wa [ Hanako-ni at-ta ato-de]
    Taro-TOP Hanako-DAT meet-PAST after
denwa-o su-ru.
    phone-ACC do-PRES
    ‘Taro will call Hanako after he sees her.’
Syntactically, *mae* ‘before’ and *ato* ‘after’ are common nouns and *ni* and *de* ‘at’ are postpositions. Thus, in a proper syntactic analysis, an entire temporal adverbial clause should be regarded as a PP (postpositional phrase). However, I adopt a simplified syntactic analysis of temporal adverbial clauses in this book and regard *mae-ni* ‘before’ and *ato-de* ‘after’ as lexical items of the category “temporal conjunction.” It is clear from the examples in (55a–d) that tenses in Japanese temporal adverbial clauses are interpreted as embedded in the scope of matrix clause tenses. The expression *mae-ni* ‘before’ indicates that the main clause event occurs before the adverbial clause event, if any, whereas *ato-de* ‘after’ indicates that the main clause event is located after the adverbial event. This difference is mirrored by the choice of tense morphemes in the adverbial clauses. *mae-ni* only occurs with a present tense morpheme, whereas *ato-de* only occurs with a past tense morpheme. In other words, the following sentences are uninterpretable:

(56)  
  a. *Taroo-wa [ Hanako-ni at-ta mae-ni]  
     Taro-TOP Hanako-DAT meet-PAST before  
     denwa-o si-ta.  
     phone-ACC do-PAST  
     [Intended] ‘Taro called Hanako before he saw her.’  
  b. *Taroo-wa [ Hanako-ni au ato-de]  
     Taro-TOP Hanako-DAT meet-PRES after  
     denwa-o suru.  
     phone-ACC do-PRES  
     [Intended] ‘Taro will call Hanako after he sees her.’

(56a–b) are telling because a simple theory which states that tenses in temporal adverbial clauses are interpreted as unembedded clearly has a problem here. For example (56a) is bad even if Taro actually met Hanako at a past time and his calling her is before this event. This is entirely unexpected if we assume that the past tense morpheme simply places the temporal adverbial event in the past. Similarly, (56b) is ill-formed even if Taro sees Hanako at a future time and his calling her is after this event. Again this result is unexpected if tenses are interpreted as unembedded.

The simplest way of accounting for the above data is to assume that tenses in temporal adverbial clauses are semantically dependent upon
matrix clause tenses, just like tenses in verb complements. I propose the following translations for before and after, which provide a compositional semantics for Japanese sentences that involve temporal adverbial clauses:

(57) a. *ato-de* ‘after’ translates into
\[ \lambda R_t \lambda t'_4 \lambda t_3 \exists t_2[R(t_3)(t_2) & R'(t_4)(t_3) & t_2 < t_3] \]
b. *mae-ni* ‘before’ translates into
\[ \lambda R_t \lambda t'_4 \lambda t_3 \exists t_2[R(t_3)(t_2) & R'(t_4)(t_3) & t_3 < t_2] \]
[N.B.: \( R_t \) and \( R'_t \) (mnemonic for ‘temporal relations’) are variables of type \( <i,i,t> \)].

According to the translations of *ato-de* and *mae-ni* given in (57), (55a–b) are accounted for as in (58) and (59), respectively. I assume that the present tense that occurs in a *mae-ni*-clause (‘before-clause’) receives a future-oriented interpretation.

(58) 1. Hanako-ni au mae-ni ‘[Lit.] before [Taro] sees Hanako’
\[ \Rightarrow \lambda t_3 \exists t_2 [t_3 < t_2 & t_2 \subseteq t_{RT} & Taro sees Hanako at t_2 & t_3 < t_4 & t_3 \subseteq t_{RT}' & Taro calls Hanako at t_3] \]
\[ \Rightarrow \lambda t_4 \lambda t_3 \exists t_2 [t_2 < t_3 & t_2 \subseteq t_{RT} & Taro sees Hanako at t_2 & t_3 < t_4 & t_3 \subseteq t_{RT}' & Taro calls Hanako at t_3] \]
3. \[ \exists t_3 \exists t_2 [t_3 < t_2 & t_2 \subseteq t_{RT} & Taro sees Hanako at t_2 & t_3 < t_4 & t_3 \subseteq t_{RT}' & Taro calls Hanako at t_3] \]
(Truth Definition)

(59) 1. Hanako-ni at-ta ato-de ‘after [Taro] saw Hanako’
\[ \Rightarrow \lambda R_t \lambda t'_4 \lambda t_3 \exists t_2 [t_2 < t_3 & t_2 \subseteq t_{RT} & Taro sees Hanako at t_2 & t_2 < t_3 & t_2 \subseteq t_{RT}' & Taro calls Hanako at t_3] \]
2. Taroo-wa [Hanako-ni at-ta ato-de] denwa-o si-ta ‘Taro called [Hanako] after [he] saw her’
\[ \Rightarrow \lambda t_4 \lambda t_3 \exists t_2 [t_2 < t_3 & t_2 \subseteq t_{RT} & Taro sees Hanako at t_2 & t_2 < t_3 & t_2 \subseteq t_{RT}' & Taro calls Hanako at t_3] \]
3. \[ \exists t_3 \exists t_2 [t_2 < t_3 & t_2 \subseteq t_{RT} & Taro sees Hanako at t_2 & t_3 < t_4 & t_3 \subseteq t_{RT}' & Taro calls Hanako at t_3] \]
(Truth Definition)

What is interesting about this proposal is that it predicts on semantic
grounds the ill-formedness of (56a–b). For illustrative purposes, let us analyze (56a).

(60) 1. Hanako-ni at-ta mae-ni ‘before [Taro] saw Hanako’ ⇒
\[
\lambda R_{1} \lambda t_{4} \lambda t_{3} \exists t_{2} [t_{2} < t_{3} \& t_{2} \subseteq t_{RT} \& \text{Taro sees Hanako at } t_{2} \& R_{1}(t_{4})(t_{3}) \& t_{3} < t_{2}]
\]
2. Taro-o wa [Hanako-ni at-ta mae-ni] denwa-o si-ta
[Intended] ‘Taro called [Hanako] before [he] saw her’
⇒ \exists t_{3} \exists t_{2} [t_{2} < t_{3} \& t_{2} \subseteq t_{RT} \& \text{Taro sees Hanako at } t_{2} \& t_{3} < s^{*} \& t_{3} \subseteq t_{RT} \& \text{Taro calls Hanako at } t_{3} \& t_{3} < t_{2}]

Note that the final translation includes two clauses that are incompatible: “\( t_{2} < t_{3} \)” and “\( t_{3} < t_{2} \).” This captures the native speaker’s intuition that past tense and mae-ni ‘before’ contribute two mutually contradictory pieces of information. In sum, as far as Japanese is concerned, the relative tense theory accounts for the data that concern temporal adverbial clauses headed by mae-ni (‘before’) or ato-de (‘after’).

Let us return to English. The English data presented at the beginning of this section seem to show that an absolute tense theory is sufficient for temporal adverbial clauses. However, as we have just concluded, this theory does not account for the Japanese data. Rather than concluding that Japanese and English are different in this respect, I will try to pursue the idea that English temporal adverbial clauses are also subject to the SOT rule and are interpreted as embedded in the scope of the matrix tense, and see what consequences will follow from this line of thought. In the data given above, I intentionally selected English data that are least problematic for the absolute theory of tense. But once we look more closely, we find data that are in favor of the relative theory of tense. Consider examples like the following, most of which are discussed by Stump (1985:121–162):

(61) a. John will enter the room before Mary leaves.
b. John will enter the room after Mary has left.
c. John will enter the room after Mary leaves.
d. *John will enter the room after Mary will leave.
e. *John will enter the room before Mary will leave.
(61a–c) show that temporal adverbial clauses that describe events that obtain in the future are either in the simple present or in the present perfect. If we employ the future auxiliary *will* as in (61d–e), the resulting sentences are ill-formed and uninterpretable. This is puzzling if we assume that English tense morphemes are invariably speech-time-oriented. On the other hand, if we continue to assume that *will* is morphologically in the present tense and the SOT rule applies to present tense morphemes as well, the judgments about (61a–d) are accounted for on the basis of the LF structures given as (62a–d), respectively.

\[(62)\]
\begin{align*}
  a. & \quad \text{John Pres woll enter the room before Mary Ø leave.} \\
  b. & \quad \text{John Pres woll enter the room after Mary Ø have left.} \\
  c. & \quad \text{John Pres woll enter the room after Mary Ø leave.} \\
  d. & \quad \text{*John Pres woll enter the room after Mary Ø woll leave.}
\end{align*}

We might entertain the following hypotheses: First, the SOT rule *must* apply to temporal adverbial clauses when the conditions are satisfied. Second, temporal adverbial clauses with a null tense node are semantically flexible (unlike Japanese temporal adverbial clauses in the present tense) and are compatible with both *before* and *after*. Third, temporal adverbial clauses can optionally have the perfect (*have*) or the future auxiliary (*will*), which *must* be interpreted in relation to the matrix tense. That is, a temporal adverbial clause in the perfect can only describe a past event relative to the matrix event, whereas one in the future tense can only describe a future event relative to the matrix event. This also means that *have* is compatible only with *after*, whereas *woll* goes only with *before*. These reasonable hypotheses account for the data in (62). (62a–c) are compatible with the hypotheses, whereas (62d) is not. However, there are problematic data for these hypotheses. First, consider (63), which is a putative LF structure for (61e).

\[(63)\]  
\text{*John Pres woll enter the room before Mary Ø woll leave.}

(63) is predicted to provide a coherent interpretation because *woll* places Mary’s leaving in the future relative to John’ entering the room. However, (61e) is ungrammatical. The following example due to Stump (1985) is also problematic:
(64) *John will enter the room after Mary left.

If past tense can be embedded in the scope of the matrix future tense, then (64) ought to be a well-formed sentence with a possible interpretation. However, (64) is ill-formed. There are other complicated issues having to do with English temporal adverbials that my proposal cannot account for. I refer the reader to Stump (1985:121–162). Since my proposal cannot account for the behavior of English temporal adverbial clauses completely, they are not included in the fragment to be presented in the appendix. However, a theory of tense that assumes that tense is inherently speech-time-oriented also has problems with the English data considered in this section.

There is a different type of problem that the proposal given in this section does not address. Consider the following example due to Heinämäki (1974):

(65) Max died before he saw his grandchildren.

On its natural interpretation, (65) means that Max died without seeing his grandchildren. In other words, there is no time at which he saw his grandchildren. (65) could describe a situation in which Max’s only child was pregnant with her first child when he died. Thus, there is no past time (and of course no future time) at which Max sees his grandchildren. This use of before is referred to as non-factual or counterfactual before. Anscombe (1964) proposes the following analysis of non-factual before, which is adopted by Heinämäki (1972, 1974) and Landman (1991:140–145):

(66) \[ \exists t_3 [t_3 < s^* \& t_3 \subseteq t_{RT} \& \text{Max dies at } t_3 \& \forall t_2 [(t_2 < s^* \& \text{Max sees his grandchildren at } t_2) \rightarrow t_3 < t_2]] \]

We find exactly the same phenomena in Japanese. Consider (67).

(67) Hanako-wa oboreru mae-ni tasukeda-sare-ta.

Hanako- TOP drown-PRES before rescue-PASS-PAST
‘Hanako was rescued before she drowned.’

I do not adopt this analysis of before in the official Japanese fragment to be presented at the end of the book because adopting this proposal
would complicate my overall proposal about tenses. I believe that a completely successful analysis of before must involve an intensional analysis of before-clauses. See Ogihara (in press) for one concrete proposal.

NOTES

1 Klima’s analysis is that the complementizer that which occurs in the S’ (= CP) is deleted obligatorily in modern English, optionally in middle English.
2 I will continue to talk as if the SOT rule refers to structural relations between tense morphemes when no confusion results from this practice. Strictly speaking, the applicability of the SOT rule is now defined in terms of tense features as in (1).
3 A past tense in the relative clause can also refer to a time before the time of the matrix predicate, as shown in (i).

(i) Taroo-wa eki-de ototoi nai-te i-ta
    Taro-top station-at the-day-before-yesterday cry-prog past
    otoko-o kinoo mise-de mi-ta.
    man-acc yesterday store-at see-past
    ‘Yesterday Taro saw at the store the man who was crying at the station the day before yesterday.’

4 At this point, we do not worry about intensional transitive verbs such as seek. They will be discussed in detail in Section 5.4. of Chapter 5.
5 As mentioned in Chapter 4, sentential subjects in Japanese do not undergo QR (i.e., cannot escape the scope of the immediately higher tense) despite some evidence that they are categorially NPs. For the purpose of this book, I simply regard them as an exception.
6 Many Japanese relative clauses do not seem to have a gap, as in the following example (See Kuno 1973, among others):

(i) [NP [CP zoo-ga omosiroi] saakasu]
    elephant-nom interesting-pres circus
    [rough gloss] ‘a/the circus such that its elephants are interesting’

This is a potential problem for our analysis. However, since this problem is independent of our main concern, I will only deal with Japanese relatives that clearly have gaps.
7 Fukui (1986) argues that Japanese lacks such “functional categories” as Det and Comp.
8 The rule (i) introduced in Chapter 4 is also employed here.
(introduction of an empty definite or indefinite article)

9 When it receives a simultaneous reading, that is. Since it is ambiguous between the “present tense meaning” and the “futurate meaning,” when it receives a futurate reading, it has an interpretation analogous to *would* in English. For example, in (i) the time of Taro’s going to Tokyo is in the future relative to the time of his saying.

(i) Tarо-wa Tookyoo-e iku to it-tа.
   Taro-top Tokyo-to go-pres that say-past
   ‘Taro said that he would go to Tokyo.’

10 This does not follow from the hypothesis (4) because it is given in terms of a conditional, not in terms of a biconditional. That is why I use the expression *suggest*.

11 The same reading results if we adjoin the NP to the VP and do not apply the SOT rule.

12 Under our current account, (23) is expected to mean what (i) means. However, this prediction is not borne out.

   (i) John said that Mary would be pregnant now.

13 I shall leave out the features on tense morphemes when no confusion arises from this.

14 The adverb *still* is ignored in the translation.

15 QR is now an optional rule, but my system is constructed in such a way that some NPs cannot be interpreted unless they move to adjoined positions. For example, the object NP of an extensional transitive verb like *hit* must move because the NP is of type <<e, i, t>>, whereas *hit* is of type <<e, e, i, t>>, and they are not directly combinable.

16 Parenthetically, we will not consider the possibility that the relative clause tenses in (35a–b) are deleted by the SOT rule because the relative clauses are telic (i.e., event) sentences there. In languages like English which have an overt progressive form, a simultaneous reading (in the narrow sense of the term) is possible only if the sentence is question is a stative sentence or an event sentence in the progressive form (which is considered to be stative by many linguists (e.g., Vlach 1981)). If the SOT rule applied to the relative clause tense in (35a–b), the relative clause would receive a habitual or generic interpretation, if any.

17 (44) is due to Abusch (1988). (47) is adapted from the following example that Abusch (1988:6) presents:

   (i) John suspected that a man who killed him was behind the door.

18 I assume that *look for* is synonymous with *seek*.

19 Those who find this example unnatural can substitute the following pair:

   (i) John looked for a person who is on a diet.
   (ii) John looked for a person who was on a diet.
20 Dowty (1982:42) agrees with Ladusaw’s judgments on these examples.
21 A before B does not entail B, whereas B after A entails A. See below for the relevant discussion.
6.1. PRELIMINARIES

I will discuss so-called double-access interpretations associated with various constructions in this chapter. They are analyzed as involving de re attitudes about temporal entities (either states or intervals). I will develop my argument in several stages. First, I will discuss a family of examples that involve a present tense morpheme locally commanded by a past tense morpheme. They are divided into two subclasses that conform to the following two schematic S-structure representations:

\[
\begin{align*}
(1) \quad & \text{a. } \left[ \ldots \text{Past} \ldots \left[ \ldots \text{Pres } V \ldots \right] \right], \text{ where } V \text{ is a non-auxiliary ("regular") verb} \\
& \text{b. } \left[ \ldots \text{Past} \ldots \left[ \ldots \text{Pres woll } \ldots \right] \right], \text{ where Pres woll surfaces as will}
\end{align*}
\]

These two sub-cases are different and difficult enough to deserve separate discussions. After developing a proposal for these two constructions, I will extend the same type of analysis to other constructions. They include those that conform to the S-structure configurations given in (2).

\[
\begin{align*}
(2) \quad & \text{a. } \left[ \ldots \text{Pres woll } \ldots \left[ \ldots \text{Pres } \ldots \right] \right] \\
& \text{b. } \left[ \ldots \text{Pres woll } \ldots \left[ \ldots \text{Past } \ldots \right] \right] \\
& \text{c. } \left[ \ldots \text{Pres woll } \ldots \left[ \ldots \text{Pres woll } \ldots \right] \right] \\
& \text{d. } \left[ \ldots \text{Past } \ldots \left[ \ldots \text{Past } \ldots \right] \right]
\end{align*}
\]
I will discuss them to show that sentences that conform to these tense configurations optionally receive de re readings about embedded tenses.

First, let us start with a tentative definition of double-access sentences which require that a double-access sentence have a present tense in an embedded clause.

(3)  [First Version] A double-access sentence is defined as an English sentence that has a present tense morpheme in an intensional domain at S-structure commanded by a past tense morpheme associated with the expression that induces the intensional domain.¹

According to this definition, the following examples considered so far count as double-access sentences:

(4)  a. John said that Mary is pregnant.
    b. John looked for a student who lives in Tokyo.
    c. John suspected that a man who is annoying him was behind the door.

(4a) is required to receive a double-access reading: Mary’s pregnancy is “relevant” both at the time of John’s saying and at the time of the report. (4b–c) must receive a double-access reading if we restrict our attention to their de dicto-like interpretations. As explained in Chapter 5, no immediate solution was available given the mechanism proposed so far. I will continue to assume that the English present is an indexical unlike the Japanese present and that this is the source of the peculiar interpretation. Compare the examples in (4) with those in (5). The Japanese examples in (5) have the same structures and tense forms as the English examples in (4), but they have purely simultaneous readings.²
(5) a. Taroo-wa Hanako-ga ninsinsi-te i-ru to
Taro-TOP Hanako-NOM be-pregnant-PRES that
say-PAST
‘Taro said that Hanako was [simultaneous] pregnant.’

b. Taroo-wa Tookyoo-ni sunde i-ru hito-o
Taro-TOP Tokyo-in live-PRES person-ACC
seek-PAST
‘Taro looked for a person who lived in Tokyo (at that
time).’

c. Taroo-wa zibun-o koro-soo-to si-te i-ru
Taro-TOP self-ACC kill-try-to do-PROG-PRES
otoko-ga doa-no kage-ni
man-NOM door-GEN behind-DAT
hison-de i-ru to omot-ta.
hide-PROG-PRES that think-PAST
‘Taro thought that a man who was [simultaneous]
trying to kill him was behind the door.’

(5a), for example, translates as follows:

(6) $\exists t [t < s^* \& \text{say}(t, \text{Taro}, ^\land t^\lambda x [\text{be-pregnant}'(t, \text{Hanako})])]$

If my proposal is correct and moreover the English present has the
same meaning as the Japanese present, (4a–c) should receive readings
that parallel (5a–c) because the SOT rule does not apply to (4a–c).
However, this prediction is not borne out. Thus, I attribute this fact to
the indexical nature of the English present, which distinguishes it from
the Japanese present.

However, this special assumption about the English present does not
predict a double-access reading, either. It yields the following
translation of (4a) instead:

(7) $\exists t [t < s^* \& \text{say}(t, j, ^\land t^\lambda x [\text{be-pregnant}'(s^*, m)])]$

We can assume that this reading roughly corresponds to what (8)
means.
(8) John said that Mary would be pregnant now.

The interpretation of (8) is very different from what (4a) means. Examples (4b–c) have the same problem. Restricting our attention to their *de dicto*-like interpretations, we cannot account for their double-access nature by the stipulation about the English simple present. In the discussion that follows, I will show what additional assumptions are needed to obtain double-access readings for (4a–c).

### 6.2. SIMPLE-PRESENT-UNDER-PAST CASES INVOLVING VERB COMPLEMENT CLAUSES

As a representative example of double-access sentences, I first take up the construction in which a present tense is found in a verb complement clause in the scope of the matrix past. (4a), repeated here as (9c), is one such example.

(9) a. Mary is pregnant.
   b. John said that Mary was pregnant.
   c. John said that Mary is pregnant.

Suppose that John utters (9a) at some time \( t \). (9b) and (9c) are both acceptable ways of reporting at a time later than \( t \) what John says at \( t \). However, (9b) and (9c) are not interchangeable. (9b) has a simultaneous interpretation in that the time at which Mary is allegedly pregnant is simultaneous with the time of John’s saying, whereas (9c) receives a double-access interpretation. There are situations in which (9b) is true but (9c) is not. Double-access sentences of the type exemplified by (9c) have been discussed by various researchers in the literature, but usually only in passing. Traditional grammarians often claim that this construction is used when the complement clause describes a fact. Curme’s (1931:355) comment is typical: “[past-controlling-present sentences are used] to represent something as customary, habitual, characteristic, or as universally true.” This is usually the way this type of “violation of the SOT rule” is described in school grammar textbooks. Modern linguists assume that more subtle conditions dictate the behavior of this construction, but they do not
offer precise licensing conditions for it. According to Comrie (1985:115), the sentence *John said that he is ill* is used “when the speaker is reporting a (real or imaginary) illness which he believes still has relevance.” Smith (1978:66) says, “The speaker is responsible, as it were, for the complement’s being true or relevant at ST [speech time]. More precisely, they [double-access sentences] indicate that the same event or state referred to holds at the time referred to in the matrix and at ST.” Comrie and Smith recognize one important characteristic of double-access sentences: the situation described by the embedded clause seems to have “access” to both the past time referred to by the matrix predicate (e.g., the time of John’s saying in (9c)) and the utterance time of the report. However, to say that the embedded clause has access to the two times does not make precise the semantic contribution made by double-access sentences. Some questions immediately arise. Does (9c) mean that the state described by the embedded clause actually obtains throughout an interval that encompasses the time of John’s saying and the utterance time of (9c)? If not, what does it mean to say that the episode described by the embedded clause is “relevant” at the speech time of the report? I will try to answer these questions in the following discussion.

6.2.1. Four Preliminary Hypotheses

My strategy in this section is to consider a series of hypotheses about the truth conditions of double-access sentences, thereby arriving at the right descriptive generalizations step by step. In order to simplify the following discussion, I will restrict my attention to cases where the matrix verb is *say*. There are more complex cases such as those involving *deny* or *doubt*, but these I will not consider in this book. I believe that my proposal applies with some modification to such complex examples as well. Let us examine the following hypothesis first.\(^3\)
Hypothesis 1: A double-access sentence is true if and only if
(i) the subject of the attitude asserts at the time of his saying
that the proposition denoted by the embedded clause is true
at that time, and (ii) the proposition denoted by the
embedded clause is in fact true in the real world at an
interval that includes the time of the matrix verb and the
speech time of the report.

