The Dissertation Committee for Makiko Nakayama Certifies that this is the approved version of the following dissertation:

When in Context

Committee:

David Beaver, Chair

John Beavers

Katrin Erk

Chiyo Nishida

Stephen Wechsler

When in Context

by

Makiko Nakayama, B.A.; M.A.

Dissertation

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Doctor of Philosophy

The University of Texas at Austin

August 2008

Dedicated to the Memory of Dr. Carlota S. Smith

Acknowledgments

Although this dissertation does not officially have co-supervisors, two great professors must be mentioned as such. I started the project with supervision of the late Carlota S. Smith. After her passing, I worked with David Beaver to complete it. I am truly grateful to both of them for their professionalism, linguistic and technical insights, appropriate guidance at each stage of my progress and, I really should say this, great patience with the pace at which I worked. I am not going to say any more on my supervisors, because I am not capable of finding suitable words to express how influential each of them has been to me. I am also indebted to the other members of my committee, John Beavers, Katrin Erk, Chiyo Nishida and Stephen Wechsler for their careful and helpful comments on the drafts. Besides the official committee members, I would like to thank Nicholas Asher, Rajesh Bhatt, Lisa Green and Bernhard Schwarz for reading and commenting on earlier versions of the dissertation. Thanks also go to other people who have been in contact with this work at its various stages and commented on what they read. Errors and shortcomings contained in this dissertation solely belong to me. I am also grateful to my pre-UT linguitics teachers: Yoshio Endo, Christpher Tancredi and Tomoyuki Yoshida.

I also thank the Linguistics department staff members and fellow graduate students for their help and friendship. I am grateful to my non-linguist friends in Austin, Tokyo and elsewhere. I am not going to refer to them individually because long lists should be avoided wherever possible. Thanks also go to everything that affected me directly or indirectly during my graduate years, regardless it's animate or inanimate, online or offline. I am glad to be finally able to share this achievement with my family members: my father the late Masahiro Sakugawa, my mother Machiko Nakayama and my sister Mikiko Nakayama.

When in Context

Publication No._____

Makiko Nakayama, Ph. D

The University of Texas at Austin, 2008

Supervisor: David Beaver

This dissertation explores a family of temporal meanings pertaining to *when*, as it appears in *When the results were negligible, Galdwin asked why*; *when she was 50, she left him*; and *Lowe took a 3-1 lead into the 5th when he finally surrendered his first home run of the season*. A widely-accepted view is that *when* used this way functions as a general-purpose temporal connective, with underspecified semantics reminiscent to *after*, *during* or *before*, which vary depending on the surrounding context. I propose a heavy revision of this particular claim; surrounding contexts do not by themselves determine the temporal interpretation of *when*, but they function to strengthen the basic meaning already imposed by grammatical features and lexical constraints. The present system provides accounts for several empirical problems related to corpus-based examples which are inconsistent with previous approaches to the semantics of *when*. A further characteristic of the present study is its cross-linguistic nature. I extend the analysis of *when* to *toki(-ni)*, the Japanese counterpart to *when*. Comparing English and Japanese, I argue that the two languages share the fundamental semantic system but employ different sets of triggering factors for the strengthening process. Supporting evidence for my arguments comes from two manually-culled newstext corpora prepared for this study.

Chapter 1 gives an introduction to the phenomena and issues of interest. I address three distinct temporal relations holding between the *when*- and main clause events. Forward-sequence entails that the *when*- clause event occurs earlier than the main, as in ***when*** *the results were negligible, Galdwin asked why*. Overlap consists of two clauses that denote overlapping events, as in ***when*** *she was 50, she left him.* Backward-sequence entails that the *when*- clause event takes place after the main clause event, as in *Lowe took a 3-1 lead into the fifth* ***when*** *he finally surrendered his first home run of the season*.

Discussions in later chapters assume some familiarity to temporal and discourse semantics literature. Chapter 2 has been devoted to providing such background information, including an introduction to Discourse Representation Theory (Kamp and Reyle (1993)) and Two-Component Aspect Theory (Smith (1993, 1997)). For visual presentation of my ideas, I adopt Blackburn & Bos' (2000) DRS-building scheme.

In Chapter 3 I sketch previous analyses on *when*- sentences and address their empirical problems. I discuss two streams of approaches. Under one view, *when* commits to placing two eventualities temporally close to each other, without fixing their relative order (Heinëmäki (1978), Ritchie (1979) and Hinrichs (1986)). An implication of this type of proposal is that whenever a *when* appears, there is little restriction as to which one of the temporal meanings is chosen. Thus, for these authors *when* is a general-purpose temporal adverbial used without a specific temporal meaning built into it. Alternatively, scholars such as Moens and Steedman (1989) and Sändström (1993) argue that *when* does not order events temporally; it only adds an implication concerning event consequentiality, namely that the main clause event is a consequence of the *when* clause event. A major problem common to both approaches is empirical. The former entails that *when* is vague as to its temporal implications, when in actuality a given *when* sentence is usually associated with only one of the temporal meanings. The latter approach, on the other hand, is misleading in giving the impression that all *when* sentences bear a consequential relation: corpus examples in the present study reveal that it is not true.