As mentioned above, this is the view often voiced by traditional
grammarians (e.g., Curme, 1931:355) and also by a modern linguist
(Costa 1972). Let us consider the above example (9c). The
interpretation that I have in mind is the one predicted by the formula
(11).

(11) \[\exists t < s^* \& \text{say}'(t, j, ^\lambda t_2 ^\lambda x [\text{be-pregnant}'(t_2, m)]) \& \exists t_1 [t \subseteq t_1 \& s^* \subseteq t_1 \& \text{be-pregnant}'(t_1, m)]\]

(11) predicts that the subject’s attitude reported by (9c) produces a
simultaneous interpretation on a par with (9b). However, (9c) carries
the additional assertion that the embedded proposition is in fact true in
the actual world at an extended interval that includes the time of the
subject’s attitude and the speech time of the report. This view seems
empirically correct if we restrict our attention to examples that contain
a factive verb in the main clause as in (12).

(12) Kepler discovered that the earth revolves around the sun.

Hypothesis 1 predicts that (12) is true because (i) it is true that Kepler
discovered that the earth revolved around the sun (at the time of his
discovery), and (ii) the earth still goes around the sun now. I will
henceforth refer to examples like (12) as factive double-access
sentences. On the other hand, Costa (1972:48) claims that if the
proposition denoted by the embedded clause is shown to be false at the
speech time, a double-access sentence is false.

(13) Look, the dip-stick shows oil right up the full mark. But Joe
said his car *is/was out of oil.
I will demonstrate, however, that this position is empirically flawed. Consider the following example:

(14) John and Bill are looking into a room. Sue is in the room.
    (a) John (nearsighted): Look! Mary is in the room.
    (b) Bill: What are you talking about? That’s Sue, not Mary.
    (c) John: I’m sure that’s Mary.
    One minute later, Kent joins them. Sue is still in the room.
    (d) Bill (to Kent): John said that Mary is in the room. But
        that’s not true. The one that is in the room is Sue.

As this conversational exchange shows, the person in the room is not Mary, and sentence (14a), *Mary is in the room*, is false in the real world both at the time of John’s saying and at the speech time. Nevertheless, (14d) is true in this situation. We must conclude then that the first hypothesis is untenable.

Let us move on to Hypothesis 2. It differs from Hypothesis 1 in that the claim made by the subject concerns an interval extended into the future from the time of John’s saying, not just the time of his claim. Thus, the claim is not a purely simultaneous claim.

(15) Hypothesis 2: A double-access sentence is true if and only if
    the subject of the matrix sentence asserts at the time of his
    original statement that the proposition denoted by the
    embedded clause is true at an interval that encompasses the
    time of the original speech and the time of the report.

Hypothesis 2 predicts that (9c) is true if and only if John claims at the time of his saying that Mary’s pregnancy obtains at an interval extending from the time of his claim until the speech time of the report. The above informal description of Hypothesis 2 is subject to several formal interpretations. One possible symbolization of Hypothesis 2 is (16).

(16) \[ \exists t < s^* \& \exists t_1 [s^* \subseteq t_1 \& t \subseteq t_1 \& \text{say}'(t, j, \lambda ] \]

Let us refer to the actual world and the time of John’s saying as \( w_0 \) and \( t_0 \), respectively. The speech time of the report is referred to as \( t_1 \). (16)
is true iff there is an interval \( t_3 \) in \( w_0 \) which contains both \( t_0 \) and \( t_1 \), and John self-assigns at \( t_1 \) the property \( \langle w, t, x \rangle \ | \text{Mary is pregnant at } t_3 \).

 According to Hypothesis 2, the embedded clause of (14d) describes what John claims to obtain throughout an extended interval, not what actually obtains either at the time of John’s original utterance or at the speech time of the report. Thus, we predict that what happens in the actual world after John utters (14a) does not affect in any way the truth conditions of (14d). However, this prediction fails. Consider the following example, which is based upon (14) but contains one important modification:

(17) John and Bill are looking into a room. Sue is in the room.
   (a) John (nearsighted): Look! Mary is in the room.
   (b) Bill: What are you talking about? That’s Sue, not Mary.
   (c) John: I’m sure that’s Mary.
   Sue leaves the room. One minute later, Kent joins them.
   (d) Bill (to Kent): # John said that Mary is in the room.

Note that in this example, Sue leaves the room before Bill utters the final statement. This is the only difference between (14) and (17). Therefore, it is clear that Sue’s leaving the room after John’s statement was made causes (17d) to be judged false. Since there is no difference between (14) and (17) up to the time when John makes his statement, it is improbable that John’s claim concerns an extended interval in (14) but not in (17). A more reasonable conclusion would be that the acceptability of Bill’s final utterances in (14) and (17) depends (at least partially) upon how the events in the real world develop after John makes his claim. To be more specific, the situation that gives rise to the subject’s (possibly erroneous) belief must persist at least until the time of the report. Thus, the truth value of (14d) or (17d) is not entirely determined by the content of John’s claim. Hypothesis 2 therefore is empirically inadequate, at least in the version I have just considered.

Let us test a third hypothesis.
(18) Hypothesis 3: A double-access sentence is true if and only if (i) the subject of the attitude asserts that the proposition denoted by the embedded clause is true at the time of his saying, and (ii) it is the case that if that individual were to express his attitude at any time between the time of his saying and the time of the report, he would be prepared to use the same words that he used at the time of his speech.

If we take (14) as an example, the idea is that John must maintain the same belief or claim about the identity of the person in the room throughout an interval that covers the time of his utterance and the time of the report. In other words, John believes throughout an extended interval that Mary is in the room. Roughly speaking, this means that the following formula must be true:

\[
\exists t < s^* \& \text{say}'(t, j, ^\lambda t_1 ^\lambda x [\text{be-in-the-room}'(t_1, m)]) \& \\
\exists t_2 [s^* \subseteq t_2 \& t \subseteq t_2 \& \forall t_3 [t_3 \subseteq t_2 \rightarrow \text{believe}'(t_3, j, ^\lambda t_4 ^\lambda x [\text{be-in-the-room}'(t_4, m)])]]
\]

Here is my reasoning. If Sue stays in the room, John presumably maintains his belief because from his point of view, the situation is unchanged. If she leaves the room, however, it is reasonable to conclude that John modifies his belief at that point. That is, even though John is nearsighted, he should be able to see Sue leave the room. Then he no longer has reason to believe that Mary is in the room. Therefore (17d) is judged to be false. In this way, we might hope to establish a connection between what happens in the real world and the subject’s attitude (i.e., what John believes/claims). Unfortunately, this hypothesis is also empirically inadequate. Most of the native speakers that I consulted accepted the following dialogue:

(20) John and Bill are looking into a room. Sue is in the room.
   (a) John (nearsighted): Look! Mary is in the room.
   (b) Bill: What are you talking about? That’s Sue, not Mary. Mary is not that tall.
   (c) John: Yeah. You’re right. That’s Sue.
   One minute later, Kent joins them. Sue is still in the room.
   (d) Bill (to Kent): John said that Mary is in the room.
(20d) is acceptable even though John modifies his belief about the identity of the person in the room before it is uttered, thereby invalidating Hypothesis 3.

At this point, I would like to reconsider Hypothesis 1, which was rejected above: double-access sentences require that something actually obtain at an extended interval that includes the attitude time and the report time. Recall that when we restrict our attention to factive double-access sentences, Hypothesis 1 is empirically adequate. Let us briefly shift our attention to constructions that involve causative adverbial clauses. Consider the following examples, which are due to Hans Kamp (personal communication):

(21)  a. John is relating what happened today.
      John: I went out in my winter coat because it is very cold today.

       b. John is writing a letter. Mary enters the room. She wants to talk to him. But since he is writing a letter, she goes out of the room. Five minutes later, Bill describes what happened to Jim. John is still writing the letter.
      Bill: Mary left because John is writing a letter.

Note that (21a–b) satisfy the definition of double-access sentences given at the beginning of this chapter, less the requirement about the intensional context: the matrix predicate is in the past tense, and the subordinate clause (a because-clause in this case) is in the present tense. I will henceforth refer to this type of sentence as causative double-access sentences. Note further that their semantic behavior resembles that of factive double-access sentences. (21a) is true iff the following conditions are satisfied: (i) John goes out in his winter coat at a past time because it was cold then; (ii) its being cold encompasses both the time of John’s going out in his winter coat and the speech time of John’s statement. The two conditions cannot be reduced to one. For example, in (21a) John’s going out in his winter coat is not caused by its being cold at an extended interval that encompasses the time of his going out and the speech time. Similarly, (21b) is true iff Mary left because John was writing a letter then, and John’s writing a letter obtains at an extended interval that includes the two relevant times.
Furthermore, in order to make Bill’s statement in (21b) true, the letter that John is now writing must be the same letter that he was writing when Mary came in and left. Intuitively, one and the same state must obtain throughout an extended interval in order to make causative double-access statements true. Note that factive double-access sentences also have to satisfy the same condition. Consider the following example:

(22) John found out that Mary is pregnant.

If Mary is pregnant at the time of John’s finding out, gives birth to a child, and gets pregnant again shortly before the speech time of (22), it is false. This suggests that the truth of (22) requires that one and the same pregnancy obtain throughout an extended interval that accesses both the time of John’s finding out and the speech time of (22). The similarity of the two constructions is quite striking. To understand why they behave alike, let us compare the following two examples, which have a past tense morpheme in the subordinate clause.

(23)  
   a. John found out that Mary was pregnant.  
   b. I went out in my winter coat because it was very cold.

(23a–b) are not double-access sentences and receive purely simultaneous interpretations. (23a) is just like (22) except that the complement clause is in the past tense, not in the present tense; (23b) differs from (21a) in exactly the same way. (23a) and (23b) clearly have similar properties. They both guarantee the truth of the subordinate clause at the time indicated by the matrix verb. That is, the following entailment relations hold:6

(24)  
   a. John found out that Mary was pregnant. \( \models \) Mary was pregnant (at the time of John’s finding out).  
   b. I went out in my winter coat because it was cold.  
      \( \models \) It was cold (when I went out).  
      [where ‘A \( \models \) B’ reads ‘A semantically entails B’]

(24a–b) show that complement clauses of factive verbs and causative adverbial clauses are similar in that they are required to be true in order for the entire sentence to be true. For lack of a better name, I will
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refer to such clauses as CRTs (Clauses that are Required to be True). When a CRT occurs in the present tense and the matrix clause is in the past tense (i.e., in a double-access configuration), the characteristics of CRTs are preserved and extended in such a way that one continuous state denoted by the subordinate clause is required to overlap both the time of the matrix verb and the speech time of the entire sentence. The configurations of three types of double-access sentences and the terms used to refer to them are summarized in (25a–c).

(25) a. \([S \ldots \text{Past } V_1 \ldots [\text{that } [S \ldots \text{Pres } V_2 \ldots ]]\]
    (where \(V_1\) is a non-factive verb)
    "regular" double-access sentences
b. \([S \ldots \text{Past } V_1 \ldots [\text{that } [S \ldots \text{Pres } V_2 \ldots ]]\]
    (where \(V_1\) is a factive verb)
    factive double-access sentences
c. \([S \ldots \text{Past } V_1 \ldots [\text{because } [S \ldots \text{Pres } V_2 \ldots ]]\]
    causative double-access sentences

Sentences of the type in (25b) or (25c) (i.e., factive double-access sentences and causative double-access sentences) will be collectively referred to as CRT double-access sentences since they require that the embedded clause be a CRT. The semantics of double-access sentences involving CRTs is described informally as follows:

(26) If \(S_2\) of a sentence of the form \([S_1 \ldots \text{Past } V_1 \ldots [S_2 \ldots \text{Pres } V_2 \ldots ]]\) is a CRT, \(S_1\) is true iff (a) \([S_1 \ldots \text{Past } V_1 \ldots [S_2 \ldots \text{Past } V_2 \ldots ]]\) (with a simultaneous reading) is true and (b) one and the same state described by \([S_2 \ldots V_2 \ldots ]\)
    (tenseless) obtains at an interval that overlaps the time of the event denoted by \(V_1\) and the speech time (of \(S_1\)).

I assume that as far as double-access sentences involving CRTs are concerned, the above descriptive generalization is correct. In what follows, I will pursue the hypothesis that any additional complications with "regular" double-access sentences stem from the fact that the embedded clause is not true in the real world. I assume that condition (a) in (26) is appropriate for non-factive cases as well. However, condition (b) in (26) apparently is not satisfied by regular double-access sentences. It requires that the state described by the embedded
clause obtain in the real world at an extended interval, and it is precisely this condition that non-factive clauses fail to satisfy.

However, there is reason to believe that condition (b) in (26), albeit under slightly modified conditions, also applies to non-factive double-access sentences. The condition requires that one and the same state obtain from the time of the original speech until the time of the report. The non-factive examples also require that one and the same state obtain throughout an interval that overlaps both the original attitude time and the report time although the state in question is not the one described by the embedded clause. Consider the following example:

(27) John and Bill are looking into a room. Sue is in the room.
    (a) John (nearsighted): Look! Mary is standing in the room.
    (b) Bill: What are you talking about? That’s Sue, not Mary.
    On the following day, Bill and Kent return to the same location and are now looking into the same room. Sue is standing there.
    (c) Bill: # John said yesterday that Mary is standing in the room. But that’s Sue, not Mary.

Let us assume that the room in question is in an office building. Assume also that after John utters (27a), Sue goes back home, spends the night there, and comes back to her office the following day. In this case, these two references to Sue’s standing in the room concern two temporally discontinuous states, and the double-access sentence uttered by Bill is false. In order to make (27c) true, one continuous state of Sue’s standing in the room must obtain from the time of John’s saying until the time of the report. Thus, CRT and non-CRT double-access sentences share the condition that some relevant state must obtain at an extended interval. The problem, though, is that the states relevant to non-CRT cases are not the ones described by embedded clauses. Since the sentence Mary is standing in the room is false in the actual world in the situation described by (27), I will pursue the possibility that it is true in some possible worlds at an interval that contains the time of the original speech and the time of the report. This line of reasoning points to a counterfactual analysis of double-access sentences, which I present here as Hypothesis 4.
Hypothesis 4: A double-access sentence is true if and only if (a) the subject of the attitude asserts that the state described by the embedded clause is true at the time of his saying, and (b) it is the case that if the state claimed to obtain by the subject of the attitude did in fact obtain at the time of the original claim, the state would obtain at an interval that encompasses the time of the attitude and the speech time of the report.

Let us analyze (14d) using Hypothesis 4. Suppose, counterfactually, that John’s claim were true, i.e., that the person who is in the room were Mary, not Sue. Then, the hypothesis predicts that the state of Mary’s being in the room would continue to obtain until the speech time of the report. But this proposal has no empirical content unless we provide a concrete way of evaluating counterfactual conditionals.

I adopt Lewis’s (1973) proposal to give substance to Hypothesis 4. According to Lewis (1973:13–14), in order to evaluate counterfactual conditionals, we should posit a similarity relation defined with respect to some particular world (e.g., the actual world). I adopt a simplified version of Lewis’s original proposal here. The truth conditions for counterfactual sentences can be defined as follows:

\[ \llbracket \alpha \Box \rightarrow \beta \rrbracket_w = 1 \]  \(\text{("If it were the case that } \alpha, \text{ then it would be the case that } \beta."\) iff for the world(s) } w' \text{ closest to } w \text{ in terms of the similarity hierarchy among those in which } \alpha \text{ is true, } \beta \text{ is also true in } w'\).\]

According to this proposal, (14d) is true iff the following counterfactual conditional is true in the actual world \(w_0\):

\[ \Box (\text{Mary is in the room at } t_0, \text{ i.e., the attitude time}) \rightarrow (\text{Mary is in the room throughout an interval that encompasses } t_0 \text{ and the speech time}). \]

Which worlds should we examine in order to determine the truth value of (30)? In other words, which worlds are considered to be closest to \(w_0\) among those in which Mary is in the room at \(t_0\)? I contend that we should examine the worlds in which Mary is in the room at \(t_0\) and behaves as closely as possible to the way Sue does in \(w_0\). For example,
if Sue leaves the room in \( w_0 \), Mary leaves the room in these possible worlds at the same time. This idea is plausible because in the situation under description, John would not be able to distinguish between \( w_0 \) and these “closest worlds.” On this analysis, (30) is true iff Mary continues to be in the room until the speech time in the world(s) in which Mary is in the room at \( t_0 \) and behaves as closely as possible to the way Sue does in \( w_0 \). We can check whether this condition obtains by observing Sue’s behavior in \( w_0 \) because Mary’s behavior in these selected possible worlds is duplicated by Sue’s behavior in \( w_0 \). Thus, we predict that if Sue continues to stay in the room until the speech time in \( w_0 \), then (14d) is true. This is the desired result. On the assumption that any world resembles itself most closely, this proposal also accounts for CRT double-access sentences. That is, when the antecedent is true in the actual world \( w_0 \), it suffices to check whether the consequent is true in \( w_0 \).

Unfortunately, Hypothesis 4 turns out to be empirically inadequate. An anonymous reviewer suggests if we assume that Mary never stays in any room more than one hour and modifies the dialogue (20) in such a way that Kent joins them two hours later instead, it is arguable that the following counterfactual conditional is false: “if Mary were in the room at the time of the original claim, this state would obtain throughout an interval that overlaps both the time of the original claim and the speech time of the report.” I agree with the referee’s judgment. Hypothesis 4 makes the wrong prediction here.

### 6.2.2. De Re Attitudes About Intervals

Abusch (1991) proposes a \textit{de re} attitude account of double-access sentences. To be more precise, she claims that the interpretation of (14d) can be accounted for as a \textit{de re} attitude report about an extended interval. Abusch’s account is based upon Cresswell and von Stechow’s (1982) proposal about \textit{de re} attitudes, which I have already discussed in earlier chapters. Cresswell and von Stechow generalize their \textit{de se}-based analysis of \textit{de re} attitudes to objects other than normal individuals, such as predicates. Abusch (1991) employs this technique in her analysis of double-access sentences. She claims that double-access sentences involve \textit{de re} attitude reports about intervals that
satisfy “suitable relations.” Her analysis starts with the logical structure in (31b) of the sentence in (31a).

(31)  
a. John said that Mary is pregnant.
b. \[S \text{John [VP Past say [S Pres } λt [S Mary be pregnant at t]]}\]

I translate (31b) into the version of IL adopted in this book and show how the interpretation proceeds. This will facilitate the comparison of Abusch’s proposal with my account to be presented below.

(32)  \[∃t < s^* & \text{say}'(t, j, \text{Pres, } ^λt_1 ^λt_2[\text{Mary be pregnant at } t_2])\]

The lexical meaning of \text{say}' is defined here for \textit{de re} attitudes about intervals.

(33)  
\[
\text{For any } w_0 ∈ W, P_0 ∈ D_{<s, <t, s, t>}, t_1 ∈ T, a_0 ∈ A, \text{ and } t_0 ∈ T, \text{ [say}'<s, t, s, t>, <s, t, s, t>, >]w_0(\text{Pres}(t_1))(a_0)(t_0) = 1 \]
\[
\text{(which informally reads 'in } w_0 \text{ at } t_0, a_0 \text{ ascribes the property } P_0 \text{ to } t_1) \]
\[
\text{iff there is a ‘suitable relation’ } SR ∈ D_{<s, <t, s, t>}, \text{ such that (i) } t_1 \text{ is the interval to which } a_0 \text{ bears } SR \text{ in } w_0 \text{ at } t_0, \text{ and (ii) } a_0 \text{ talks in } w_0 \text{ at } t_0 \text{ as if for every doxastic alternative } <w, t, x> \text{ of } a_0 \text{ in } w_0 \text{ at } t_0, \text{ the interval to which } x \text{ bears } SR \text{ in } w \text{ at } t \text{ has the property } P_0 \text{ in } w \text{ at } t.\]

According to (33), the truth conditions for (32) are stated as in (34).

(34)  
\[
\text{There is a suitable relation } SR \text{ such that (i) the denotation of } Pres \text{ is the interval to which John bears } SR \text{ in } w_0 \text{ at } t_0, \text{ and (ii) John talks in } w_0 \text{ at } t_0 \text{ as if for every doxastic alternative } <w, t, x> \text{ of John in } w_0 \text{ at } t_0, \text{ Mary is pregnant in } w \text{ at the interval to which } x \text{ bears } SR \text{ in } w \text{ at } t.\]

In her discussion of (31a), Abusch considers the following situation: John sees Mary’s big belly, which is a product of her overeating, and forms an erroneous belief that she is pregnant. According to Abusch, \textit{Pres} must denote an interval that contains the speech time of the report, and the suitable relation \textit{SR} is \(\{<w, t, t', x> | t' \text{ overlaps } t \text{ in } w,\)
and \( t' \) is the maximal interval at which Mary has a swollen belly in \( w' \), where \( t' \) indicates the \( res \) to which the property in question is ascribed. Given these assumptions, we can provide the truth conditions for (31a) as it is used in the context under discussion.

(35) (i) The denotation of \( Pres \) is the interval such that it overlaps \( t_0 \) in \( w_0 \) and it is the maximal interval at which Mary has a swollen belly in \( w_0 \), and (ii) John talks in \( w_0 \) at \( t_0 \) as if for every doxastic alternative \( \langle w, t, x \rangle \) of John in \( w_0 \) at \( t_0 \), Mary is pregnant in \( w \) at the interval \( t' \) such that \( t' \) overlaps \( t \) in \( w \) and \( t' \) is the maximal interval at which Mary has a swollen belly in \( w \).

Abusch claims that this analysis provides an empirically satisfactory result. I believe that her account must be slightly modified in order to become fully satisfactory. First, Abusch employs as a suitable relation \( \{ \langle w, t, t', x \rangle \mid t' \) overlaps \( t \) in \( w \), and \( t' \) is the maximal interval at which Mary has a swollen belly in \( w \} \). Note that the specification of the unique interval is made solely in terms of the “context time” \( t \), not in terms of the subject \( x \). As it stands, any individual bears the relation to the maximal interval of Mary’s having a swollen belly as long as there is such an interval, and (34) therefore makes the wrong predictions. Thus, to correct this problem, we must employ the following relation as a suitable relation, instead: \( \{ \langle w, t, t', x \rangle \mid t' \) is the maximal duration of the state of Mary’s having a swollen belly that \( x \) observes in \( w \) at \( t \} \).

On the basis of this revision of the suitable relation, the truth conditions for (31a) are restated as follows:

(36) (i) The denotation of \( Pres \) is the maximal interval of the state of Mary’s having a swollen belly that John observes in \( w_0 \) at \( t_0 \), and (ii) John talks in \( w_0 \) at \( t_0 \) as if for every doxastic alternative \( \langle w, t, x \rangle \) of John in \( w_0 \) at \( t_0 \), Mary is pregnant in \( w \) at the maximal interval of the state of Mary’s having a swollen belly that John observes in \( w \) at \( t \).

The revised truth conditions (36) for (31a) are empirically satisfactory. Since Abusch requires \( Pres \) to denote an interval that overlaps the speech time, the state of Mary’s having a swollen belly overlaps both the time of the attitude and the speech time of the report in the actual
world. After presenting my account of the double-access sentences in the following section, I will make a brief comparison of my proposal with Abusch’s proposal as reinterpreted here.

I shall briefly touch upon Enç’s (1987:653) proposal about double-access sentences. In order to obtain double-access readings, Enç proposes that the embedded CP (= S’) is moved at LF and is adjoined to the matrix sentence. I do not adopt her proposal partly because she does not make explicit what semantic import it has. For example, it is not clear how the variable left behind by the moved CP should be interpreted semantically. Moreover, her proposal seems to make some incorrect empirical predictions. Enç (1987:654) suggests that (37a) can receive a bound-variable interpretation represented by the indicated coindexing, whereas (37b) cannot.

(37)  a. Every child_j said that he_j was tough.
    b. *Every child_j said that he_j is tough.

[N.B.: The judgment is Enç’s.]

According to Enç’s proposal, the embedded CP in (37b) is moved and adjoined to the matrix S at LF. Then the pronoun he is outside the scope of the quantifier every child and cannot be interpreted as being bound by every child. Therefore, Enç predicts that (37b) is ungrammatical with the indicated coindexing. However, many native speakers disagree with this judgment. That is, they find the bound-variable reading of (37b) acceptable. This is another reason to reject Enç’s proposal. However, moving the embedded clause out of an opaque context seems to represent the native speaker’s intuition that the semantic contribution of the embedded clause is partly independent of what the subject originally expresses. The proposal to be put forth in what follows incorporates the ideas contained in Enç’s proposal but avoids the problems associated with it.

6.2.3. De Re Attitudes About States

Having considered four hypotheses and two previous proposals, I am now in a position to present my own proposal. It is based upon an eventuality-based semantics, which claims that a declarative sentence
is assumed to involve an existential assertion about an eventuality. An event-based system was originally proposed by Davidson (1967). Bach (1986) extends it to deal with various “action types” (or Aktionsarten) such as events, states and processes, and he refers to them collectively as “eventualities.” My proposal posits two distinct eventuality types: events and states. Formally, I posit two sets of entities distinct from $A$ (a set of “normal” individuals): $E$ for events, $S$ for states.\(^{10}\) Events and states are distinguished in the following way: I posit a function $\text{Duration}$ from $A \cup E \cup S$ to the set of intervals $T$. For example, for any element $\alpha$ of $A \cup E \cup S$, $\text{Duration}(\alpha)$ is the maximal interval that $\alpha$ occupies. The next step is to define the lexical semantics for $\text{exist}^{\prime}$ (for states) and $\text{exist}^{\prime}$ (for events), which have different properties.

(38) a. $[\text{exist}^{\prime}_{st, i, t}]_{w}$ (for any $w$) is that function from $S$ to $\{f | f$ is a function from $T$ to $\{0,1\}\}$ such that for any $s \in S$ and $t \in T$, $[\text{exist}^{\prime}_{st}]_{w}(s)(t) = 1$ if and only if $t \subseteq \text{Duration}(s)$

b. $[\text{exist}^{\prime}_{ev, i, t}]_{w}$ (for any $w$) is that function from $E$ to $\{f | f$ is a function from $T$ to $\{0,1\}\}$ such that for any $e \in E$ and $t \in T$, $[\text{exist}^{\prime}_{ev}]_{w}(e)(t) = 1$ if and only if $\text{Duration}(e) = t$.\(^{11}\)

I shall omit the subscripts on $\text{exist}^{\prime}$ when no confusion arises from this. As this lexical meaning of the predicate $\text{exist}^{\prime}$ shows, it is important to use state individuals, but event individuals can be dispensed with for our purposes. Therefore, in the following discussion, I will only employ temporal terms and state terms (in addition to individual terms) in the object language. This prevents further aggravation of the already very complicated representation language. Temporal terms and state terms occupy argument positions of predicates as in the system we have been using up to now.

We are now ready to discuss some of the empirical predictions that the new proposal makes. Consider a simple sentence such as (39a).

(39) a. John is at home.

b. John Pres be at home.

In order to accommodate the proposed change concerning state
predicates, we must propose a new translation for each tree structure that contains a VP as a daughter. I present here only the one we need to account for (39a). For the other rules, the reader is referred to the appendix.

(40) Rule for English:
Translation Rule: \([ \text{TP T VP} ]\) (where VP is a stative predicate) translates into
\[\lambda \varphi \lambda \lambda [ \varphi(\lambda x \lambda t \exists s[T(i)(i') & \text{exist}'(s)(i) & \text{VP}(x)(s))]]\]

(41) 1. \([\text{TP Pres [VP be at home]}] \Rightarrow \lambda \varphi \lambda \lambda [\varphi(\lambda x \lambda t \exists s[t = s^* \& t \subseteq t_{RT} & \text{exist}'(t, s) & \text{be-at-home}'(x)(s))]]\)
2. \([\text{NP John [TP Pres [VP be at home]]]} \Rightarrow \lambda \varphi \lambda \lambda [\varphi(\lambda x \lambda t \exists s[t = s^* \& t \subseteq t_{RT} & \text{exist}'(t, s) & \text{be-at-home}'(x)(s))])(\lambda P \lambda t_3 [P(t_3, j)])\]
3. \(\lambda' \lambda t_3 [\exists s[t = s^* \& t \subseteq t_{RT} & \text{exist}'(t, s) & \text{be-at-home}'(s, j)]]\]
4. \(\exists s[s^* \subseteq t_{RT} & \text{exist}'(s^*, s) & \text{be-at-home}'(s, j)]]\)
(Truth Definition)

The final line says that there is a current state of John’s being at home. This is the desired interpretation.

We now return to the issue of double-access sentences. First, let us confirm that the new proposal accounts for the by-now-familiar example in (42).

(42) John said that Mary is in the room.

(42) is syntactically analyzed as in (43), and it translates into \(\text{IL}\) as in (44).

(43) \([\text{S John Past say that [S Mary Pres be in the room]}]\)

(44) 1. \[\text{Mary Pres be in the room} \Rightarrow \lambda t' \lambda t [\exists s[t = s^* \& t \subseteq t_{RT} & \text{exist}'(t, s) & \text{be-in-the-room}'(s, m)]]\) (see above)
2. \[\text{say that [S Mary Pres be in the room]} \Rightarrow \text{say}'(\wedge t \lambda x \exists s[s^* \subseteq t_{RT} & \text{exist}'(s^*, s) & \text{be-in-the-room}'(s, m)])\]
3. John Past say that Mary Pres be in the room $\Rightarrow \exists t_3 [t_3 < s^* \& t_3 \subseteq T_{RT} \& \text{say}'(t_3, j, \lambda t_1 \lambda x \exists s[s^* \subseteq T_{RT} \& \text{exist}'(s^*, s) \& \text{be-in-the-room}'(s, m)])] \) (Truth Definition)

This translation has virtually the same interpretation as the formula given earlier as (7) and is clearly empirically inadequate; (44) incorrectly predicts that (42) is nearly synonymous with (45).

(45) John said that Mary would be in the room now.

In order to rule out on principled grounds the reading (44) predicts, I propose the following informal restriction upon permissible attitude reports:

(46) **Temporal Directionality Isomorphism**: Any attitude report must be made in such a way that the temporal directionality of a reported attitude agrees with the inherent temporal orientation of the tense morpheme that appears in the verb complement clause at LF. When a double-access de re attitude report is made, the perspective of the reporter must also obey this constraint in that the temporal direction of the event or state from the viewpoint of the reporter must also agree with the inherent temporal directionality of the tense morpheme that is used in the rendition of the reported attitude.

The temporal directionality of each tense is given as follows: the simple past is previous time oriented; the simple present tense and the null tense are current time oriented, and the future auxiliary (will or would) is future time oriented. This constraint is a revised version of a similar constraint I proposed in Ogihara (1989). I contend here that (44) violates this constraint. In (44), the verb complement clause translates as the following property: $\{<w,t,x>|\text{there is a state that exists at }s^* \& s \text{ is Mary's being in the room in } w\}$. That is, whether or not some element of $W \times T \times A$ belongs to this set of triples solely depends upon whether Mary is in the room at the speech time of the report. In this sense, the property only concerns the utterance time of (42). Since John expresses the reported attitude at a past time and the
time of Mary’s being in the room is in the future relative to the attitude
time, John’s attitude is rendered as a future-oriented one in (44). However, John’s attitude is reported in (42) with a sentence in the
simple present tense, which is current time oriented. This is a violation
of the constraint (46). Hence, the final translation given in (44) is
illicit.

I have another reason to rule out (44) as a rendition of (42). Note
that the special indexical term \( s^* \) occurs within the translation of the
embedded clause. I think it is fair to say that the speech time (i.e., the
time of the context) is fully accessible only from the speaker of the
entire sentence. Thus, the interpretation suggested by (44) is a
distortion of John’s original utterance and is not tolerated. The idea
can be stated as follows:

\[ (47) \text{ Speech-time-oriented indexicals such as } s^*, \text { today, etc.} \]
\hspace{1cm} \text{cannot appear in the translation of the intensional argument}
\hspace{1cm} \text{of an attitude verb.} \]

To predict a double-access reading for (42), I furnish an option for the
present tense morpheme to move out of the complement clause. I
assume that the present tense morpheme moves cyclically to the matrix
clause level and moves into the empty Comp position, leaving a trace,
as in (48).

\[ (48) \text{ [CP Pres}_2 [s \text{ Past say } s_2 \text{ [CP}_1 \text{ that } [s \text{ Mary s}_1 \text{ be in the room}]]] } \]

For our purposes, it is important for the translation rule to see that the
initial trace that the tense leaves behind is distinct from its
intermediate trace outside the complement clause. In order to
accomplish this effect, I stipulate that when a tense moves out of an
intensional domain, it obtains a new index distinct from the initial one.
This resembles the rule proposed in Chapter 5 for NPs that move out
of intensional domains. I also posit a rule that assigns a numerical
subscript to the highest node of the intensional domain in which the
tense originates. These rules are given in (49). In addition, three
translation rules are proposed in (50)–(52) for sentences like (42). (50)
has a dual role of providing a truth definition for the matrix clause and
of binding the variable that is the target for a de re reading.
Rule for English:
An Obligatory Movement Rule for Present Tense at LF
\[ [S \ldots [\alpha \ldots \text{Pres} \ldots ]] \Rightarrow [CP \text{Pres}_2 [s \ldots s_2 [s_1 \ldots s_1 \ldots ]]], \]
where \( \alpha \) is the outermost category of an intensional context, and \( s_1 \) and \( s_2 \) are state empty categories.

Rule for English:
\[ [CP \text{Pres}_n S] \text{ translates into } \lambda t_3 \lambda t_2 \exists s_2 [\text{Pres}_{n}(t_2) & \exists'(t_2, s_n) & \exists t_5 [S(s^*)(t_5)]] \]

Rule for English:
\[ [TP [T s_n] VP] \text{ translates into } \lambda \rho \lambda t \rho(\lambda \lambda t' [VP(\lambda s)(s_n)]) \]

Rule for English:
\[ [VP \text{ V <<} s, i, <s,t>,<i,t>,<e,i>,<t,e> >>},<s,t>,<e,i>,<t,e>>>> s_m CP_n] \text{ translates into } \text{V}^{<s_i,<s,t,t>,<s,t,t>,<s,t,t>,<s,t,t>,<s,t,t>}>^\lambda \lambda t_3 \lambda s \exists t_5 [\text{CP}_n(t)(t')] (s_m) \]

The translation into IL proceeds as in (53).

1. \[ [S \text{ John Past say } s_2 [CP_1 \text{ that } [S \text{ Mary } s_1 \text{ be in the room}]]] \Rightarrow \lambda t \lambda t' [t < t' & t \subseteq t_{RT} & \text{say}''(t, j, s_2, \wedge \lambda t_3 \lambda s_1 \text{[be-in-the-room}''(s_1, m)]))] \]
2. \[ [CP \text{ Pres}_2 [S \text{ John Past say } s_2 [CP_1 \text{ that } [S \text{ Mary } s_1 \text{ be in the room}]]]) \Rightarrow \lambda t_4 \lambda t_2 \exists s_2 [t_2 = s^* & t_2 \subseteq t_{RT} & \exists'(t_2, s_2) & \exists t [t < s^* & t \subseteq t_{RT} & \text{say}''(t, j, s_2, \wedge \lambda t_3 \lambda s_1 \text{[be-in-the-room}''(s_1, m)]))] \]
3. \[ \exists s_2 [s^* \subseteq t_{RT} & \exists'(s^*, s_2) & \exists t [t < s^* & t \subseteq t_{RT} & \text{say}''(t, j, s_2, \wedge \lambda t_3 \lambda s_1 \text{[be-in-the-room}''(s_1, m)])] \] (Truth Definition)

In order to interpret the final formula, we must define the lexical meaning of \text{say}'' that takes a state individual as well as a property of states as its arguments. We can simply adopt the lexical meaning of \text{say}'' proposed for \text{de re} attitudes about intervals given earlier as (33), except that we must now substitute a state for an interval.
For any \( w_0 \in W, P_0 \in D_{s,t}, s_0 \in S, a_0 \in A, t_0 \in T, \) \( \text{[say'}(s_0, a_0, t_0) = 1 \) (which informally reads ‘in \( w_0, a_0 \) talks at \( t_0 \) as if \( a_0 \) ascribes the property \( P_0 \) to \( s_0 \)’ if there is a “suitable relation” \( SR \in D_{s,t} \) such that (i) \( s_0 \) is the state to which \( a_0 \) bears \( SR \) in \( w_0 \) at \( t_0 \), and (ii) \( a_0 \) talks in \( w_0 \) at \( t_0 \) as if for every doxastic alternative \( \langle w, t, x \rangle \) of \( a_0 \) in \( w_0 \) at \( t_0 \), the state to which \( x \) bears \( SR \) in \( w \) at \( t \) has the property \( P_0 \) in \( w \) at \( t \).

According to (54), the translation given in (53) says that there exists a state \( s_2 \) now such that John talks in the past as if he ascribes to \( s_2 \) the property of being a state of Mary’s being in the room. The state that satisfies this description in the actual world is, of course, Sue’s being in the room. To be more accurate, ascribing the property of being a state of Mary’s being in the room to a state \( s_2 \) can be explicated in terms of self-ascription of properties: (i) there is an acquaintance relation \( SR \) that relates John uniquely to some state in \( w_0 \) at \( t_0 \). The relation is that of “the situation that one is observing.” The state in question is Sue’s being in the room. (ii) John talks as if he self-ascribes the property of bearing this acquaintance relation uniquely to some state \( s' \), which is Mary’s being in the room. I believe that the acquaintance relation involved in this account is plausible. It simply says that the subject is acquainted with a unique state in \( w_0 \) at \( t_0 \) via \( SR \). The only thing John needs to do with regard to the above example is to recognize “the situation he is looking at” and to ascribe a property to it. Moreover, since this acquaintance relation requires the subject and the \( res \) to be present at the time of the attitude (i.e., \( t_0 \)), this automatically guarantees that the \( res \), i.e., the state, occupies an interval that overlaps \( t_0 \). Since the state is the same state that “exists” at the speech time, this analysis guarantees that Sue’s being in the room spans both the time of John’s saying and also the speech time of the report.

To see that this account of the double-access phenomena conforms to the temporal directionality isomorphism, compare (53) with (55b).

(55) a. John says that Mary is in the room.
    b. \( \exists s[\text{exist}'(s, s) \& \text{say}'(s', j, s, \lambda t \lambda s_1 [\text{be-in-the-room}'(s_1, m)])] \)
(55b) is a translation of (55a) that yields a de re interpretation about a state, which is almost identical with its de dicto interpretation. Since (55a) can only have a purely simultaneous reading, the “suitable relation” is \( \{<x, s> | x \text{ currently observes a state } s\} \). Note here that, as far as the arguments of say' are concerned, (53) is exactly the same as (55b). This gives us justification for adopting the same relation as a “suitable relation” for (53) as well, which means that John’s attitude reported by (53) is current time oriented. This conforms to the temporal directionality isomorphism because the simple present tense that occurs in the verb complement clause is also current time oriented. I should also mention that according to this new rendition of (42), the embedded clause denotes the property of being a state of Mary’s being in the room and does not make reference to the speech time of the report. Thus, this rendition is quite satisfactory from this viewpoint as well.

The example that Abusch discusses extensively, that of Mary’s having a big belly, also receives a satisfactory account under my proposal. Sentence (56a) is analyzed as having (56b) as its LF structure.

\[
\begin{align*}
\text{(56)} & \quad \text{a. John said that Mary is pregnant.} \\
& \quad \text{b. } [\text{CP Pres}_2 [S \text{ John Past say } s_2 [\text{CP}_1 \text{ that Mary } s_1 \text{ be pregnant}]]]
\end{align*}
\]

(56b) translates into IL as in (57).

\[
\begin{align*}
\text{(57)} & \quad \exists s_1 [\text{exist}'(s^*, s) & \text{& } \exists t [t < s^* & \text{& say}'(t, j, s, ^\lambda t_3 \lambda s_1 [\text{be-pregnant}'(s_1, m)])]]
\end{align*}
\]

(57) says that there is a state \( s \) now such that John talks in the past as if he ascribes to \( s \) the property of being a state of Mary’s being pregnant. The state in the actual world that satisfies these conditions is Mary’s having a swollen belly. Just as in the above example, this can be restated in terms of self-ascription of properties: there is a state \( s \) now and there is a suitable relation \( SR \) such that (i) \( s \) is the state to which John bears \( SR \) in \( w_0 \) at \( t_0 \), and (ii) John talks in \( w_0 \) at \( t_0 \) as if for every doxastic alternative \( <w, t, x> \) of John in \( w_0 \) at \( t_0 \), the state to which \( x \) bears \( SR \) in \( w \) at \( t \) has in \( w \) at \( t \) the property of being a state of Mary’s being pregnant. Note that even if Mary were pregnant when John
believes, for the wrong reason, that she is pregnant, what happens to
Mary’s pregnancy later would not affect the truth conditions of the
sentence in the new proposal. All that matters is whether Mary’s
having a swollen belly, the state that John is acquainted with in
\( w_0 \) at \( t_0 \) via \( SR \), still obtains at the speech time of the report. This is the
desired result.

I now provide an account of factive double-access sentences. As a
representative example, let us consider the following, which involves
the expression \( \text{find out} \):

(58) John found out that Mary is pregnant.

When the verbal expression \( \text{find out} \) is used for a double-access
interpretation as in (58), I assume that it translates as an \( IL \) expression
\( \text{find-out}' \) that has the properties described in (59). This proposal was
arrived at simply by incorporating into the proposal for \( \text{say}' \) given in
(54) the following two assumptions about factive predicates like \( \text{find out} \):
(i) \( t_0 \) is an initial interval at which the subject bears \( SR \) to the \( \text{res} \);
(ii) the \( \text{res} \) has in \( w_0 \) at \( t_0 \) the property that the subject ascribes to the
\( \text{res} \) in \( w_0 \) at \( t_0 \).

(59) For any \( w_0 \in W \), \( P_0 \in D_{s_0,s,t,r} \), \( s_0 \in S \), \( a_0 \in A \) and \( t_0 \in T \),
\[ \text{find-out}'(s_0,s_3,t_0) = 1 \] \( \text{iff} \) there is a “suitable
relation” \( SR \in D_{s_0,s,t,r} \) such that (i) \( t_0 \) is an initial
interval at which \( a_0 \) bears \( SR \) to \( s_0 \) in \( w_0 \), (ii) \( a_0 \) self-ascribes
in \( w_0 \) at \( t_0 \) the property of bearing \( SR \) uniquely to some state
\( s \), which has \( P_0 \), and (iii) \( s_0 \) has the property \( P_0 \) in \( w_0 \) at \( t_0 \).

Armed with the lexical meaning of \( \text{find-out}' \) given in (59), let us
consider the interpretation of (58) on the basis of (60).

(60) \[ [\text{CP Pres}_3 [S \text{ John Past find out } s_3 [\text{CP}_2 \text{ that } Mary s_2 \text{ be
pregnant}] ]] \Rightarrow \exists s_3 [\text{exist}'(s_*, s_3) \& s_\ast \subseteq r_T \& \exists t < s_\ast \& \text{find-out}'(t, j, s_3, \lambda \lambda s_2 [\text{be-pregnant}'(s_2, m)])] \]

(60) says that there is a state \( s_3 \) which overlaps the present moment
such that there is a past time \( t_0 \) such that \( t_0 \) is an initial interval at
which John bears SR to s_3 (and to nothing else) in w_0. John self-ascribes the property of bearing SR uniquely to some s, which is a state of Mary’s being pregnant, and s_3 is a state of Mary’s being pregnant in w_0 at t_0. This is exactly what we want.

Finally, Enç's example (62a) will be discussed, which was given above as (37b). On the basis of the LF structure given below as (62b), we can provide the translation into IL as in (63). The translation given in (63) is not completely compositional in that I do not state the conditions under which the pronoun he is allowed to be interpreted de se. I simply give the translation in a semi-compositional manner so that the reader can follow my reasoning. We also need a translation rule for a structure in which an NP is adjoined to a CP.12

(61) Rule for English:
[CP NP CP] translates into \( \lambda t_1 \lambda t_2 [\text{NP}_{\text{c}}(\lambda x_n \lambda t)](\text{CP}(t(t_2))(t_1)) \) (QR to CP)

(62) a. Every child said that he is tough.
   b. [CP[NP, every child][CP Pres s_2 [S e_1 Past say s_2 [CP_3 that he_4 s_3 be tough]]]]

(63) 1. \([S \text{ he_4 s_3 be tough}] \Rightarrow \lambda t_1 \lambda t_2 [\text{be-tough}’(s_3, x_1)] \)
   2. \([S \text{ e_1 Past say s_2 [CP_3 that he_4 s_3 be tough]]}] \Rightarrow \lambda t_1 \lambda t_2 [\text{be-tough}’(s_3, x_1, s_2, ^\lambda t_1 \lambda x_4 \lambda s_3[\text{be-tough}’(s_3, x_4)])]\)
   3. \([\text{CP Pres s_2 [S e_1 Past say s_2 [CP_3 that he_4 s_3 be tough]]}] \Rightarrow \lambda t_3 \lambda t_2 \exists s_2[t_2 = s^* & \text{exist’}(t_2, s_2) & \exists t_5[t_5 < s^* & t_5 \subseteq t_{\text{RT}} & \text{say’}(t_5, x_1, s_2, ^\lambda t_1 \lambda x_4 \lambda s_3[\text{be-tough}’(s_3, x_4)])]]\]
   4. every child \( \Rightarrow \lambda P \lambda t \forall x[\text{child’}(t, x) \Rightarrow P(t, x)] \)
   5. \([\text{CP[NP, every child][CP Pres s_2 [S e_1 Past say s_2 [CP_3 that he_4 s_3 be tough]]}] \Rightarrow \lambda t_1 \lambda t_2 [\forall x[\text{child’}(t_1, x) \rightarrow [\exists s_2[t_2 = s^* \text{ & exist’}(t_2, s_2) & \exists t_5[t_5 < s^* \text{ & } t_5 \subseteq t_{\text{RT}} \text{ & say’}(t_5, x, s_2, ^\lambda t_1 \lambda x_4 \lambda s_3[\text{be-tough’}(s_3, x_4))]]]]]]\]
   6. \( \forall x[\text{child’}(s^*, x) \rightarrow [\exists s_2[\text{exist’}(s^*, s_2) & \exists t_5[t_5 < s^* \text{ & } t_5 \subseteq t_{\text{RT}} \text{ & say’}(t_5, x, s_2, ^\lambda t_1 \lambda x_4 \lambda s_3[\text{be-tough’}(s_3, x_4))])]][]] \)

(Truth Definition)

Note that \text{say'} as used in (63) is a four-place predicate and is designed for a de se interpretation of \text{he} and a de re reading for the present
tense. To show how (63) is interpreted, the lexical meaning of \textit{say}′\textless s, i, e, st, t\textgreater\textgreater\textgreater\textgreater is provided in (64).

\begin{equation}
\text{(64) For any } w_0 \in W, P_0 \in D_{s, i, e, st, t}, s_0 \in S, a_0 \in A, \text{ and } t_0 \in T, \text{ if } |\text{say'}\textless s, i, e, st, t\textgreater\textgreater\textgreater\textgreater\textgreater w_0(P_0)(s_0)(a_0)(t_0) = 1 \text{ iff there is a "suitable relation" } SR \in D_{s, i, e, st, t}\textgreater\textgreater\textgreater\textgreater such that (i) } s_0 \text{ is the state to which } a_0 \text{ bears } SR \text{ in } w_0 \text{ at } t_0, \text{ and (ii) } a_0 \text{ talks in } w_0 \text{ at } t_0 \text{ as if } a_0 \text{ self-ascribes the following property: } \{<w, t, x> | \text{there is a unique } s \text{ to which } x \text{ bears } SR \text{ in } w \text{ at } t \text{ and } P_0(w)(t)(x)(s) = 1\}
\end{equation}

According to (64), the final translation in (63) reads, “For every child \(y\), there is a current state \(s\) such that at some past time, \(y\) bears \(SR\) to \(s\) and \(y\) self-ascribes the property of being \(x\) who bears \(SR\) to a unique \(s\), which is a state of \(x\)’s being tough.” One advantage of this analysis with regard to (62a) is that it yields a reading in which there is a different state (i.e., \(res\)) for each child since it involves existential quantification over states. I think this is more intuitive than positing the same \(res\) for every child, which is predicted by giving the tense broader scope than every child.

To conclude my response to Abusch’s proposal, I shall provide a short self-evaluation of my proposal in comparison with Abusch’s (1991). My proposal and Abusch’s were developed independently and at approximately the same time, and they have similar properties. As far as I can see, both of them are empirically satisfactory, and I do not find a decisive argument in favor of one over the other. Both proposals are encoded in terms of \textit{de re} attitude reports. Abusch claims that double-access sentences involve \textit{de re} attitudes about intervals, whereas I contend that they invoke \textit{de re} attitudes about state individuals. I agree with Abusch that present tense in English must receive special treatment, as I stated above. In my proposal, a sentence in the present tense is used to assert that a state “exists” at the speech time, whereas Abusch assumes that a present tense morpheme is a referential expression that directly denotes an interval that overlaps the speech time. Although our proposals regarding present tense in English are not exactly the same, let us grant that there is no disagreement between us regarding its special nature. Despite these similarities, however, there is one important difference between our approaches.
As explained earlier, I propose a constraint referred to as the temporal directionality isomorphism to account for the double-access phenomena. This constraint says that when we make an attitude report, the temporal direction of the reported attitude must be mirrored by the inherent temporal directionality of the tense morpheme used in the verb complement clause. In my account, the present tense that has been adjoined to the complement clause must move again in order to create a structure that conforms to the constraint. This structure is appropriate for a de re reading for a state. This reading predicts that the state in question overlaps both the time of the attitude and the time of the report. Abusch, on the other hand, accounts for the phenomena in a different way. She requires that a present tense morpheme denote an extended interval that includes the speech time. However, this requirement alone does not force the interval in question to overlap the attitude time. Abusch accomplishes this effect by positing a suitable relation that requires that the interval in question overlap the original attitude time (in her original formulation) or that the subject actually observe the state (in my re-interpretation). However, the question is why this type of relation is “suitable” for the given situation. It appears that Abusch’s overall proposal does not provide a compelling explanation.

I think there is a way of justifying Abusch’s proposal, however. A little thought should convince the reader that Abusch has in mind something very similar to the temporal directionality isomorphism. If the interval in question is a future interval in relation to the time of the reported attitude, say an interval that contains the speech time of the report but is not extensive enough to cover the time of the reported attitude, then there would be a discrepancy between the temporal directionality of the original attitude, which looks to the future, and the temporal directionality of the present tense, which is current time oriented. A relation is “suitable” only if it forces the interval in question to overlap the attitude time, because this interval then counts as a “current interval” from the subject’s point of view, in conformity with the temporal directionality isomorphism. Thus, our proposals capture very similar, if not identical, ideas.

Returning to Enç’s example (62a), I am not sure whether Abusch’s proposal would analyze it correctly. Given that the sentence has a quantificational subject NP every child, we can assume that there is no unique attitude time, nor is there any unique interval that is common to
all relevant states for the children. Thus, it is not clear what is the right
denotation of Pres for Abusch. Perhaps the interval that completely
contains all the relevant states for the children is the one she needs, but
it is not obvious that this is the right analysis.

6.3. OTHER TYPES OF SIMPLE-PRESENT-UNDER-PAST
SENTENCES

According to the definition of double-access sentences given in (3),
there are other types of double-access sentences that involve a clause
in the simple present such as those exemplified by (65a–b).

(65)  a. John looked for a student who lives in Tokyo.
      b. John suspected that a man who is trying to kill him was
         behind the door.

(65a) is a sentence in which a present tense appears within the object
NP of an intensional transitive verb. The sentence (65b) has a present
tense within the subject NP of a verb complement clause. In both
cases, the matrix clause is in the past tense. Although Abusch
introduces such examples and discusses her observations, she does not
provide a fully compositional analysis of such examples in her early
paper (1988) or in her subsequent paper (1991). Thus, a formal
analysis of such examples will be provided in this section. (65a) is
discussed first. If the English present refers to the speech time and the
NP is interpreted de dicto, (65a) translates as in (66b) on the basis of
the LF structure given in (66a).

(66)  a. LF: John Past look for a student who_1 e_1 Pres live in
      Tokyo
      b. ∃t[t < s* & \text{seek}'(t, j, \lambda t_1 \exists x[\text{student}'(t_1, x) &
          \exists s[\text{exist}'(s*, s) & \text{live-in}'(s, x, Tokyo)] & P(t_1, x)]}]

(66b) predicts what I take to be an impossible interpretation. It says
that at a past time John looked for someone who lives in Tokyo at the
utterance time of the report (but not necessarily at the time of the
search). This is not what (65a) means. The translation given in (66b)
must be ruled out because, as I claimed in (47), \(s^*\) cannot appear as part of the translation of the object of an attitude. I will assume that the right interpretation of (65a) is based upon a different LF structure, which is obtained as a result of a tense movement as shown in (67). As in (48), the trace in the original position and the trace left outside the intensional domain must bear different numerical indices, and this is guaranteed by the rule proposed above in (49).

\[
(67) \quad [CP \, Pres_2 \, [S \, John \, Past \, look \, for \, s_2 \, [NP_1 \, a \, student \, who_1 \, e_1 \, s_1 \, live \, in \, Tokyo]]]
\]

We need the following new rule to translate (67) into IL:

\[
(68) \quad \text{Rule for English:} \\
\text{[VP} \, V <<s,<<e,i,t>>,i,\text{s},i,t,>>,s_n,\text{NP}_n \text{]} \\
\text{translates into} \, \text{V} <<s,<<e,i,t>>,i,\text{s},i,t,>>,s_n,\text{NP}_n(P(t))(s_m)
\]

(67) translates into IL as follows:

\[
(69) \quad 1. \quad [S \, e_1 \, s_1 \, live \, in \, Tokyo] \Rightarrow \lambda t_1 \lambda t_2 \text{[live-in}'(s_1, x_1, \text{Tokyo})] \\
2. \quad [NP_1 \, a [N' \, student \, [CP \, who_1 \, [S \, e_1 \, s_1 \, live \, in \, Tokyo]]]] \Rightarrow \lambda P \lambda \exists x \text{[live-in}'(s_1, x, \text{Tokyo}) \& \text{student}'(t, x) \& P(t, x)] \\
3. \quad \text{John \, Past \, look \, for \, s_2 \, a \, student \, who_1 \, e_1 \, s_1 \, live \, in \, Tokyo} \\
\Rightarrow \lambda t_3 \lambda t_4[t_3 < t_4 \& t_3 \subseteq t_{RT} \& \text{seek}'(t_3, j, s_2, \\
\lambda P \lambda \lambda x \exists x \text{[student}'(t, x) \& \text{live-in}'(s_1, x, \text{Tokyo}) \& P(t, x)))] \\
4. \quad [CP \, Pres_2 \, [S \, John \, Past \, look \, for \, s_2 \, [NP_1 \, a \, student \, who_1 \, e_1 \, s_1 \, live \, in \, Tokyo]]] \Rightarrow \exists s_2[s^* \subseteq t_{RT} \& \text{exist}'(s^*, s_2) \& \exists t_5[t_5 < s^* \& t_5 \subseteq t_{RT} \& \text{seek}'(t_5, j, s_2, \\
\lambda P \lambda \lambda x \exists x \text{[student}'(t, x) \& \text{live-in}'(s_1, x, \text{Tokyo}) \& P(t, x))]] \\
\text{(Truth Definition)}
\]

In order to provide the right truth conditions for (66a), we need a new IL translation for \textit{look for} and \textit{seek} that is designed for de re interpretations involving states. The lexical meaning of this newly proposed IL constant \textit{seek}' <<s,<<e,i,t>>,i,\text{s},i,t,>>,s_m,\text{NP}_n(P(t))(s_m) is defined in (70).
(70) For any world $w_0$, object $k$ in $D_{s_5, <e, i, t_0>, <i, s, t_0>, <s, i, t_0>, <t, i>>}$, state $s_0$, individual $a_0$, and interval $t_0$,
\[
\text{\text{seek}'_{s_5, <e, i, t_0>, <i, s, t_0>, <s, i, t_0>, <t, i>>}}\text{\_w}_0(k)(s_0)(a_0)(t_0)
\]
is true if and only if there is a suitable relation $SR \in D_{s_5, <e, i, s, t_0>, <s, i, t_0>, <t, i>>}$ such that (i) $s_0$ is the thing to which
\[
a_0 \text{\_bears}_s SR \text{ \_in } w_0 \text{ \_at } t_0,
\]
and (ii) every desiderative alternative of $a_0$ in $w_0$ at $t_0$ ($a_0$’s alternative that has all the
\[
\text{\_properties \_a_0 \_wishes \_to \_have \_in } w_0 \text{ \_at } t_0
\]
is such that $k(w_0)((<x, t_2> | \text{there is a time } t_1 > t_2 \text{ such that } y \text{ finds } x \text{ in } w \text{ at } t_1})(t_0) = 1$, and (iii) $a_0$ engages in an
activity in $w_0$ at $t_0$ which $a_0$ believes will enable $a_0$ to have the property in question.

According to this proposal, the final translation in (69) is true in $w_0$ iff
\[
\text{there is a suitable relation } SR \text{ such that there is a state } s_2 \text{ existing now, and}
\text{John bears } SR \text{ uniquely to } s_2 \text{ at some past time } t_0, \text{ and John’s}
\text{every desiderative alternative in } w_0 \text{ at } t_0 \text{ is an element of }
\{<w, t, y> | \text{the unique state } s \text{ to which } y \text{ bears } SR \text{ in } w \text{ at } t \text{ is such that there is a}
\text{student } x \text{ (at } t) \text{ and } s \text{ is } x \text{’s living in Tokyo and there is a time } t_1 > t \text{ such that } y
\text{ finds } x \text{ in } w \text{ at } t_1 \}, \text{ and (iii) } a_0 \text{ engages in a search activity at } t_0.
\text{Since the state is described by a sentence in the simple present, } SR
\text{ is assumed to be } \{<x, s> | x \text{ is in touch with a state } s\}, \text{ an abstract}
relation that obtains between individuals and states. Therefore, the
state must overlap the time of the search. Since this is a state that
“exists” at the speech time, it spans both the speech time and the time
of the search. Thus, a double-access reading is successfully accounted
for.

Let us now consider the following example, which has the same
structure as (65b):

(71) John suspected that a man who is annoying him was behind
the door.

It is also a double-access sentence, and it involves a relative clause in
the present tense that is contained in a verb complement clause. As in
the earlier examples, I will first show why interpreting the simple
present in situ gives us the wrong result. (71) would in that case be
rendered as follows:
(72) a. LF: \[ S \text{ John Past suspect that } [S[NP \text{ a man who } \text{ be annoying him}]] \emptyset \text{ be behind the door}]]

b. \[ \exists [t < s^* \& t \subseteq t_{RT} \& \text{ suspect}(t, j, ^{\lambda t_2 \lambda t \exists \lambda y} \text{[man}(t_2, y) \& \exists [\text{exist}(s^*, s) \& \text{be-annoying}(s, y, x)] \& \exists s_2 [\text{exist}(t_2, s_2) \& t_2 \subseteq t_{RT} \& \text{be-behind-the-door}(s_2, y))]]] \]

The translation says that at some past time John self-ascribes the property \{<w, t, x> \mid \text{there is a man who is annoying } x \text{ in } w \text{ at } s^* \text{ and is behind the door in } w \text{ at } t\}. Note that this property contains the special indexical constant \(s^*\). This violates the constraint proposed above in (47). Since the state of the man’s annoying John is (merely) required to overlap the speech time in this analysis, it is located in the future relative to the time of John’s suspicion. This does not agree with the temporal directionality of the tense (the present tense) of the relative clause, and hence (46) is also violated. I contend that (71) requires a de re reading about a state, just like all other double-access sentences discussed so far. The right interpretation of (71) is provided on the basis of the LF structure given in (73), and the IL translation proceeds as in (74).

(73) LF: \[ CP \text{ Pres}_{3} [S \text{ John Past suspect } s_3 [CP_1 \text{ that } [S[NP \text{ a man who } \text{ be annoying him}]] \emptyset \text{ be behind the door}]]]]

(74)

1. \[ [NP \text{ a man who } [S \text{ e } [S \text{ be annoying him}]] \emptyset \text{ be behind the door}]] \Rightarrow \lambda P \lambda t_1 \lambda x [\text{man}(t_3, x) \& \text{be-annoying-him}(s_1, x) \& P(x)(t_3)]

2. \[ [S[NP \text{ a man who } [S \text{ e } [S \text{ be annoying him}]] \emptyset \text{ be behind the door}]] \Rightarrow \lambda t_1 \lambda t_2 \lambda x [\text{man}(t_3, x) \& \text{be-annoying-him}(s_1, x) \& \exists [t_1 = t_3 \& \text{exist}(s)(t_3) \& \text{be-behind-the-door}(x)(s)]]]

3. \[ [CP \text{ Pres}_{3} [S \text{ John Past suspect } s_3 [CP_1 \text{ that } [S[NP \text{ a man who } [S \text{ e } [S \text{ be annoying him}]] \emptyset \text{ be behind the door}]]]] \Rightarrow \exists s_3 [s^* \subseteq t_{RT} \& \text{exist}(s^*, s_3) \& \exists [t_5 [t_5 < s^* \& t_5 \subseteq t_{RT} \& \text{suspect}(t_5, j, s_3, ^{\lambda t_1 \lambda s_1} \exists [\text{man}(t_1, x) \& \text{be-annoying-him}(s_1, x) \& \exists [\text{exist}(t_1, s) \& \text{be-behind-the-door}(s, s))]]]] (Truth Definition) \]

Since the sentence involves a present tense embedded within a verb complement clause, we slightly modify the lexical semantics of the IL
expression \textit{say}'<<s,i,\textlt{st},\textgt{t},>>>,\textlt{st},<e,<<i,i,t>>,>>\textgt{t} defined in (54) and provide one for \textit{suspect}'<<s,i,\textlt{st},\textgt{t},>>>,\textlt{st},<e,<<i,i,t>>,>>\textgt{t} in (75).

\begin{equation}
\text{For any } w_0 \in W, P_0 \in D_{<s,i,\textlt{st},\textgt{t},>>, \textlt{st},<e,<<i,i,t>>,>>}, s_0 \in S, a_0 \in A, \text{ and } t_0 \in T, \{\text{suspect}'<<s,i,\textlt{st},\textgt{t},>>>,\textlt{st},<e,<<i,i,t>>,>>\textgt{t}\} w_0 (P_0)(s_0)(a_0)(t_0) = 1 \text{ (which informally reads 'in } w_0 \text{ at } t_0, a_0 \text{ ascribes the property } P_0 \text{ to } s_0 \text{') iff there is a 'suitable relation' } SR \in D_{<s,i,\textlt{st},<e,<<i,i,t>>,>>\textgt{t},>>}, \text{ such that (i) } s_0 \text{ is the state to which } a_0 \text{ bears } SR \text{ in } w_0 \text{ at } t_0, \text{ and (ii) for every doxastic alternative } <w, t, x> \text{ of } a_0 \text{ in } w_0 \text{ at } t_0, \text{ the state to which } x \text{ bears } SR \text{ in } w \text{ at } t \text{ has the property } P_0 \text{ in } w \text{ at } t. \}
\end{equation}

According to (75), the final translation given in (74) is true iff there is a suitable relation \( SR \) such that a state \( s_3 \) exists now such that at a past time \( t_5 \), John bears \( SR \) uniquely to \( s_3 \) and self-ascribes the property \( \{<w, t, x> | \text{there is a man } y \text{ and the unique state } s \text{ to which } x \text{ bears } SR \text{ in } w \text{ at } t \text{ is } y \text{'s annoying } x \text{ and at } t \text{ there exists a state } s_5 \text{ that is } y \text{'s } \text{being behind the door in } w \} \). This is the right reading.

### 6.4. FUTURE-UNDER-PAST SENTENCES

So far we have examined those constructions in which a simple present occurs within an intensional domain that is induced by a simple past. However, recall the definition of a double-access sentence given in (3), which involves a \textit{present tense morpheme}, rather than a simple present tense. According to (3), the sentences in (76) are also classified as double-access sentences.\cite{baker1989}

\begin{enumerate}
\item John said that Mary will visit Seattle on Friday.
\item He also said that she will have finished her paper then.
\item John looked for a person who will visit Seattle on Friday.
\item John suspected that a student who will major in semantics was knocking on the door.
\end{enumerate}

\begin{equation}
\text{(76) }\begin{align*}
\text{a. } & \text{John said that Mary will visit Seattle on Friday.} \\
\text{b. } & \text{He also said that she will have finished her paper then.} \\
\text{c. } & \text{John looked for a person who will visit Seattle on Friday.} \\
\text{d. } & \text{John suspected that a student who will major in semantics was knocking on the door.}
\end{align*}
\end{equation}
At first glance, the sentences in (76) do not seem to require a special mechanism unlike the past-controlling-simple-present examples discussed above. But as I explained in Chapter 5, interpreting the future tense in situ is a pseudo-solution. If we simply translate the embedded clause as is, the translation would contain a special indexical expression $s^u$, which denotes the speech time of the report. This information is not directly accessible from the attitude bearer and should not be part of the property he self-ascripts. I believe that a true solution must involve a de re interpretation because the use of will in (76a–d), just like the simple present in the above discussion, involves the speaker’s reinterpretation of the original utterance made by the agent.

Let us consider the above examples in turn. Let us start with a descriptive generalization about (76a). Suppose that John utters (77) on a Monday.

(77) Mary will visit Seattle this Friday.

If today is Wednesday of the same week, (76a) can be uttered truthfully now. On the other hand, (76a) is an unacceptable way of reporting what John said if the report is made on next Monday, presumably because the target date is already past. To obtain the desired interpretation, I propose a movement rule for tense morphemes similar to the one posited for simple present double-access sentences.

(78) Rule for English:

An Obligatory Movement Rule for $Pres + \text{woll}$ at LF

\[ S \ldots [\alpha \ldots \text{Pres woll} \ldots ] \Rightarrow [CP Pres [CP \text{woll}_n [S \ldots t_n [\alpha_m \ldots [TP \emptyset [MP_m \text{woll}_m \ldots ]]]]], \text{where } \alpha \text{ is the outermost category of an intensional context, and } t_n \text{ is a temporal empty category, and } m, n \text{ are numerical indices.} \]

Admittedly, this rule is rather unwieldy, but the intuition this syntactic operation is meant to capture is clear. An occurrence of the future auxiliary will in indirect speech should not be taken to indicate that its indexical meaning is part of “what the agent said.” Rather it is used for the specification of the res involved in a de re attitude report. Thus, $Pres + \text{woll}$ must move to the matrix S level. To represent the subject’s attitude properly, the embedded property must indicate that the episode
The in question is located at a time later than the attitude time. This is due to the temporal directionality isomorphism. This means that we need "woll", but not the present tense morpheme in the embedded clause at LF. This idea is encoded in (78) by the fact that "woll" leaves a copy when it moves, whereas the present tense morpheme leaves a null tense. We also need an intermediate trace, which indicates the res to which the agent ascribes a relevant property. The rule given in (78) applies to (76a) and provides the LF structure given in (79).

\[(79)\]  
\[ \text{[CP Pres [CP woll3 [S John Past say t3 [CP1 that Mary [TP Ø [MP1 woll1 visit Seattle on Friday]]]]]} \]

Some translation rules are proposed in (80) for those LF structures that result from the movement of "Pres" and "woll":

\[(80)\]  
\[ \text{Rules for English:} \]
\[ \text{a. [CP αₙ CP] translates into} \]
\[ \lambda t_2 \lambda t_1 [\alphaₙ(t_1)(t_2) & \exists t[\text{CP}(t_1)]], \text{where } \alpha \text{ is T, M, or Perf, and } n \text{ is a numerical index.} \]
\[ \text{b. [CP αₙ S] translates into} \]
\[ \lambda t_3 \lambda t_1 [\alphaₙ(t_1)(t_3) & \exists t_5[\text{S}(s*)](t_5)], \text{where } \alpha \text{ is Past, woll, or have and } n \text{ is a numerical index.} \]
\[ \text{c. [VP V << s, i, t >>, < i, e, i, t >>, tₙ CPₘ] translates into} \]
\[ V << s, i, t >>, < i, e, i, t >>, (tₙ\lambda tₙ \exists t'[\text{CPₘ}(t')](tₙ)], \text{where } m \text{ and } n \text{ are numerical indices.} \]
\[ \text{d. Translation rule for temporal phrases that bear numerical indices:} \]
\[ \text{[TP T MPₜₐ] translates into} \lambda f\lambda t'[\text{T}(t')(tₜ)] & \text{MP}(f)(t₀)] \]
\[ \text{[N.B.: This rule is designed for “Quasi-Traces,” i.e., copies left behind after movement.]} \]

On the basis of the rules in (80), the translation of (79) proceeds as in (81).
On the basis of the lexical semantics of \textit{say} \langle s, t, x \rangle, \textit{visit Seattle} \langle s, t, x \rangle \rangle presented earlier in (33), the truth conditions for the final formula are given as follows: there is a future time $t$ (relative to the speech time) such that at a past time $t_5$ John ascribes to $t$ the property of being a future time $t_1$ (relative to the attitude time) such that $t_1$ is part of Friday and Mary visits Seattle at $t_1$. To be more formal, the formula is true in $w_0$ iff there is a suitable relation $SR$ such that (i) at some past time $t_0$, John bears $SR$ uniquely to some future time $t''$ (relative to the speech time), and (ii) in $w_0$ at $t_0$, John self-ascribes the property $\langle s, t, x \rangle$ the unique time to which $x$ bears $SR$ in $w$ at $t$ has in $w$ at $t$ the property of being a time $t'$ such that $t'$ is part of Friday and Mary visits Seattle at $t'$. This represents the desired reading.

(76b), repeated here as (82), receives a similar account. But it receives a \textit{de re} reading about two temporal objects and requires a more complex analysis than (76a). Assume that (76a–b) form a short
discourse. The natural interpretation of (76b) is that Mary’s finishing her paper is located earlier than Friday, which is the time of her visiting Seattle.

(82) (John said that Mary will visit Seattle on Friday.)
He also said that she will have finished her paper then.

I posit an LF movement rule for English in (83) to obtain the LF structure given in (84).

(83) Rule for English:
An Obligatory Movement Rule for Pres + woll + have at LF
[S … [α … Pres woll have … ]] ⇒ [CP Pres [CP woll[CP have[CP α[S … tm. tn[αo,p … [TP Ø [MP woll[PerfP have[p … ]]]]])]], where α is the outermost category of an intensional context, m, n, o, p are numerical indices, and tn and tm are temporal empty categories.

(84) LF: [CP Pres [CP woll7 [CP have1 [S he Past say t7 t1 [CP3,4 that she [TP Ø [MP3 woll3 [PerfP4 have4 finish her paper then]]]]]]]

Two additional translation rules in (85) and (86) are proposed to deal with the LF structure (84).

(85) Rule for English [for temporal phrases that bear numerical indices]:
[MP M PerfP] translates into λφλt′λt[MPφ(t9)(t9) & PerfPφ(t′)(t9)(t9)]
[N.B.: This rule is designed for “Quasi-Traces,” i.e., copies left behind after movement.]

(86) Rule for English:
[VP V<ss,si,si,ti,……,si,si,ei,ti,……> tm tn CPo,p] translates into V<ss,si,si,si,ei,ti,……>tn tm CPo,p
(λtλtλtP t′∃[CPo,p(t′)])(tn tm), where m, n, o, p are numerical indices.

The translation of (84) proceeds as in (87).
The final formula says that there is a future time $t_7$ and some time $t$ anterior to $t_7$ such that at some past time $t_5$ (relative to the speech time) he (= John) talks as if he ascribes to $t_7$ and $t$ the following relational property: $t_7$ is located in the future (relative to $t_5$), $t$ is located in the past relative to $t_7$, and she (= Mary) finishes her paper at $t$. To be formal, the lexical semantics for yet another type of say′ is specified in (88):
(88) For any \( w_0 \in W, P_0 \in D_{s,s,i,i,t}, t_1, t_2 \in T, a_0 \in A, \) and \( t_0 \in T, \)
\[
[\text{say}'_{s,s,i,i,t}, i,i,i,i,t] \downarrow_{w_0}(P_0(t_1)(t_2)(a_0)(t_0) = 1 \) (which informally reads ‘in \( w_0 \) at \( t_0 \), \( a_0 \) talks as if \( a_0 \) ascribes the relational property \( P_0 \) to \( t_1 \) and \( t_2 \)’) \iff there are “suitable relations” \( \text{SR}_1 \) and \( \text{SR}_2 \in D_{s,s,i,i,t} \) such that (i) \( t_1 \) is the interval to which \( a_0 \) bears \( \text{SR}_1 \) in \( w_0 \) at \( t_0 \), (ii) \( t_2 \) is the interval to which \( a_0 \) bears \( \text{SR}_2 \) in \( w_0 \) at \( t_0 \), and (iii) \( a_0 \) talks in \( w_0 \) at \( t_0 \) as if for every doxastic alternative \( <w, t, x> \) of \( a_0 \) in \( w_0 \) at \( t_0 \), the interval to which \( x \) bears \( \text{SR}_1 \) in \( w \) at \( t \) and the interval to which \( x \) bears \( \text{SR}_2 \) in \( w \) at \( t \) have the relational property \( P_0 \) in \( w \) at \( t \).

According to (88), the final translation in (87) is true in \( w_0 \) \iff for some future time \( t_2 \) (relative to now) and a time \( t_1 \) located prior to \( t_2 \), there is a past time (relative to now) at which he (= John) bears a relation \( \text{SR}_2 \) only to \( t_2 \) and a relation \( \text{SR}_1 \) only to \( t_1 \) and talks as if he self-ascribes the following property: \{\( <w, t, x> \) | the interval (= \( t_3 \)) to which \( x \) bears \( \text{SR}_1 \) in \( w \) at \( t \) is later than \( t \), and the interval (= \( t_4 \)) to which \( x \) bears \( \text{SR}_2 \) in \( w \) at \( t \) is earlier than \( t_3 \), and she (= Mary) finishes her paper in \( w \) at \( t_4 \)\}. I believe that this account does justice to the native speaker’s intuitions about this sentence.

At this point, we turn to intensional transitive verbs like seek and look for. The example presented earlier as (76c) is repeated here as (89).

(89) John looked for a person who will visit Seattle on Friday.

We can use the technique we have developed above for (76a–b) to account for the reading associated with (89). (89) can be used truthfully when John conducts a search at a past time, say on a Monday, and what he had in mind is characterized by his monologue given in (90).

(90) I want to find a person who will visit Seattle on Friday.

John is not looking for a particular person. He would be happy with any person who will visit Seattle on Friday. Suppose that today is Wednesday of the same week, and (89) is uttered today. In this case,
(89) is a true statement. This reading is "de dicto-like" in that the search is guided by the property described by the relative clause. However, the temporal information conveyed by the relative clause is not exactly the information that guided the search. Our task is to characterize this complex meaning by means of the mechanism introduced in this chapter. The account of (90) that I will offer is based upon the LF structure in (91) and a translation rule given in (92).

(91) \[ CP \ Pres [CP woll_6 [S John Past look for t_6 [NP_4 a man who_1 e_1 [TP \ Ø [MP_4 woll_4 visit Seattle on Friday]]]]] \]

(92) \[ VP V \ltimes s, e, i, t >> t_m NP_4 \ltimes a man who_1 e_1 [TP \ Ø [MP_4 woll_4 visit Seattle on Friday]] \] translates into \[ V \ltimes s, e, i, t >> t_m NP_4 \ltimes a man who_1 e_1 [TP \ Ø [MP_4 woll_4 visit Seattle on Friday]] \] (Truth Definition)

In order to obtain a de re interpretation about an interval with seek or look for, we must give the definition of the lexical meaning of a new type of seek' designed for de re readings about intervals.
(94) For any world \(w_0\), object \(k\) in \(D_{s,s_i,e,t}^{i,i,i,j}\), interval \(t_1\), individual \(a_0\), and interval \(t_0\),
\[
\text{see}^{<s,s_i,e,t>^{i,j,k,i,j,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,
The final line in (97) says that there is some suitable relation $SR$ such that there is a future time $t_4$ to which John uniquely bears $SR$ at some past time $t_0$, and John self-ascribes at $t_0$ the property \{\ang (<w, t, x> | there is a student $y$ who majors in linguistics in $w$ at the unique time $t_2$ to which $x$ bears $SR$ in $w$ at $t$ such that $t < t_2$, and $y$ is knocking on the door in $w$ at $t$). This is the reading we want.

It has been shown in this chapter that some occurrences of tense morphemes receive double-access de re interpretations. In order to predict when such interpretations obtain, I have introduced two principles that must be satisfied by tense morphemes. One is that any attitude report must respect the inherent temporal orientation of tense morphemes. Present tense and null tense are current-time-oriented, future tense is future oriented, and past tense is past oriented. The other principle is that speech-time-oriented indexical expressions such as $s^*$ cannot appear in the translation of the intensional argument of an attitude verb. See (46) and (47) above.

These two principles predict that a simple-present-under-past sentence yields a double-access interpretation. Schematically, this type
of sentence is interpreted on the basis of an LF structure of the form given in (98).

\[(98) \text{[Pres}_1 [ \ldots \text{Past} V s_1 \ldots [ \ldots s_2 \ldots ]]\]

The present tense must move out of the surface position because it is a speech-time-oriented indexical. But since it is employed in a verb complement clause, the reported attitude can only be current time oriented. These considerations force this type of sentence to receive a double-access interpretation. There is a state \( s \) that obtains now such that at a past time the subject ascribed to \( s \) a property of being a current state of some sort.

The two principles also predict that \textit{will}-under-past sentences also receive double-access interpretations. Schematically, their interpretations are based upon LF configurations of the form given in (99).

\[(99) \text{[Pres woll}_1 [ \ldots \text{Past} V t_1 \ldots [ \ldots t_3 \text{ woll}_4 \ldots ]]]\]

The present tense must move out of the surface position because it is an indexical. But in order to conform to the temporal directionality isomorphism, we must move \textit{woll} as well, resulting in the configuration shown in (99). This results in an interpretation in which an interval is recognized as a future time with respect to both the speech time and the time of the attitude. Summarizing the above findings, we now re-define double-access sentence as follows.

\[(100) \text{[Second Version]} \text{ A double-access sentence is defined as a natural language sentence that contains a speech-time-oriented indexical expression in an intensional domain at S-structure. In this type of sentence, the predicate associated with this expression receives a \textit{de re} interpretation on the basis of an LF structure where the expression in question has moved out of the intensional domain. This type of interpretation has a \textit{“double-access”} nature because it causes one and the same temporal object to be viewed from two non-overlapping intervals.}\]
6.5. THE REMAINING POSSIBILITIES

In this chapter, we have seen various examples of double-access sentences. I have shown that double-access phenomena are much more widespread than have previously been assumed in the literature. In this section, I shall speculate on the possibility that some tense configurations that usually receive straightforward de se (“relative tense”) interpretations (with possible applications of the SOT rule) also receive de re readings with an indexical (“absolute tense”) interpretation of the embedded tense. Combining the tense forms Pres, Past and Pres + will (i.e., will) in various ways, we obtain the following nine possible configurations:

(101) [ … Pres … [ … Past … ]]
     [ … Pres … [ … Pres … ]]
     [ … Pres … [ … will … ]]
     [ … Past … [ … Pres … ]]
     [ … Past … [ … will … ]]
     [ … Past … [ … Past … ]]
     [ … will … [ … Past … ]]
     [ … will … [ … Pres … ]]
     [ … will … [ … will … ]]

Capable of Yielding Truth-Conditionally Distinct Double-Access Readings

Capable of Yielding Truth-Conditionally Redundant Double-Access Readings

According to my proposal, the first three configurations license de re readings on the basis of wide scope LF structures for the embedded tenses, but they are virtually identical to their de dicto interpretations. Thus, sentences that conform to these patterns will not be discussed here. Present-under-past examples and future-under-past examples yield truth-conditionally distinct double-access readings, as shown earlier in this chapter. In this section, I will consider the remaining four possibilities and argue that they optionally receive double-access de re interpretations. They are not discussed widely in the literature presumably because double-access readings associated with them are not clearly distinguished from “normal” interpretations of the tenses.
involved. Examples like the following are noted by Costa (1972:44) and Smith (1978), among others:

\[(102)\]
(a) John said last week that Mary visited Seattle two weeks ago. [past—past]
(b) John will claim next week that Bill committed a crime yesterday. [future—past]
(c) John will claim next week that Mary will visit Seattle two weeks from now. [future—future]
(d) John will announce next week that Mary is pregnant now. [future—present]

Intuitively, the episode described in each embedded sentence is described partly from the perspective of the speaker. This is clear from the use of such adverbials as *two weeks ago* and *yesterday*.\(^{18}\) I will hypothesize that the use of this type of adverbial in a sentence implies the indexical interpretation of the tense morpheme in it.\(^{19}\) If this hypothesis is correct, the sentences in (102) also count as double-access sentences. For example, (103a) (= (102a)) can be rendered as in (103b–c):

\[(103)\]
(a) John said last week that Mary visited Seattle two weeks ago.
(b) LF: \(\text{[CP Past}_1\text{ two weeks ago [S John Past say last week}
\text{t}_1\text{ [CP}_6\text{ that Mary Past}_6\text{ visit Seattle]]]}\)
(c) \(\exists t [t < s^* \& t \text{ is two weeks before } s^* \& \exists t_1 [t_1 < s^* \& t_1 \subseteq \text{last-week}' \& \text{say'(t}_1, j, t, \lambda t_5 \lambda t_6 [t_6 < t_5 \& \text{visit'(t}_6, m, \text{Seattle)}])]\)

Although I will not offer a compositional analysis of *two weeks ago*, it is intuitively correct to give this adverbial wide scope along with the embedded past tense. The *IL* translation says that there is a past time \(t\), which is two weeks before the speech time such that at some past time \(t'\), John ascribes to \(t\) the property of being a past time (relative to \(t'\)) at which Mary visits Seattle. Note that the time of Mary’s visiting Seattle is seen as a past time both from the time of John’s saying and also from the speech time of the report. Thus, it is also a double-access sentence. I believe that this is the right interpretation for (103a).
Let us now examine (102b) (= (104a)), which has a past tense in the scope of a future tense.

(104)  

a. John will claim next week that Bill committed a crime yesterday.

b. LF: [CP Past₁ yesterday [S John Pres woll claim next week t₁ [CP₆ that Bill Past₆ commit a crime]]]

c. ∃ₜ[t < s* & t ⊆ yesterday' & ∃ₜ₅[s* < t₁ & t₁ ⊆ next-week' & claim'(t₁, j, t, ^λ₅λ₆[t₆ < t₅ & commit-a-crime'(t₆, b)])]]

(104c) says that there is a past time t that is part of yesterday such that at a future time t' (relative to the present moment) John ascribes to t the property of being a past time (relative to t') at which Bill commits a crime. This is intuitively the right interpretation.

We now move on to future-under-future constructions. (105a) (= (102c)) is analyzed as in (105b–c).

(105)  

a. John will claim next week that Mary will visit Seattle two weeks from now.

b. LF: [CP Pres [CP woll₄ [S John Pres woll claim next week t₃ t₄ [CP₂, that Mary Ø woll₂ visit Seattle two weeks from now]]]]

c. ∃ₙ₄[s* < t₄ & t₄ is two weeks after s* & ∃ₜ₅[s* < t₅ & t₅ is within the next week relative to s* & claim'(t₅, j, t₄, ^λ₅λ₂[t₁ < t₂ & visit'(t₂, m, Seattle)])]]

(105c) says that there is a future time t₄ that is two weeks from now such that at a future time t₅ that is part of next week with respect to now, John ascribes to t₄ the property of being a future time (with respect to t₅) at which Mary visits Seattle. Given the use of time adverbials, this is what we want. Note that the time of Mary’s visiting Seattle is recognized as a future time relative to both the speech time and the claim time.

I believe that (102d) must receive a double-access reading due to the presence of an indexical adverb now. This reading is predicted on the basis of a mechanism analogous to the one used for present-under-past examples. (102d) is repeated here as (106a) and is analyzed as in (106b–c).
According to this analysis, the double-access reading associated with (106a) is the mirror image of the double-access reading associated with simple-present-under-past examples discussed in detail above. The intended interpretation is that there exists a state $s$ now such that at a future time John talks as if he attributes to this state $s$ the property of being a current state of Mary’s being pregnant. (106c) captures this interpretation correctly.

I have discussed the truth-conditionally redundant de re readings for various tense configurations using sentences that contain verb complement clauses. Obviously, the same analysis can be extended to other constructions in a straightforward way. I will not work out the details of such extensions, but the interested reader is encouraged to try to do this on his or her own.

6.6. PAST-UNDER-PAST SIMULTANEOUS READINGS

AS PSEUDO-DOUBLE-ACCESS READINGS

In the light of the preceding discussion, what shall we say about the simultaneous reading associated with a past-under-past sentence in English? In this section, I shall demonstrate that the simultaneous reading of (107a) cannot be analyzed as a de re attitude report with an indexical interpretation of the embedded tense, if we are to preserve the temporal directionality isomorphism. According to the new analysis of double-access de re interpretations developed above, we expect the sentence in (107a) to translate into IL as in (107c) on the basis of the LF structure given in (107b). Our assumption here is that the past tense moves out of the intensional domain without being subject to the SOT rule. Note that a copy of the past tense morpheme is left behind in the complement clause in order to conform to the temporal directionality isomorphism.
John said that Mary was pregnant.

(107) a. John said that Mary was pregnant.
b. LF: [cp Past1 [S John Past say s1[CP 2 that Mary Past 2 be pregnant]]]
c. \[\exists t_1 \exists s_1 [t_1 < s^* \& \exists t' [t' < s^* \& t' \subseteq t_{RT} \& say'(t', j, s_1, ^\lambda t^\lambda s_2 \exists t_3 [t_3 < t \& \exists t_3 (s_2 \& be-pregnant'(s_2, m))]]]

Now the question is whether a purely simultaneous reading of (107a) is predicted on the basis of the formula in (107c). (107c) informally reads, “A state \( s_1 \) exists at some past time \( t_1 \), and John talked at a past time \( t' \) as if he ascribes to \( s_1 \) the property of being a state \( s_2 \) such that \( s_2 \) exists at an earlier time and \( s_2 \) is a state of Mary’s being pregnant.” This only allows a shifted interpretation because Mary’s pregnancy is required to be a past state from John’s viewpoint. If one chooses to ignore the temporal directionality, (107b) translates into IL as in (108).

(108) \[\exists t_1 \exists s_1 [t_1 < s^* \& \exists t' [t' < s^* \& t' \subseteq t_{RT} \& say'(t', j, s_1, ^\lambda t^\lambda s_2 \exists t_3 [be-pregnant'(s_2, m))]]\]

If (108) were a possible translation, we would predict that a simultaneous reading is among the possible interpretations of (107a). (108) says, “There was a state \( s_1 \) at a past time and there was a past time at which John talked as if he ascribed to \( s_1 \) the property of being a state of Mary’s being pregnant.” Since the state is not required to be a previous state from John’s perspective, it is possible for the state to be a current state for John. However, I would argue against this approach because it has some serious problems. First, the IL translation in (108) incorrectly predicts that a forward-shifted reading is also possible, in which the time of Mary’s pregnancy falls between the time of John’s saying and the utterance time of the entire sentence. Second, we would be positing an unmotivated stipulation if we claimed that the temporal directionality isomorphism could be ignored just for this type of sentence.\(^{21}\)

The hypothesis under debate assumes that the embedded past tense in (107a) is not subject to the SOT rule and can still receive a simultaneous reading. If a simultaneous reading based upon a de re interpretation of a “real past tense” were possible in English, we would expect the same to hold for Japanese as well because Japanese has no SOT rule. That is, the Japanese past should also be able to receive a
simultaneous reading when it surfaces in a verb complement clause and is interpreted relative to the speech time. Unfortunately, Japanese past-under-past sentences that involve verb complements can only receive shifted interpretations, as pointed out in earlier chapters.

(109) John-wa Mary-ga byookidat-ta to it-ta.
    John-TOP Mary-NOM be-sick-PAST that say-PAST
    ‘John said that Mary had been sick.’ [shifted reading only]

All else being equal, this invalidates the hypothesis under consideration. Some Japanese native speakers (personal communication) report that past-under-past sentences can receive simultaneous readings when the main predicate is a factive verb (e.g., sit-te iru ‘know’). (110a) is one such example.

(110) a. ?? Taroo-wa zibun-ga gan-dat-ta
    Taro- TOP self-NOM have-cancer-PAST
    to sit-te i-ta.
    that know-PAST
    [Intended] ‘Taro knew that he had cancer.’
    [simultaneous reading]

b. Taroo-wa zibun-ga gan-da
    Taro- TOP self-NOM have-cancer-PRES
    to sit-te i-ta.
    that know-PAST
    ‘Taro knew that he had cancer.’
    [simultaneous reading only]

I agree that simultaneous interpretations for such sentences are less objectionable than non-factive examples like (109), but I think such interpretations are at best marginal. (110b) sounds far better for conveying a simultaneous reading. Thus, it is reasonable to assume that simultaneous readings cannot be conveyed with past-under-past sentences in Japanese. Therefore, the above hypothesis is rejected also under the cross-linguistic considerations.
6.7. DOUBLE-ACCESS SENTENCES IN JAPANESE

So far we have assumed that Japanese has no double-access phenomena. This is true as long as we are only concerned with sentences that obligatorily receive double-access interpretations as defined in (100). However, we have just seen that some occurrences of English tense morphemes may receive truth-conditionally redundant but theoretically interesting double-access (de re) readings. If so, we expect the same phenomena to be found in Japanese as well. I believe that some Japanese sentences do receive double-access interpretations at least in some situations, but they are not clearly distinguished from normal readings of such sentences. Consider the following examples:

(111) a. Taroo-wa kinoo Hanako-ga ima
   Taro-TOP yesterday Hanako-NOM now
   Tookyoo-ni i-ru to it-ta yo.
   Tokyo-at be-PRES that say-PAST ending
   ‘Taro said yesterday that Hanako is in Tokyo now.’
   Ai-ni it-ta ra?
   [Lit] Meeting-DAT go-PAST if
   ‘Why don’t [you] go see her.’

b. Kinoo Taroo-wa Hanako-ga
   yesterday Taro-TOP Hanako- NOM
   ototoi Tookyoo-ni ki-ta
   the day before yesterday Tokyo-to come-PAST
   to it-ta.22
   that say-PAST
   ‘Taro said yesterday that Hanako visited Tokyo the day
   before yesterday.’

(111a) is a type of sentence that has been assumed to receive only a purely simultaneous reading. However, in a context like the one given above, the speaker clearly assumes that Hanako is still in Tokyo (assuming that the conversation is taking place in Tokyo). It seems that (111a) deserves a double-access treatment along the following lines:
I assume a tense movement analogous to the one posited for English. The Japanese present is different from the English present in that its denotation is not inherently tied to the speech time. Therefore, this movement is completely optional. The LF structure in (112a) translates as in (112b). It says that there is a current state $s_2$ such that at a past time, Taro ascribed to $s_2$ the property of being a state of Hanako’s being in Tokyo. The reader is referred to the lexical meaning of say' given in (54) for checking the details of this analysis. (111b) is completely parallel to the English example (103a) because at LF the English past is just like the Japanese past. Therefore, I will not provide a formal analysis of this example. Please refer to (103c) for the IL translation of (103a).

On the basis of the above discussion, we now define “double-access structures” (instead of sentences) in the following manner to accommodate the non-obligatory de re interpretations we have discussed:

(113) [Definitive Version] A double-access structure is defined as an LF structure of a natural language sentence that contains a temporal expression that has moved out of an intensional domain where it originates and is interpreted in relation to the utterance time. This type of structure induces a de re interpretation of the moved expression. This type of interpretation has a “double-access” nature because it causes one and the same temporal object to be viewed from two non-overlapping intervals.
6.8. THE BIG PICTURE: TOWARD A TYPOLOGY OF TENSES

I have looked at the behavior of tense in various syntactic constructions in this book. The main hypothesis that I have pursued is very simple. Tense morphemes are interpreted as embedded within the scope of local tenses (or tense features) at LF. The surface configurations do not necessarily reflect the semantic relations between tense morphemes because tenses may be embedded within NPs, which can quantifier-raise to a VP or to an S. When an NP moves, it takes with it the tenses it contains, if any. Otherwise, tenses are interpreted in situ. I have shown that this very simple proposal accounts for all straightforward cases in Japanese and English. Only one stipulation is needed to distinguish between English and Japanese with regard to tense-related phenomena: English has an SOT rule, whereas Japanese does not.

The view I defend in this book can be referred to as a relative tense theory, which contrasts with an absolute tense theory. As we have seen, these two conflicting views are presented in various guises in the literature. This relative-absolute distinction translates into the distinction between indexicals and non-indexicals in the logical literature. Prior’s (1967) view that natural language tenses correspond to sentential operators whose interpretations are sensitive to shiftable temporal coordinates can be identified with the non-indexical view of tenses. More recent discussions about context-dependency and indexicality by Kaplan (1977) and others tend to stress the indexical nature of tense. The two theories of tense referred to as “an independent theory of tense” and a “SOT theory of tense” by Abusch (1988) can also be understood to characterize these two opposing views. I have shown that the apparent indexical behavior of tense is explained as an epiphenomenon. I shall summarize the main arguments for this position. The fact that tensed sentences are generally interpreted in relation to the speech time is attributed to the semantics of the speech act of saying. I contend that uttering a sentence involves the speaker’s self-ascribing the property denoted by the sentence. Thus, the sentence itself simply denotes a property of the form \( \{ w, t, x \} \), and no reference is made to the speech time. In embedded contexts, tenses are normally interpreted as embedded in the
scope of higher tenses. The *de se* analysis of attitude verbs proposed in this book has the effect of embedding structurally lower tenses. Adjunct clause tenses are literally embedded in the scope of higher tenses. As far as I can see, there are very few exceptions to the above generalization. A major exception is the English present. I regard it as an indexical inherently bound to the speech time. This exceptional character of the English present is partly responsible for obligatory double-access interpretations of some sentences, as shown in the first four sections of this chapter. I have also suggested the possibility that some embedded tenses optionally receive double-access *de re* interpretations. Although double-access phenomena are very interesting and important, they are truly exceptional. The relative tense theory accounts for most straightforward examples.

Based upon the above discussion, I shall suggest on a speculative basis a possible typological classification of natural languages with respect to tense systems. I expect the world’s languages to be classified into the following three types. The first type is exemplified by Japanese, which only has non-indexical (“relative”) tenses. Tenses are generally interpreted as embedded, and the highest tense is interpreted in relation to the speech time via the speaker’s self-ascription of the property denoted by the matrix clause. Occasional *de re* readings, if any, are predicted on the basis of a wide-scope configuration for a tense. This type of language has no SOT rule. The second type is a language that has an obligatory SOT rule. I do not know of a language that conforms to the following description completely, but French (Kamp and Rohrer 1983) perhaps comes close to it. The hypothetical language that I have in mind has an SOT rule and always follows it, resulting in a configuration shown in (114).

(114)  [ … regular past … [ … dummy past + indicator of temporal orientation … ]]

In this language, any embedded tense in the scope of a past tense (and possibly a present tense, too) is always a dummy tense in that it simply acts as a marker of morphological agreement with a higher tense. The schematic structures in (115) show how the temporal orientation of the embedded clause is indicated by expressions other than the “regular” tense morphemes:
(115) a. [ … regular past … [ … dummy past + perfect … ]]
b. [ … regular past … [ … dummy past … ]]
c. [ … regular past … [ … dummy past + future auxiliary … ]]

This language is like English except that the SOT rule is obligatory. (115a) yields a shifted reading, (115b) a simultaneous reading, and (115c) a futurate (or forward-shifted) reading. Since the SOT rule is an obligatory rule, the configuration given in (115b) never yields a shifted interpretation (unlike English). Could we say that the regular past in this hypothetical language is an indexical inherently bound to the speech time? Perhaps. But if our claim about the semantics of the speech act of saying is correct, this claim is presumably valid for any natural language. Therefore, it is not at all necessary for us to assume for the purpose of semantic interpretation that a past tense that only occurs in a matrix clause is inherently speech time oriented. The fact that this type of tense only occurs in a matrix clause could be attributed to some syntactic requirement independently needed in this language.

Finally, the third type is exemplified by English. This type of language has an optional SOT rule. It is probably the most complex (and perhaps the messiest) of the three. Since the SOT rule is not obligatory, past-under-past sentences can receive shifted interpretations, and past-under-present sentences obligatorily yield double-access readings.

I am sure tense systems can differ from one another in countless other ways, and I am merely suggesting a very rough idea about a typology of tense systems here. Kamp and Rohrer’s (1983) work on French tense suggests that the reality is much more complicated than the above discussion suggests. I conclude this book noting the need to investigate many other languages to propose and establish a more substantive basis for a typology of tenses.

NOTES

1 This is a rather loose definition in that when an NP that contains a tense morpheme surfaces in an intensional domain, it could receive a de re interpretation resulting in a non-double-access interpretation. (3) should therefore be understood as a characterization of the type of sentence that can receive a double-access reading. I
could instead define a double-access sentence in terms of its LF properties, but that would run the risk of a circular definition. (3) is nearly theory-neutral and is, therefore, empirically testable.

2 As shown in Chapter 5, (5b–c) do not have to receive a simultaneous reading if the relativized NP receives a de re interpretation.

3 Costa (1972) claims this to be the right analysis.

4 There were a small number of native speakers who did not accept the dialogue described in (20). I have no explanation for this disagreement among the native speakers regarding Hypothesis 3.

5 Let me respond to two possible counter-arguments to my descriptive generalization. It may be contended that in the situation described in (21b) Mary left because she expected John to continue writing a letter for a long time. (In other words, she would have waited if she thought that he would be finished in 3 minutes, for example.) However, I take it that this situation cannot be described by Bill’s statement in (21b). Alternatively, it might be argued that Mary’s leaving in (21b) was caused by John’s writing a letter at an extended period (of which the time of Mary’s leaving is not a final subinterval). I assume that this is not possible as backward causation is improbable. The same comment applies to (21a).

6 I restrict my attention to cases where the sentences in (24) receive a simultaneous interpretation, though the entailment relations hold on a shifted interpretation as well.

7 This point is due to Irene Heim (personal communication).

8 Abusch slightly simplifies Cresswell and von Stechow’s analysis and uses the structure of the form given in (i).

   (i) \([s \text{ NP TNS}_1 [\text{vp } V [s \text{ TNS}_2 [s \lambda t S]]]]\)

9 I added a world coordinate, which Abusch’s (1991:6) original relation \(R_4\) does not contain.

10 Accordingly, the set of types is re-defined as follows: (i) \(e\) is a type; \(i\) is a type; \(t\) is a type; \(p\) is a type (for positions); \(ev\) is a type (for events); \(st\) is a type (for states); (ii) if \(\alpha\) and \(\beta\) are types, so is \(<\alpha, \beta>\); (iii) if \(\alpha\) is a type, so is \(<s, \alpha>\); (iv) nothing else is a type.

11 I leave out a clause that concerns exist*, for “normal” individuals.

12 Also assumed here is the following translation rule:

   (i) \([\text{vp } V <s, \lambda s, \lambda t, \lambda e, \lambda s, \lambda t, \lambda f, \lambda s, \lambda t, \lambda e, \lambda s, \lambda t>\lambda m \text{ CP } \alpha]\) translates into \(V<\lambda s, \lambda t, \lambda f, \lambda s, \lambda t, \lambda e, \lambda s, \lambda t, \lambda f, \lambda s, \lambda t>\lambda m \text{ CP } \alpha t_1((\exists t_2)[\text{CP } \alpha t_1(t_2)](s_m))\)

13 Some readers might object to the use of the term “double-access” here because unlike the case of the simple present, the examples in (76) do not involve any object that overlaps two relevant times. We might as well adopt a separate name for them. However, as we shall see, all sentences considered in this chapter involve a special type of de re attitude report that causes one temporal entity to be viewed from two different time points. In the future-under-past construction, an interval is viewed as a future time both from the speech time and from the past attitude time. In present-under-past examples, one and the same state is viewed from two time points as a
current state. Thus, we will continue to use the same term with a slightly different interpretation. See (100).

14 In theory, we can create other types of examples by replacing the future in the examples (76c–d) with the future perfect. But such constructions are so rarely used that it is hard to think of natural examples. Thus, I will not consider them in this book.

15 The pronouns he and she are rendered with free occurrences of variables y and z, respectively.

16 The lexical semantics for suspect′ (<s, <s, i, t>, <s, <e, t> >) can be obtained by slightly modifying the proposal made in (33) for say′ (<s, <s, i, t>, <s, <e, t> >). Thus, I do not state it explicitly here.

17 It is not my intention to indicate here that a relative tense theory can only be encoded in terms of a de se analysis.

18 Here, I am assuming that such adverbials are indexicals. Smith (1978:60) reports that some speakers can use adverbials like two weeks ago as non-indexicals. For example, for those people, two weeks ago can mean two weeks before. I am not concerned with such uses of these adverbials here.

19 Since the possibilities that I will pursue in this section are speculative in nature, I will not offer a complete set of compositional rules for the translation. Accordingly, these sentences are not necessarily covered by the tools found in the appendix.

20 See Chapter 4 Section 4.2. for discussion on some relevant examples due to Stump (1985).

21 It would of course be even worse to abandon the temporal directionality isomorphism completely.

22 (111b) also has a reading in which the day before yesterday denotes two days before yesterday. I believe this is possible only when the sentence is a direct discourse.
APPENDIX

THE SYNTAX AND SEMANTICS OF TENSES
IN ENGLISH AND JAPANESE

THE MODEL-THEORETIC DEFINITIONS

1. The set of types is defined as follows: (i) $e$ is a type; $i$ is a type; $t$ is a type; $p$ is a type (for positions); $ev$ is a type (for events); $st$ is a type (for states); (ii) if $a$ and $b$ are any types, $<a,b>$ is a type; (iii) if $a$ is any type, $<s,a>$ is a type; (iv) nothing else is a type.

2. The model $M$ consists of $<A, E, S, W, Mt, <, P, C, F>$, where $A$ is a non-empty set (the set of “normal individuals”), $E$ a non-empty set (the set of events), $S$ a non-empty set (the set of states), $W$ a non-empty set (the set of possible worlds), $Mt$ the set of rationals, understood to be the set of moments, $<$ a linear order imposed upon $Mt$, $P$ a non-empty set (a set of positions), $C$ a non-empty set (a set of contexts), and $F$ an interpretation function for all constants of the translation language $IL$. $F$ is a function that applies to an $IL$ constant and yields its “character.” (For example, for any expression $\alpha$ of type $a$, $c \in C$ and $w \in W$, $F(\alpha)(c)(w) \in D_\alpha$) The set of intervals of time $T$ is defined in terms of $Mt$: $T = \text{def } \{t \mid t \subseteq Mt \text{ such that for any } m_1, m_2, m_3 \in Mt \text{ if } m_1, m_3 \in t \text{ and } m_1 < m_2 < m_3, \text{ then } m_2 \in t\}$.

3. Duration is a function from $A \cup E \cup S$ to the set of intervals $T$. For example, for any element $\alpha$ of $A \cup E \cup S$, Duration ($\alpha$) is the maximal interval that $\alpha$ occupies.

4. $H$ is a relation in $W \times T \times A$ such that for any $<w,t,a>$ and $<w',t',a'>$ in $W \times T \times A$, $<w,t,a>$ bears $H$ to $<w',t',a'>$ (informally represented as $<w,t,a>H<w',t',a'>$) iff $<w',t',a'>$ satisfies every property $\alpha$ self-ascribes in $w$ at $t$. When $<w,t,a>H<w',t',a'>$ holds, $<w',t',a'>$ is said to be a doxastic alternative of $<w,t,a>$. (ch. 4 (33))

5. $DA$ is a relation in $W \times T \times A$ such that for any $<w,t,a>$ and $<w',t',a'>$ in $W \times T \times A$, $<w,t,a>$ bears $DA$ to $<w',t',a'>$ (informally
represented as \( <w,t,a>DA<w',t',a'> \) iff \( <w',t',a'> \) satisfies every property \( a \) wishes to have in \( w \) at \( t \). When \( <w,t,a>DA<w',t',a'> \) holds, \( <w',t',a'> \) is said to be a desiderative alternative of \( <w,t,a> \).

6. If \( c \in C \), then
   (i) \( c_{AG} \) (the agent of \( c \)) \( \in A \)
   (ii) \( c_{AD} \) (the addressee of \( c \)) \( \in A \)
   (iii) \( c_{T} \) (the time of \( c \)) \( \in T \)
   (vi) \( c_{P} \) (the position of \( c \)) \( \in P \)
   (v) \( c_{W} \) (the world of \( c \)) \( \in W \)

7. If \( c \in C \), then
   (i) \( F(be-located')(c)(c_{W})(c_{P})(c_{AG})(c_{T}) = 1 \) (That is, \( c_{AG} \) is located at \( c_{P} \) in \( c_{W} \) at \( c_{T} \).)
   (ii) \( F(address')(c)(c_{W})(c_{AD})(c_{AG})(c_{T}) = 1 \) (That is, \( c_{AG} \) addresses \( c_{AD} \) in \( c_{W} \) at \( c_{T} \).)
   (iii) \( g_{c}(t_{RT}) \cap g_{c}(t_{RM}) = \emptyset \), \( g_{c}(t_{RT}) \cap g_{c}(t_{RP}) = \emptyset \), and \( g_{c}(t_{RM}) \cap g_{c}(t_{RP}) = \emptyset \). (That is, the reference times used in the translation of a single clause must be pairwise disjoint sets.)

8. The set of possible denotations of type \( \alpha \), denoted \( D_{\alpha} \), is defined recursively as follows: \( D_{s} = \{0,1\}, D_{a} = A, D_{i} = T, D_{ev} = E, D_{st} = S, D_{p} = P \), for \( s \) and any type \( b, D_{<s,b>} = D_{b}^{W} \) and for any type \( a, b, D_{<a,b>} = D_{b}^{A} \) where \( \{f | f \text{ is a function from } D_{a} \text{ into } D_{b} \} \).

9. For any context \( c \), the value assignment \( g_{c} \) furnished by \( c \) is a function that assigns to each variable of type \( a \) a value in \( D_{a} \).

THE SYNTAX AND INTERPRETATION OF \( IL \)

The set of basic expressions of \( IL \) consists of a set \( Con_{a} \), of constants of type \( a \), and a denumerably infinite set \( Var_{a} \), of variables of type \( a \), for each type \( a. ME_{a} \) for any type \( a \) (the set of meaningful expressions of type \( a \)) is obtained via the following recursive rules, together with the denotations of such expressions with respect to the model \( M, w \in W, g_{c} \) a value assignment furnished by context \( c \), and \( c \in C. \) I will leave out the subscript indicating the model \( M \), unless explicitly required.

1. If \( \alpha \in Con_{a} \), then \( \alpha \in ME_{a} \), and \( \llbracket \alpha \rrbracket_{w,g_{c}} = F(\alpha)(c)(w) \)
2. If \( \alpha \in Var_{a} \), then \( \alpha \in ME_{a} \), and \( \llbracket \alpha \rrbracket_{w,g_{c}} = g_{c}(\alpha) \)
3. \( I \in \text{Con}_c \) and \([I]_{w,g,c} = F(I)(c)(w) = \) the speaker of \( c \)
4. \( s^* \in \text{Con}_c \) and \([s^*]_{w,g,c} = F(s^*)(c)(w) = \) the time of \( c \)
5. \( \text{here} \in \text{Con}_c \) and \([\text{here}]_{w,g,c} = F(\text{here})(c)(w) = \) the position of \( c \)
6. you \( \in \text{Con}_c \) and \([\text{you}]_{w,g,c} = F(\text{you})(c)(w) = \) the addressee of \( c \)
7. \( t_{RT} \in \text{Var}_i \) and \([t_{RT}]_{w,g,c} = g_c(t_{RT})(c)(w) = \) the reference time associated with the tense morpheme in \( c \).
8. \( t_{RM} \in \text{Var}_i \) and \([t_{RM}]_{w,g,c} = g_c(t_{RM})(c)(w) = \) the reference time associated with the future auxiliary in \( c \).
9. \( t_{RP} \in \text{Var}_i \) and \([t_{RP}]_{w,g,c} = g_c(t_{RP})(c)(w) = \) the reference time associated with the perfect in \( c \).
10. \( t_R \in \text{Var}_i \) and \([t_R]_{w,g,c} = g_c(t_R)(c)(w) = \) the reference time associated with the infinitive in \( c \).
11. If \( \alpha \in ME_{<a,b>} \) and \( \beta \in ME_a \), then \( [\alpha \beta]_{w,g,c} = \) \( \alpha \in \text{Var}_i \) and \([\alpha]_{w,g,c} = \) \( \beta \in \text{Var}_i \) and \([\beta]_{w,g,c} = 
12. If \( \alpha \in ME_a \) and \( \beta \in \text{Var}_b \), then \( \lambda \beta[\alpha]_{\in ME_{<b,a>}} \). \( \lambda \beta[\alpha]_{w,g,c} \) is \( \lambda \beta[\alpha]_{w,g,c} \) is that function \( h \) from \( D_b \) into \( D_a \) such that for any \( k \in D_b \), \( h(k) = [\alpha]_{w,g,c} \), where \( g_c^\lambda \beta \) is that assignment just like \( g_c \) with the possible exception that \( g_c^\lambda \beta(k) = k \).
13. If \( \alpha \in ME_a \), then \( [\lambda \alpha]_{w,g,c} \) is \( [\lambda \alpha]_{w,g,c} \) is a function \( h \) from \( W \) to \( D_a \) such that for any \( w' \in W \), \( h(w') = [\alpha]_{w',g,c} \).
14. If \( \alpha \in ME_{<a,b>} \), then \( [\forall \alpha]_{w,g,c} = [\forall \alpha]_{w,g,c} \).
15. If \( \alpha, \beta \in ME_a \), then \( [\alpha \beta]_{w,g,c} = [\alpha \beta]_{w,g,c} = ) = 1 \) iff \( [\alpha]_{w,g,c} = 1 \) iff \( [\alpha]_{w,g,c} = 0 \).
16. If \( \alpha \in ME_f \), then \( [\neg \alpha]_{w,g,c} = 1 \) iff \( [\alpha]_{w,g,c} = 0 \).
17. If \( \phi \in ME_i \) and \( u \in \text{Var}_a \), then \( \exists u \phi \in ME_i \) and \([\exists u \phi]_{w,g,c} = 1 \) iff there exists an object \( k \in D_a \) and \([\phi]_{w,g,c} = 1 \), where \( g_c^u(u) = k \).
18. If \( \phi \in ME_i \) and \( u \in \text{Var}_a \), then \( \exists! u \phi \in ME_i \) and \([\exists! u \phi]_{w,g,c} = 1 \) iff there are exactly two objects \( k \in D_a \) such that \([\alpha]_{w,g,c} = 1 \), where \( g_c^k(u) \) is a value assignment exactly like \( g_c \) with the possible exception that \( g_c^k(u) = k \).
19. If \( t_1, t_2 \in ME_i \), then \([t_1 \leq t_2] \) and \([t_1 < t_2] \in ME_i \), and (i) \([t_1 \leq t_2]_{w,g,c} = 1 \) iff \([t_1]_{w,g,c} \leq [t_2]_{w,g,c} \) and (ii) \([t_1 < t_2]_{w,g,c} = 1 \) iff for every element \( m_1 \) of \([t_1]_{w,g,c} \) and for every element \( m_2 \) of \([t_2]_{w,g,c} \) such that \( m_1 < m_2 \).

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Additional Definitions

1. **Truth Definition**: An IL expression \( \phi \) of type \(<i, <i, t>>\) that serves as a translation of a natural language matrix sentence is true in the context \( c \) (in the structure \( M \)) iff there is a time \( i \in T \) such that \( [\phi]_{M,c_W,g,c} (c_T)(i) = 1 \) (equivalently, \( [\exists [\phi(s^g)(t)]]_{M,c_W,g,c} = 1 \)).

   [N.B.: The idea that an utterance of a sentence is verbal expression of self-ascription of a property is better represented in a system that has the following properties: (i) A natural language sentence translates as an IL expression of type \(<s, <i, <e, i, t>>\>). (ii) If a natural language sentence \( \alpha \) translates into IL as \( \phi \), an utterance of \( \alpha \) in some context \( c \) is understood (in normal situations) as \( c_{AG} \)'s speech act of expressing in \( c_W \) at \( c_T \) his/her self-ascription of the property \{ \(<w, t, x> \mid \text{there is a time } i \text{ such that } [\phi]_{M,c_T,g,c} (c_W)(c_T)(c_{AG})(i) = 1 \). \}

2. **Definition of Validity**: An IL expression \( \phi \) of type \(<i, <i, t>>\) that serves as a translation of a natural language matrix sentence is valid iff for every structure \( M \) and every context \( c \) of \( M \), \( \phi \) is true in \( c \).

Notational Conventions

\( \mathcal{R} \) is a variable of type \(<\langle e, <i, t>, <i, t>, <i, t>\>>\).

\( \mathcal{P} \) is a variable of type \(<s, <i, e, t>>\).

\( P, Q \) are variables of type \(<e, <i, t>>\).

\( P_t, Q_t \) are variables of type \(<i, t>>\).

\( R_t \) is a variable of type \(<i, <i, t>>\).

\( t \) is a variable of type \( i \).

\( w, x, y, z \) are variables of type \( e \).

\( s \) is a variable of type \( st \).

Primes or numerical subscripts are also used to distinguish among variables of the same type.

For any expression \( \alpha \) of type \(<a, <b, t>>\) where \( a \) and \( b \) are any types ("two-place predicate"), and its arguments \( \beta \) (of type \( a \)) and \( \gamma \) (of type \( b \)), \( \alpha(\gamma, \beta) \) is a relational notation equivalent to the official notation \( \alpha(\beta)(\gamma) \). Similarly for "n-place predicates," where \( n \geq 3 \).
Lexical Semantics of IL Constants

Chapter 4

believe’: de se attitudes
(32) For any world $w_0$, property $P_0$ in $D_{s,i,e,t}$, individual $a_0$, and interval $t_0$, $[\text{believe} ]_{w_0}(P_0)(a_0)(t_0)$ is true if and only if at $w_0$, $t_0$, $a_0$ self-ascribes the property $P_0$. That is, every doxastic alternative $<w', t', x'>$ of $a_0$ in $w_0$ at $t_0$ is an element of $\{<w'', t'', x''> | P_0(w'')(t'')(x'') = 1\}$.

say’: de se attitudes
(38) For any world $w_0$, property $P_0$ in $D_{s,i,e,t}$, individual $a_0$, and interval $t_0$, $[\text{say} ]_{w_0}(P_0)(a_0)(t_0)$ is true if and only if at $w_0$, $t_0$, $a_0$ talks as if $a_0$ self-ascribes the property $P_0$. That is, $a_0$ talks in $w_0$ at $t_0$ as if every doxastic alternative $<w', t', x'>$ of $a_0$ in $w_0$ at $t_0$ is an element of $\{<w'', t'', x''> | P_0(w'')(t'')(x'') = 1\}$.

NOM: nominalizer for clausal subjects
(51) NOM is an IL expression of type $s,i,e,t$, and for any $w \in W, k \in D_{s,i,e,t}$, and $a \in A$, $[\text{NOM} ]_w(k)(a) = 1$ iff $a$ is the individual correlate of $k$.

be-obvious’: used for obvious, which takes a clausal subject
(53) For any $a \in A$ and $t \in T$, $[\text{be-obvious} ]_{w,c}(a)(t) = 1$ iff the agent of $c$ (i.e., the speaker) self-ascribes with confidence the property $k$ in $w$ at $t$, where $k$ is such that $[\text{NOM} ]_{w,c}(k)(a) = 1$.

POSS: used for the possessive morpheme (Poss) in English
(78) POSS is an IL expression of type $s,i,e,t$ and for any $w_0 \in W, a_0, A \in A$ and $t_0 \in T$, $[\text{POSS} ]_{w_0}(a_0)(a_1)(t_0) = 1$ iff in $w_0$ at $t_0$, $a_0$ is related to $a_1$ in a non-trivial way. One possibility is that $a_1$ owns $a_0$. Another is that $a_1$ is the agent of the “event” $a_0$.

claim’ $s,i,e,t$, POSS, and claim’ $s,i,e,t$ [used for English]
(80) For some $w \in W, P \in D_{s,i,e,t}$, $a_0, a_1 \in A$ and $t \in T$ if $[\text{claim’ } ]_{w}(P)(a_0)(a_1)(t) = a_0$ and there is some $t' \in T$ such that $[\text{POSS} ]_{w}(a_0)(a_1)(t') = 1$, then $a_1$ self-ascribes the property $P$ in $w$ at $t$. In other words, $[\text{claim’ } ]_{w}(P)(a_1)(t) = 1$. 
claim' \ll <s,s,i,e,t>,<e,e,s,i,t>,<e,e,i,t>\rr and claim' \ll <s,s,i,e,t>,<e,e,i,t>\rr [used for Japanese]

(84) For any P ∈ D<s,s,i,e,t>, any a₀, a₁ ∈ A, and t ∈ T, if
[\text{claim' } \ll <s,s,i,e,t>,<e,e,s,i,t>,<e,e,i,t>\rr ]ₜ₁ \{P\}(a₀)(a₁)(t) = 1, then a₁ should be understood as the event of a₀’s self-ascribing P in w at t. (Thus, \text{claim' } \ll <s,s,i,e,t>,<e,e,i,t>\rr \ll ;w\rr \{P\}(a₀)(t) = 1.)

\textbf{believe': de re attitudes about “normal” individuals}

(94) For any w₀ ∈ W, P₀ ∈ D<s,s,i,e,t>, a₁, a₂ ∈ A, and t₀ ∈ T, 
[\text{believe' } \ll <s,s,i,e,t>,<e,e,s,i,t>,<e,e,i,t>\rr ]ₜ₀ \{P₀\}(a₁)(a₂)(t₀) = 1 (which
informally reads ‘in w₀ at t₀, a₂ ascribes the property P₀ to a₁’) iff
there is a “suitable relation” SR ∈ D<s,s,i,e,t> such that (i) a₁ is
the thing to which a₂ bears SR in w₀ at t₀ (formally:
\forall y[SR(w₀)(t₀)(y)(a₂) = 1 ↔ y = a₁]), and (ii) for every doxastic
alternative <w, t, x> of a₂ in w₀ at t₀, the thing to which x bears SR in
w at t has property P₀ in w at t (formally: \exists y[P₀(w)(t)(y) = 1 & \forall z[SR
(w)(t)(z)(x) = 1 ↔ z = y]].

\textbf{believe': de re attitudes about intervals}

(97) For any w₀ ∈ W, P₀ ∈ D<s,s,i,e,t>, t₁ ∈ T, a₀ ∈ A, and t₀ ∈ T,
[\text{believe' } \ll <s,s,i,e,t>,<e,e,s,i,t>,<e,e,i,t>\rr ]ₜ₀ \{P₀\}(t₁)(a₀)(t₀) = 1 (which
informally reads ‘in w₀ at t₀, a₀ ascribes the property P₀ to t₁’) iff
there is a “suitable relation” SR ∈ D<s,s,i,e,t> such that (i) t₁ is
the interval to which a₀ bears SR in w₀ at t₀, and (ii) for every doxastic
alternative <w, t, x> of a₀ in w₀ at t₀, the interval to which x bears SR in
w at t has the property P₀ in w at t.

\textbf{Chapter 5}

\textbf{seek': de se attitudes}

(38) For any world w₀, object \varnothing in D<s,s,e,i,t>, individual
a₀, and interval t₀, [\text{seek' } \ll <s,s,i,e,t>,<e,e,s,i,t>,<e,e,i,t>\rr ]ₜ₀ \{\varnothing\}(a₀)(t₀) is
true if and only if every desiderative alternative of a₀ in w₀ at t₀ (a₀’s
alternative that has all the properties a₀ wishes to have in w₀ at t₀) is
an element of \{<w, t, y> \mid \varnothing(w)(<x, t₂> \mid there is a time t₁ > t₂ such
that y finds x in w at t₁)(t) = 1\}, and a₀ engages in an activity in w₀ at
t₀ which a₀ believes will enable a₀ to have the property in question.
seek': de re attitudes about “normal” individuals

(40) For any $w_0$, object $\mathcal{J}$ in $D_{<s,<<e,i,t>>,s,i,e,t>>}$, individuals $a_0$ and $a_1$, and interval $t_0$,

\[ \left[ \text{seek}'<s,<<e,i,t>>,s,i,e,t>>\right]_{w_0}(\mathcal{J})(a_1)(a_0)(t_0) \text{ is true if and only if in } w_0 \text{ at } t_0, a_0 \text{ bears some suitable relation } SR \text{ uniquely to } a_1, \text{ and every desiderative alternative of } a_0 \text{ in } w_0 \text{ at } t_0 \text{ is an element of } \left\{ i \text{ such that } \mathcal{J}(w)(i) \right\}, \text{ and } a_0 \text{ engages in an activity in } w_0 \text{ at } t_0 \text{ which } a_0 \text{ believes will enable } a_0 \text{ to have the property in question.} \]

Chapter 6

say': de re attitudes about intervals

(33) For any $w_0 \in W$, $P_0 \in D_{<s,<<e,i,t>>,s,i,e,t>>}$, $t_1 \in T$, $a_0 \in A$, and $t_0 \in T$,

\[ \left[ \text{say}'<s,i,e,t>>\right]_{w_0}(P_0)(t_1)(a_0)(t_0) = 1 \] (which informally reads ‘in $w_0$ at $t_0$, $a_0$ ascribes the property $P_0$ to $t_1$’) iff there is a “suitable relation” $SR \in D_{<s,i,e,t>>}$ such that (i) $t_1$ is the interval to which $a_0$ bears $SR$ in $w_0$ at $t_0$, and (ii) $a_0$ talks in $w_0$ at $t_0$ as if for every doxastic alternative $<w, t, x>$ of $a_0$ in $w_0$ at $t_0$, the interval to which $x$ bears $SR$ in $w$ at $t$ has the property $P_0$ in $w$ at $t$.

exist': used to distinguish between events and states

(38a) $\left[ \text{exist}'_{st}<st,<<t,>>}\right]_w$ (for any $w$) is that function from $S$ to $\left\{ f | f \text{ is a function from } T \text{ to } \{0,1\} \right\}$ such that for any $s \in S$ and $t \in T$,

\[ \left[ \text{exist}'_{st}\right]_w(s)(t) = 1 \] if and only if $t \subseteq \text{Duration}(s)$

(38b) $\left[ \text{exist}'_{ev}\right]_w$ (for any $w$) is that function from $E$ to $\left\{ f | f \text{ is a function from } T \text{ to } \{0,1\} \right\}$ such that for any $e \in E$ and $t \in T$,

\[ \left[ \text{exist}'_{ev}\right]_w(e)(t) = 1 \] if and only if $\text{Duration}(e) = t$

say': de re attitudes about states

(54) For any $w_0 \in W$, $P_0 \in D_{<s,<<e,i,t>>,s,i,e,t>>}$, $s_0 \in S$, $a_0 \in A$, and $t_0 \in T$,

\[ \left[ \text{say}'<s,i,e,t>>\right]_{w_0}(P_0)(s_0)(a_0)(t_0) = 1 \] (which informally reads ‘in $w_0$, $a_0$ talks at $t_0$ as if $a_0$ ascribes the property $P_0$ to $s_0$’) iff there is a “suitable relation” $SR \in D_{<s,i,e,t>>}$ such that (i) $s_0$ is the state to which $a_0$ bears $SR$ in $w_0$ at $t_0$, and (ii) $a_0$ talks in $w_0$ at $t_0$ as if for every doxastic alternative $<w, t, x>$ of $a_0$ in $w_0$ at $t_0$, the state to which $x$ bears $SR$ in $w$ at $t$ has the property $P_0$ in $w$ at $t$. 
find-out': de re attitudes about states [factive cases]
(59) For any \( w_0 \in W, P_0 \in D_{s_s,i_s,i_t,t_s,s_s'}, s_0 \in S, a_0 \in A, \) and \( t_0 \in T, \]
\[ \llbracket \text{find-out}'_{s_s,i_s,i_t,t_s,s_s'} \rrbracket_{w_0}(P_0)(s_0)(a_0)(t_0) = 1 \] (which
informally reads ‘in \( w_0 \) \( t_0 \) is an initial interval at which \( a_0 \) correctly
ascribes the property \( P_0 \) to \( s_0 \)’) iff there is a “suitable relation” \( SR \in
D_{s_s,i_s,i_t,t_s,s_s'} \) such that (i) \( t_0 \) is an initial interval at which \( a_0 \) bears
\( SR \) to \( s_0 \) in \( w_0 \), (ii) \( a_0 \) self-ascribes in \( w_0 \) at \( t_0 \) the property of bearing
\( SR \) uniquely to some state \( s \), which has \( P_0 \), and (iii) \( s_0 \) has the property
\( P_0 \) in \( w_0 \) at \( t_0 \).

say': de re attitudes about states and de se attitudes about
“normal” individuals
(64) For any \( w_0 \in W, P_0 \in D_{s_s,i_s,i_t,t_s,s_s'}, s_0 \in S, a_0 \in A, \) and \( t_0 \in T, \]
\[ \llbracket \text{say}'_{s_s,i_s,i_t,t_s,s_s'} \rrbracket_{w_0}(P_0)(s_0)(a_0)(t_0) = 1 \] iff there
is a “suitable relation” \( SR \in D_{s_s,i_s,i_t,t_s,s_s'} \) such that (i) \( s_0 \) is the
state to which \( a_0 \) bears \( SR \) in \( w_0 \) at \( t_0 \), and (ii) \( a_0 \) talks in \( w_0 \) at \( t_0 \) as if
\( a_0 \) self-ascribes the following property: \( \{ <w, t, x> | \) there is a unique \( s \)
to which \( x \) bears \( SR \) in \( w \) at \( t \) and \( P_0(w)(t)(x)(s) = 1 \}

seek': de re attitudes about states
(70) For any world \( w_0 \), object \( k \) in \( D_{s_s,i_s,i_t,t_s,s_s'}, \) state \( s_0 \),
individual \( a_0 \), and interval \( t_0 \),
\[ \llbracket \text{seek}'_{s_s,i_s,i_t,t_s,s_s'} \rrbracket_{w_0}(k)(s_0)(a_0)(t_0) \] is true if
and only if there is a suitable relation \( SR \in D_{s_s,i_s,i_t,t_s,s_s'} \) such that
(i) \( s_0 \) is the thing to which \( a_0 \) bears \( SR \) in \( w_0 \) at \( t_0 \), and (ii) every
desiderative alternative of \( a_0 \) in \( w_0 \) at \( t_0 \) (\( a_0 \)’s alternative that has all
the properties \( a_0 \) wishes to have in \( w_0 \) at \( t_0 \)) is an element of \( \{ <w, t, y> | \)
the unique state \( s \) to which \( y \) bears \( SR \) in \( w \) at \( t \) is such that \( k(w)(\{<x,
t_2> | \) there is a time \( t_1 > t_2 \) such that \( y \) finds \( x \) in \( w \) at \( t_1 \})(t)(s) = 1 \}, \) and
(iii) \( a_0 \) engages in an activity in \( w_0 \) at \( t_0 \) which \( a_0 \) believes will enable
\( a_0 \) to have the property in question.

suspect': de re attitudes about states
(75) For any \( w_0 \in W, P_0 \in D_{s_s,i_s,i_t,t_s,s_s'}, s_0 \in S, a_0 \in A, \) and \( t_0 \in T, \]
\[ \llbracket \text{suspect}'_{s_s,i_s,i_t,t_s,s_s'} \rrbracket_{w_0}(P_0)(s_0)(a_0)(t_0) = 1 \] (which
informally reads ‘in \( w_0 \) at \( t_0 \) \( a_0 \) ascribes the property \( P_0 \) to \( s_0 \)’) iff there
is a “suitable relation” \( SR \in D_{s_s,i_s,i_t,t_s,s_s'} \) such that (i) \( s_0 \) is the
state to which \( a_0 \) bears \( SR \) in \( w_0 \) at \( t_0 \), and (ii) for every doxastic
alternative \( <w, t, x> \) of \( a_0 \) in \( w_0 \) at \( t_0 \), the state to which \( x \) bears \( SR \) in
\( w \) at \( t \) has the property \( P_0 \) in \( w \) at \( t \).
say′: double de re attitudes about two intervals
(88) For any \(w_0 \in W\), \(P_0 \in D_{s,<i,i,i,i>}, t_1, t_2 \in T\), \(a_0 \in A\), and \(t_0 \in T\), \(\text{say}^{\prime} <s,i,i,i,i,i>,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i,i
Chapter 6

(46) **Temporal Directionality Isomorphism:** Any attitude report must be made in such a way that the temporal directionality of a reported attitude agrees with the inherent temporal orientation of the tense morpheme that appears in the verb complement clause at LF. When a double-access *de re* attitude report is made, the perspective of the reporter must also obey this constraint in that the temporal direction of the event or state from the viewpoint of the reporter must also agree with the inherent temporal directionality of the tense morpheme that is used in the rendition of the reported attitude.

(47) Speech-time-oriented indexicals such as *s*, *today*, etc. cannot appear in the translation of the intensional argument of an attitude verb.

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**A GRAMMAR OF AN ENGLISH FRAGMENT**

**English Syntactic Categories and Some Examples** [selective]

<table>
<thead>
<tr>
<th>CATEGORIES</th>
<th>NAME/NICKNAME</th>
<th>EXAMPLES</th>
</tr>
</thead>
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<tr>
<td>S</td>
<td>sentence</td>
<td>John walks.</td>
</tr>
<tr>
<td>NP_e</td>
<td>“referential” NP</td>
<td>Sue, PRO, e, him, herself</td>
</tr>
<tr>
<td>NP&lt;&lt;e,si,t&gt;&gt;,&lt;i,t&gt;&gt;</td>
<td>“quantificational” NP</td>
<td>every boy, a girl</td>
</tr>
<tr>
<td>VP</td>
<td>verb phrase</td>
<td>walk, love Bill</td>
</tr>
<tr>
<td>N&lt;&lt;e,si,t&gt;&gt;</td>
<td>common noun</td>
<td>book, fish claim,</td>
</tr>
<tr>
<td>N&lt;&lt;s,si,&lt;&lt;e,si,t&gt;&gt;,&lt;&lt;e,si,t&gt;&gt;,</td>
<td>noun that takes a</td>
<td>announcement believe,</td>
</tr>
<tr>
<td>V&lt;&lt;s,si,&lt;&lt;e,si,t&gt;&gt;,&lt;&lt;e,si,t&gt;&gt;,</td>
<td>“propositional</td>
<td>suspect</td>
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<tr>
<td></td>
<td>attitude” verb, indirect discourse</td>
<td>verb</td>
</tr>
</tbody>
</table>
CATEGORIES
V<e,<e,ei,t>>, extensional transitive hit, touch, kiss verb
V<s,<e,<e,ei,t>>, ei,t>>, intensional transitive seek, want verb

[N.B.: Many other types of verbs are posited in the text for various types of attitudes. See the lexical semantics of specific verbs above.]

Type Assignment for English Syntactic Categories [selective]

The type assignment $f$ for English categories is a function from the set of English syntactic categories into the set of types and is partially defined as follows:

$f(N_1) = f(N) = (e,<i,t>)$
$f(N<s,<e,ei,t>>,ei,t>) = (s,<e,<e,ei,t>>,ei,t>)$
$f(NP_1) = f(\epsilon_1) = e_1$, $f(s_n) = st$, $f(t_n) = i$

[where $n$ is a numerical subscript]
$f(NP<s,<e,ei,t>>,ei,t>) = (e,<e,ei,t>,<i,t>)$
$f(VP) = (e,<e,ei,t>)$
$f(V<s,<e,ei,t>>,ei,t>) = (s,<e,ei,t>,<e,ei,t>)$
$f(V<e,ei,t>) = (e,<e,ei,t>)$
$f(V<s,<e,ei,t>>,ei,t>) = (s,<e,ei,t>,<i,t>,<e,ei,t>)$
$f(\alpha) = f(\alpha) = (e,<e,ei,t>,<i,t>,<i,t>)$

[N.B. In some situations, type-raising operations must be performed on $\lambda$ expressions. For example, when a name, pronoun, or an empty category appears in the subject position, the type of its translation must be raised to that of a generalized quantifier: $j \Rightarrow \lambda l P(j)(t)$. See Partee and Rooth (1983) and Rooth and Partee (1982).]
Phrase Structure Rules and Translation Rules

Bold-face symbols indicate IL translations. For example, \textbf{NP} = the translation of NP.

1. \( S \rightarrow \text{NP TP} \) [where \( \alpha \) is either + or -]
   - \([\alpha \text{ fin}] [\alpha \text{ fin}]\) translates into \( \text{TP(NP)} \)
2. \( \text{TP} \rightarrow \text{to VP} \)
   - \([\text{to VP}] \) translates into \( \lambda \varphi \lambda t' [\varphi(\lambda x \lambda t' [t = t' & \text{VP}(x(t))])] \) (ch. 4 (71))
3. \( \text{TP} \rightarrow \text{to PerfP} \)
   - \([\text{to PerfP}] \) translates into \( \lambda \varphi \lambda t' \lambda t' [t = t' & \text{PerfP}(\varphi(t))] \)
4. \( \text{NP} \rightarrow \text{Det N} \)
   - \([\text{Det N}] \) translates into \( \text{Det(N)} \) (ch. 4 (76b))
5. \( \text{NP} \rightarrow \text{Name} \)
   - \([\text{Name}] \) translates into \( \text{Name} \)
6. \( S \rightarrow \text{CP TP} \)
   - \([\text{CP TP}] \) translates into \( \lambda P \lambda y \exists y[P(t, y) & \text{NOM}(y, ^*\lambda x \lambda t' [t = t' & \text{CP}(x(t))])] \) (ch. 4 (51))
7. \( \text{N}' \rightarrow \text{TAdj N}' \)
   - \([\text{TAdj N']}' \) translates into \( \text{N}' \)
     - [N.B.: TAdj is ignored in the semantics, as mentioned in the text.]
8. \( \text{N'} \rightarrow \text{N'} \ CP \) [for relative clauses]
   - \([\text{N'} \ CP] \) translates into \( \lambda \lambda t' [\text{CP}(x(t)) & \text{N}(x(t))] \) (relativized N') (ch. 5 (27b))
9. \( \text{N'} \rightarrow N_{<s, s, i, t>, <e, s, i, t>, <s, i, t>, <e, i, t>, <e, i, t>, <s, i, t>, <e, i, t>}> CP \) [for noun complements]
   - \([\text{N'} \ CP] \) translates into \( N_{<s, s, i, t>, <e, s, i, t>, <s, i, t>, <e, i, t>, <e, i, t>, <s, i, t>, <e, i, t>}> \) (ch. 4 (76c))
10. \( \text{N'} \rightarrow N_{<e, s, i, t>, <s, s, i, t>, <e, i, t>, <e, i, t>}> \)
    - \([\text{N'} \ CP] \) translates into \( N_{<e, s, i, t>, <s, s, i, t>, <e, i, t>, <e, i, t>}> \) (ch. 4 (76c))
11. \( \text{Det} \rightarrow \text{NP Poss} \)
    - \([\text{Det NP Poss}] \) translates into \( \text{Poss(NP)} \) (ch. 4 (76a))
12. \( CP \rightarrow C \ S \)  
\[ \alpha \in \text{fin} \]  
\[ \alpha \in \text{fin} \]  
- \( CP \ C \ S \) (where \( C \) does not contain a \( wh \)-expression) 
\[ \text{fin} \]  
\[ \text{fin} \]  
translates as \( \lambda_{t_1} \lambda_{t_2}[t_1 < t_2 & t_2 \leq t_1 & S(t_1)(t_2)] \) (ch. 4 (74d)) 
- \( CP \ C \ S \) (where \( C \) does not contain a \( wh \)-expression) 
\[ \alpha \in \text{fin} \]  
\[ \alpha \in \text{fin} \]  
translates into \( S \) (ch. 4 (37b)) 
13. \( VP \rightarrow V \ NP \)  
- \( [VP V_{<e,e,i,i,i,i>}, NP] \) translates into \( V_{<e,e,i,i,i,i>} (NP) \) 
- \( [VP V_{<e,e,i,i,i,i>,<e,e,i,i,i,i>}, NP] \) translates into \( V_{<e,e,i,i,i,i>,<e,e,i,i,i,i>} (^NP) \) (ch. 5 (36)) 
14. \( VP \rightarrow V \ CP \)  
\[ \alpha \in \text{fin} \]  
\[ \alpha \in \text{fin} \]  
- \( [VP V_{<e,e,i,i,i,i>,<e,e,i,i,i,i>}, CP] \) translates into \( V_{^\lambda t_{\lambda x \exists t'}[CP(t')(t')]} \) (ch. 4 (37c)) 
15. \( VP \rightarrow V \ S \)  
\[ \alpha \in \text{fin} \]  
\[ \alpha \in \text{fin} \]  
- \( [VP V_{<e,e,i,i,i,i>,<e,e,i,i,i,i>}, CP] \) translates into \( V_{(\lambda t_{\lambda x \exists t'}[S(t')(t')]} \) (ch. 4 (70c)) 
16. \( VP \rightarrow V \ NP \ CP \)  
- \( [VP V_{NP, CP}] \) translates into \( [V(NP)](\lambda t_{\lambda t_{\lambda x \exists t'}[CP(t')(t')]} \) 
17. \( VP \rightarrow V \)  
\[ \alpha \in \text{fin} \]  
\[ \alpha \in \text{fin} \]  
- \( [VP V] \) translates into \( V \) 
18. \( TP \rightarrow T \ MP \)  
\[ \alpha \in \text{fin} \]  
\[ \alpha \in \text{fin} \]  
- \( [TP T \ MP] \) translates into \( \lambda \rho \lambda \lambda \lambda [T(t')(t') & \exists t_1[MP(\rho)(t_1)]] \) 
19. \( TP \rightarrow T \ PerfP \)  
\[ \alpha \in \text{fin} \]  
\[ \alpha \in \text{fin} \]  
- \( [TP T \ PerfP] \) translates into \( \lambda \rho \lambda \lambda \lambda [T(t')(t') & \exists t_1[PerfP(\rho)(t_1)]] \) 
20. \( TP \rightarrow T \ VP \)  
\[ \alpha \in \text{fin} \]  
\[ \alpha \in \text{fin} \]  
- \( [TP T \ VP] \) translates into \( \lambda \rho \lambda \lambda \lambda [T(t')(t') & VP(x)(t')] \) or \( \lambda \rho \lambda \lambda \lambda [T(t')(t') & \exists x[VP(x)(t']) \) (ch. 6 (40))
21. **MP → MP Adv**
   - \([\text{MP MP Adv}]\) translates into
     \[\lambda \varphi \lambda t_1 [t \subseteq \text{Adv} & \text{MP}(\varphi)(t)(t_1)]\]

22. **MP → M PerfP**
   - \([\text{MP M PerfP}]\) translates into
     \[\lambda \varphi \lambda t_1 [t \subseteq \text{M PerfP}(\varphi)(t)(t_1)]\]

23. **MP → M VP**
   - \([\text{MP M VP}]\) translates into
     \[\lambda \varphi \lambda t_1 [t \subseteq \text{M VP}(\varphi)(t)(t_1)]\]

24. **PerfP → PerfP Adv**
   - \([\text{PerfP PerfP Adv}]\) translates into
     \[\lambda \varphi \lambda t_1 [t \subseteq \text{PerfP}(\varphi)(t)(t_1)]\]

25. **PerfP → Perf VP**
   - \([\text{PerfP Perf VP}]\) translates into
     \[\lambda \varphi \lambda t_1 [t \subseteq \text{Perf VP}(\varphi)(t)(t_1)]\]

26. **VP → VP Adv**
   - \([\text{VP VP Adv}]\) translates into
     \[\lambda \varphi \lambda t_1 [t \subseteq \text{VP}(\varphi)(t)(t_1)]\]

27. **#!AdvP → #!Adv Adv**
   - \([\text{#!AdvP #!Adv Adv}]\) translates into
     \[\text{#!Adv}(\text{Adv})\]

28. **VP → VP #!AdvP**
   - \([\text{VP VP #!AdvP}]\) translates into
     \[\text{#!AdvP}(\text{VP})\]

---

**Transformational Rules and Translation Rules**

1. **Wh-Movement** [assumed and not given in the text explicitly]:
   - \([\text{CP [S ... wh ... ]}] \rightarrow [\text{CP whn [S ... e_n ... ]}]\)
   - \([\text{CP whn [S ... e_n ... ]}]\) translates into
     \[\lambda \varphi \lambda t_1 [t \subseteq \text{Adv}(\varphi)(t)(t_1)]\]
     (ch. 5 (27a))
2. **Quantifier Raising**

A structure of the form \([\alpha \ldots \text{NP}_n \ldots]\) is optionally converted either to (i) or to (ii) at LF: (i) \([\alpha \text{NP}_n [\alpha \ldots e_n \ldots]]\), where \(\alpha\) is either S, CP or VP and \(n\) is a numerical index, and \(\alpha\) does not contain any intensional domain that contains \(e_n\). (ii) \([\alpha \text{NP}_n [\alpha \ldots e_n[m_\beta \ldots e_m \ldots]]\), where \(\alpha\) is either S or CP, \(n\) and \(m\) are numerical indices such that \(m \neq n\), and \(\beta\) is the outermost category of an intensional context. [N.B.: This rule must apply before the SOT rule applies.] (ch. 5 (34))

- \([S \text{NP}_n S]\) translates into \(\lambda t_1 \lambda t_2 [\text{NP}_n(\lambda x_n \lambda t[S(t)(t_2)])(t_1)]\)
  (QR to S) (ch. 5 (27d))
- \([CP \text{NP}_n CP]\) translates into \(\lambda t_1 \lambda t_2 [\text{NP}_n(\lambda x_n \lambda t[CP(t)(t_2)])(t_1)]\)
  (QR to CP) (ch. 6 (61))
- \([VP \text{NP}_n VP]\) translates into \(\lambda x [\text{NP}_n(\lambda x_n \lambda t'[VP(x)(t')])\]
  (QR to VP) (ch. 5 (27e))
- \([VP \text{V}<<s,<<e,<<i,<<e,>>>e_n \text{mNP}]\) translates into \(\lambda t_1 \lambda t_2 [\text{NP}_n(\lambda x_n \lambda t'[VP(x)(t')])\)
  (\(\lambda\text{P}\lambda x_m[P(t, m\text{NP})])(x_n)\) (ch. 5 (39c))
- \([VP \text{V}<<s,<<i,<<e,>>>e_m \text{nCP}]\) translates into \(\lambda t_1 \lambda t_2 [\text{NP}_n(\lambda x_n \lambda t'[VP(x)(t')])\)
  (\(\lambda\text{P}\lambda x_m[P(t, m\text{NP})])(x_n)\) (ch. 5 (42c))

3. **The SOT rule**

If a tense feature \(B\) is the local tense feature of a tense feature \(A\) at LF, and \(A\) and \(B\) are occurrences of the same feature (i.e., either [+past] or [+pres]), \(A\) and the tense associated with \(A\) (if any) are optionally deleted. N.B.: (i) The tense features include [+past] and [+pres] and nothing else. (ii) A tense feature \(A\) is “in the scope” of a tense feature \(B\) iff \(B\) is associated with a common noun and asymmetrically \(c\)-commands \(A\), or \(B\) is associated with a tense or a perfect and asymmetrically commands \(A\). (iii) A tense feature \(B\) is the local tense feature of a tense feature \(A\) iff \(A\) is “in the scope” of \(B\) and there is no tense feature \(C\) “in the scope” of \(B\) such that \(A\) is “in the scope” of \(C\).
(ch. 4 (67))
4. **An Obligatory Movement Rule for Present Tense at LF**

\[ [s \ldots [\alpha \ldots \text{Pres}\ldots]] \Rightarrow [\text{CP Pres}_n [s \ldots s_2 [\alpha_1 \ldots s_1 \ldots]], \text{where } \alpha \text{ is the outermost category of an intensional context, and } s_1 \text{ and } s_2 \text{ are state empty categories.} \] (ch. 6 (49))

- \([\text{CP Pres}_n S] \text{ translates into } \lambda \tau_3 \lambda \tau_2 \exists s_n [\text{Pres}_n(t_2)(t_3) \& \exists t_2, s_n] \& \exists t_5 [S(s^*)(t_5)] \] (ch. 6 (50))

- \([\text{TP} \text{IT } s_2] \text{ VP}] \text{ translates into } \lambda \varphi \lambda \lambda t [\varphi(\lambda \alpha \lambda \lambda t'[\text{VP}(\alpha)(s_2)])] \] (ch. 6 (51))

- \([\text{VP} V <s, i, s_t, \ldots>, \text{st, } e, \text{e}_1, \text{e}_2, \ldots> s_m \text{ CP}_n] \text{ translates into } V <s, i, s_t, \ldots>, \text{st, } e, \text{e}_1, \text{e}_2, \ldots>(\lambda \tau_1 \lambda \lambda t \lambda \lambda t_2 [\text{CP}_n(t_1)(t_2)](s_m)) \] (ch. 6 (52))

- \([\text{VP} V <s, i, <e, s_t, \ldots>, s_t, e, s_i, \ldots> s_m \text{ CP}_n] \text{ translates into } V <s, i, <e, s_t, \ldots>, s_t, e, s_i, \ldots>(\lambda \tau_1 \lambda \lambda t \lambda \lambda t_2 [\text{CP}_n(t_1)(t_2)](s_m)) \] (ch. 6 (52))

- \([\text{VP} V <s, i, <e, s_t, \ldots>, s_t, e, s_i, \ldots> s_m \text{ NP}_n] \text{ translates into } V <s, i, <e, s_t, \ldots>, s_t, e, s_i, \ldots>(\lambda \lambda t \lambda \lambda t_2 [\text{NP}_n(P)(t_1)](s_m)) \] (ch. 6 (52))

5. **An Obligatory Movement Rule for Pres + woll at LF**

\[ [s \ldots [\alpha \ldots \text{Pres} \ldots \text{woll}\ldots]] \Rightarrow [\text{CP Pres}_n [\text{CP} \text{woll}_m [s \ldots t_n [\alpha_m \ldots [\text{TP } \text{MP}_m \text{woll}_m \ldots \ldots]]]], \text{where } \alpha \text{ is the outermost category of an intensional context, and } t_n \text{ is a temporal empty category, and } m, n \text{ are numerical indices.} \] (ch. 6 (78))

- \([\text{CP } \alpha_n \text{ CP}] \text{ translates into } \lambda \tau_2 \lambda \tau_1 \alpha_n(t_n)(t_2) \& \exists t [\text{CP}_n(t)(t_2)], \text{ where } \alpha \text{ is } T, M, \text{ or Perf, and } n \text{ is a numerical index.} \] (ch. 6 (80a))

- \([\text{CP } \alpha_n S] \text{ translates into } \lambda \tau_3 \lambda \tau_2 \alpha_n(t_n)(t_3) \& \exists t_5 [S(s^*)(t_5)], \text{ where } \alpha \text{ is } \text{Past, } \text{woll, or have and } n \text{ is a numerical index.} \] (ch. 6 (80b))

- \([\text{VP} V <s, i, s_t, \ldots>, s_t, e, s_i, \ldots> t_n \text{ CP}_m] \text{ translates into } V <s, i, s_t, \ldots>, s_t, e, s_i, \ldots>(\lambda \tau_1 \lambda \lambda t \lambda \lambda t_2 [\text{CP}_m(t_1)(t_2)](t_n)), \text{ where } m \text{ and } n \text{ are numerical indices.} \] (ch. 6 (80c))

- \([\text{TP } T \text{ MP}_n] \text{ translates into } \lambda \varphi \lambda \lambda t [\text{T}(t)(t_1)' \& \MP(t_1)](t_2) \] (ch. 6 (80d))

- \([\text{VP} V <s, i, s_t, \ldots>, s_t, e, s_i, \ldots> t_m \text{ NP}_n] \text{ translates into } V <s, i, s_t, \ldots>, s_t, e, s_i, \ldots>(\lambda \lambda P \lambda \lambda t \lambda \lambda t_2 [\text{NP}_n(P)(t_1)](t_m)) \] (ch. 6 (92))
6. **An Obligatory Movement Rule for Pres + will + have at LF**

\[ [S \ldots [\alpha \ldots \text{Pres} \, \text{woll} \, \text{have} \ldots ]] \Rightarrow [\text{CP} \, \text{Pres} \, [\text{CP} \, \text{woll}_m \, [\text{CP} \, \text{have}_n \, [\ldots \text{TP} \, \emptyset \, [\text{CP}_o \, \text{woll}_p \, [\text{CP}_o \, \text{have}_p \ldots ]]]]]]] \]

where \( \alpha \) is the outermost category of an intensional context, \( m, n, o, p \) are numerical indices, and \( t_n \) and \( t_m \) are temporal empty categories. (ch. 6 (83))

**Lexicon**

<table>
<thead>
<tr>
<th>CAT.</th>
<th>LEXICAL ITEM</th>
<th>TRANSLATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>( \emptyset )</td>
<td>( \lambda t_1 \lambda t_2 [t_1 = t_2] ) (ch. 4 (37a))</td>
</tr>
<tr>
<td>T</td>
<td>Past</td>
<td>( \lambda t_1 \lambda t_2 [t_1 &lt; t_2 \land t_1 \leq t_{\text{RT}}] )</td>
</tr>
<tr>
<td>T</td>
<td>Pres</td>
<td>( \lambda t_1 \lambda t_2 [t_1 = s^* \land t_1 \leq t_{\text{RT}}] )</td>
</tr>
<tr>
<td>M</td>
<td>will</td>
<td>( \lambda t_1 \lambda t_2 [t_2 &lt; t_1 \land t_1 \leq t_{\text{RM}}] )</td>
</tr>
<tr>
<td>Perf</td>
<td>have</td>
<td>( \lambda t_1 \lambda t_2 [t_1 &lt; t_2 \land t_1 \leq t_{\text{RP}}] )</td>
</tr>
<tr>
<td>Adv</td>
<td>in-1983</td>
<td>1983'</td>
</tr>
<tr>
<td>Adv</td>
<td>tomorrow</td>
<td>tomorrow'</td>
</tr>
<tr>
<td>Adv</td>
<td>in-January</td>
<td>January'</td>
</tr>
<tr>
<td>#!Adv</td>
<td>exactly twice</td>
<td>( \lambda t_1 \lambda t_2 \exists t_3 (t_3 \leq t) \land t = t'' \land P(x)(t_3) )</td>
</tr>
<tr>
<td>V</td>
<td>believe [ _ S ]</td>
<td>believe' (ch. 4 (70b))</td>
</tr>
<tr>
<td>V</td>
<td>expect [ _ S ]</td>
<td>( \lambda P [\text{expect}'(\lambda t_1 \lambda y \exists t_2 [t_2 &lt; t_2 \land t_2 \leq t_{\text{R}} \land \lambda P(t_2)(y))] ) (ch. 4 (72c))</td>
</tr>
<tr>
<td>V</td>
<td>remember [ _ S ]</td>
<td>( \lambda P [\text{remember}'(\lambda t_1 \lambda y \exists t_2 [t_2 &lt; t_1 \land t_2 \leq t_{\text{R}} \land \lambda P(t_2)(y))] ) (ch. 4 (73c))</td>
</tr>
<tr>
<td>V</td>
<td>convince</td>
<td>convince'</td>
</tr>
<tr>
<td></td>
<td>[ _ \text{NP CP} ]</td>
<td>(ch. 4 (74c))</td>
</tr>
<tr>
<td>—</td>
<td>Poss</td>
<td>( \lambda \varphi \lambda P \exists t_3 [\forall x [\varphi(x)(t) \land y \varphi(y)(t)] \leftrightarrow x = y] \land Q(y)(t)] ) (ch. 4 (76d))</td>
</tr>
</tbody>
</table>
A GRAMMAR OF A JAPANESE FRAGMENT

Type Assignment for Japanese Syntactic Categories

The type assignment $h$ for Japanese categories (a function from the set of Japanese syntactic categories into the set of types) is almost identical with the assignment $f$ for English, with the following important exception: $h(T) = \langle i, i, \langle i, t \rangle \rangle$

Phrase Structure Rules and Translation Rules

1. $S \rightarrow NP \ VP \ T$
   - $[S \ NP \ VP \ T]$ translates into $T(NP(VP))$
2. $VP \rightarrow Adv \ VP$
   - $[VP \ Adv \ VP]$ translates into $Adv(VP)$
3. $VP \rightarrow V$
   - $[VP \ V]$ translates into $V$
4. $VP \rightarrow NP \ V$
   - $[VP \ NP \ V]$ translates into $V(NP)$
5. $\text{VP} \rightarrow \text{CP} \quad \text{V}$  
   • $[\text{VP} \quad \text{CP} \quad \text{V} <= \text{V} <= \text{CP}(\text{V})]$ translates into $\text{V}(\lambda \text{s} \quad \lambda \text{i} \quad \lambda \text{e} \quad \lambda \text{t} \quad \text{CP}(\text{V}))$ (ch. 4 (43b))

6. $\text{NP} \rightarrow \text{N}'$  
   • $[\text{NP} \quad \text{N}']$ translates into $\lambda \text{P} \lambda \text{e} \quad \lambda \text{y} \quad [\text{NP} \quad \text{NP}(\text{y})] \land P(y)$ or $\lambda \text{P} \lambda \text{e} \quad \lambda \text{y} \quad [\text{NP} \quad \text{NP}(\text{y})] \leftrightarrow x = y \land P(y)$ (ch. 4 (82b))

7. $\text{NP} \rightarrow \text{Name}$  
   • $[\text{NP} \quad \text{Name}]$ translates into $\text{Name}$

8. $\text{N}’ \rightarrow \text{CP} \quad \text{N}'$ ("relativized N’")  
   • $[\text{N}’ \quad \text{CP} \quad \text{N}’]$ translates into $\lambda \text{P} \lambda \text{e} \quad \lambda \text{y} \quad [\text{CP} \quad \text{CP}(\text{y})] \land \text{N}'$ (ch. 5 (13b))

9. $\text{NP} \rightarrow \text{CP} \quad \text{NP} \quad \text{TAdj} \quad \text{N}$  
   • $[\text{NP} \quad \text{CP} \quad \text{NP} \quad \text{TAdj} \quad \text{N}]$ translates into $\text{NP}(\lambda \text{P}_1 \lambda \text{x} \quad \lambda \text{t}_2 \quad [\text{CP}(\text{P}_1)(\text{t}_2)]) \quad (\text{NP})$ (ch. 4 (82a))

10. $\text{CP} \rightarrow \text{S} \quad \text{C}$  
    • $[\text{CP} \quad \text{S} \quad \text{C}]$ (where C does not contain a wh-element) translates into $\text{S}$ (ch. 4 (43a))

11. $\text{S} \rightarrow \text{TAC} \quad \text{S}$ [N.B.: TAC = ‘temporal adverbial clause’]  
    • $[\text{S} \quad \text{TAC} \quad \text{S}]$ translates into $\text{TAC(S)}$

12. $\text{TAC} \rightarrow \text{S} \quad \text{TC}$  
    • $[\text{TAC} \quad \text{S} \quad \text{TC}]$ translates into $\text{TC(S)}$

Transformations and Translation Rules

1. Empty Wh-Movement: $[\text{CP}[\text{S} \quad \text{e} \quad \ldots \quad \text{e} \quad \ldots \quad \text{wh}_n]] \Rightarrow [\text{CP}[\text{S} \quad \text{e}_n \quad \ldots \quad \text{wh}_n]]$, where $n$ is a numerical index.  
   • $[\text{CP}[\text{S} \quad \text{e}_n \quad \ldots \quad \text{wh}_n]]$ translates into $\lambda \text{x}_n \lambda \text{P}[\text{S}(\text{t})]$  
     (relative clause) (ch. 5 (13a))

2. Quantifier Raising: See the rule given for the English Fragment. As mentioned in Chapter 4, this rule does not apply to Japanese sentential subjects despite some evidence that they are NPs.  
   • $[\text{S} \quad \text{NP}_n \quad \text{S}]$ translates into $\lambda \text{P}_1 \lambda \text{t}_2 \quad [\text{NP}_n(\lambda \text{x}_n \lambda \text{P}[\text{S}(\text{t}_2)]) \quad \ldots \quad \text{t}_1]]$  
     (QR to S) (ch. 5 (13c))

   • $[\text{VP} \quad \text{NP}_n \quad \text{VP}]$ translates into $\lambda \text{y}[\text{NP}_n(\lambda \text{x}_n \lambda \text{P}[\text{VP}(\text{t}_2)])]$  
     (QR to VP) (ch. 5 (13d))
### Lexicon

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<thead>
<tr>
<th>CAT.</th>
<th>LEXICAL ITEM</th>
<th>TRANSLATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>Past</td>
<td>$\lambda P, l_1, l_2, t_1 \lambda l[t &lt; t_1 &amp; t_1 \subseteq t_{RT} &amp; P(t)]$</td>
</tr>
<tr>
<td>T</td>
<td>Pres</td>
<td>$\lambda P, l_1, l_2, t_1 \lambda l[t = t_1 &amp; t_1 \subseteq t_{RT} &amp; P(t)]$</td>
</tr>
<tr>
<td></td>
<td>(simultaneous meaning) or</td>
<td>$\lambda P, l_1, l_2, t_1 \lambda l[t_1 &lt; t &amp; t_1 \subseteq t_{RT} &amp; P(t)]$</td>
</tr>
<tr>
<td>Adv</td>
<td>1983-nen-ni</td>
<td>$\lambda P, x \lambda l[t \subseteq 1983 &amp; P(x)]$</td>
</tr>
<tr>
<td>Adv</td>
<td>asita</td>
<td>$\lambda P, x \lambda l[t \subseteq \text{tomorrow'} &amp; P(x)]$</td>
</tr>
<tr>
<td>Adv</td>
<td>itigatu-ni</td>
<td>$\lambda P, x \lambda l[\text{January'}(t) &amp; P(x)(t)]$</td>
</tr>
<tr>
<td>N</td>
<td>syutyoo ‘claim’</td>
<td>$\lambda P, l_1, l_2, l_3 \lambda l[t \subseteq \text{+past}]$</td>
</tr>
<tr>
<td></td>
<td>[CP NP TAdj ____ ]</td>
<td>$\lambda P, l_1, l_2, l_3 \lambda l[t \subseteq \text{claim'}[&lt;s, e, i, e, t&gt;, &lt;e, e, i, e, t&gt;, &gt;, &lt;e, e, i, e, t&gt;, &gt;]$</td>
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<tr>
<td>TC</td>
<td>ato-de ‘after’</td>
<td>$\lambda R, l_1, l_2, l_3 \lambda l[t_2 \subseteq R(t_3)(t_2) &amp; R'(t_4)(t_3) &amp; t_2 &lt; t_3]$</td>
</tr>
<tr>
<td>TC</td>
<td>mae-ni ‘before’</td>
<td>$\lambda R, l_1, l_2, l_3 \lambda l[t_2 \subseteq R(t_3)(t_2) &amp; R'(t_4)(t_3) &amp; t_3 &lt; t_2]$</td>
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<tr>
<td>Name</td>
<td>Taro</td>
<td>Taro ($\Rightarrow \lambda P, l \lambda l[P(Taro)(t)]$)</td>
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<td>Pro</td>
<td>zibun_n</td>
<td>$x_n$ ($\Rightarrow \lambda P, l \lambda l[P(x_n)(t)]$)</td>
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<td>$e_n$</td>
<td>$x_n$ ($\Rightarrow \lambda P, l \lambda l[P(x_n)(t)]$)</td>
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[N.B.: (i) $n$ is a numerical index/subscript. (ii) “$\Rightarrow$” indicates possible type-raising operations]
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