Chapter 4 presents English corpus data collected for this study and an analysis of *when*- sentences that avoids the problems surrounding the previous approaches, with

emphasis on the claim that pragmatic information is fully responsible for rendering the temporal meanings associated with *when*. I examine this proposal critically and arrive at a hybrid system where grammatical and pragmatic or extra-linguistic informational contents work in tandem. I also discuss DRT construction rules for *when* and demonstrate my system for some key examples drawn from the corpus.

Chapter 5 turns to a cross-linguistic consideration, focusing on Japanese. After reviewing the literature on Japanese *toki-ni* ("*when*" lit. time-at) sentences, such as that authored by Yoshimoto and Mori (2003), I discuss Japanese corpus data and argue for one salient difference between the systems in the two languages: the strengthening processes in English tend to allude to pragmatic and extra-linguistic information while those in Japanese are more directly affected by grammatical factors such as tense marking variations and particle-drop.

Chapter 6 concludes the study. I mention some remaining issues, for the purpose of suggesting some future avenues of research which the achievement of this study opens up. Two appendices are included at the end of this dissertation. One explains technical details regarding the corpora used in this study. The other is a summary of miscellaneous numerical results I have obtained while I worked on the project.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

Case markers

NOM	nominative
ACC	accusative
DAT	dative
GEN	genitive

Oblique case markers

loc	locative
ben	benefactive

Discourse particles and special items

TOP	topic
INT	interrogative
hon	honorific marker

Verbal auxiliary morphemes (Japanese)

TE-I	progressive/resultative state
nonp	nonpast
past	past
pren	prenominal

List of symbols

i, i', ...	intervals
t, t', ...	time points
e, e', e1, e2, em, ew	eventualities
t(e)	interval corresponding to e (e's runtime)
$\exists$	existential quantifier
$\forall$	universal quantifier
$\neg$	negation operator
$\supset$	includes as a proper subset
$\subset$	is included as a proper subset
$\supseteq$	includes as a subset
$\subseteq$	is included as a subset
$\in$	is a member of

$\notin$	is not a member of
$\Rightarrow$	logically entails
®	temporal relation incurred by when: one of <, >, OVERLAP
R	the set of temporal relations under investigation = {<, >, o}
[[α]]	the denotation of the linguistic expression α
!	pragmatic infelicity
#	unavailability of intended meaning
*	ungrammaticality

Chapter 1 :

Introduction

1.1 Introductory Remarks

Time and events are two of the essential components of information conveyed in natural languages. We can talk about time associated with a certain event, as in *what time will John arrive?*, or refer to a sequence of events in relation to 'now,' as in (1).

(1) John arrived when Mary left.

When the speaker of English interprets (1), she understands that John's arrival and Mary's leaving occurred in an orderly manner: Mary must have left first, and then John arrived.[1] But how do we know that? Is it encoded in the semantics of *when*? Let us suppose so, and assume that there is an event-sequencing function somewhere in the semantics of the adverbial *when*. This appears to be a nice idea to start with, as we get a different temporal reading without the adverbial.

(2) John arrived. Mary left.

(2) implies that John arrived earlier than Mary left. In other words, temporal order between the events is reversed from that of the first example. The difference between the two examples is the presence of the adverbial, so it is natural to hypothesize that *when* is doing the ordering inferable from (1).

---

[1] Some speakers also get the unordered reading in which the two events occur at the same time (John Beavers p.c., Steve Wechsler p.c.)

If we look at further examples, however, we find that this 'forward-sequence'[2] reading of *when* is not always available. In another context, the same lexical item indicates the opposite temporal ordering. Consider (3).

(3) The pitcher took a slight lead when he surrendered a three-run home run.[3]

The temporal location of the main clause event precedes that of the *when* clause event. In other words, the event order is in backward-sequence. Moreover, we can find cases where the two events are not even separate events, as in (4).

(4) Delta used regional planes *when* it began testing service from Atlanta to Manchester, NH.

Using regional planes is a part of Delta's testing service. This time, it does not make much sense to order the events denoted by the two clauses because the main clause event is included in the *when* clause event, in particular the former is a proper part of the latter. Furthermore, it is possible that the two events are not ordered but overlapping, as in (5).

(5) When you're reading magazines, you feel like you MUST buy something.

Just by looking at a few examples above, we notice that the semantics of *when* is more complicated than just giving a certain temporal order between events it connects. Despite its seeming randomness, researchers have noticed a grammatical criterion on the semantics of *when* which states that States in the sentence leads to an overlap reading. The generalization is based on examples similar to (5) above as well as (6) below.

---

[2] So named due to the fact that time moves forward from the *when*-clause event to the main clause event. I consider the main clause event as the main focus, whose temporal location is specified relative to that of the *when* clause event.

[3] It is a matter of debate whether examples like this one involves backward sequencing.

(6) Aaron's family moved to Chicago when he was eight years old.

The issue can be made yet more complicated. Let us consider (7), where a when connects two totally unrelated events.

(7) !When my car broke down, the sun set.[4]
(Moens and Steedman (1988))

The sentence is quite odd, but we do not see why. How come this example cannot be interpreted as synonymous to *my car broke down, and then the sun set*, doing the same modification as we did for (1)? Hints lie in the following facts. First, we can improve the example by changing the main clause that indicates more connectedness to the *when* clause event, namely a cause-result relation, as in (8).

(8) When my car broke down, I called AAA.

Second, the awkward example can actually be improved by adding supplementary information that implicates that the two events are pragmatically related. If the hearer understands the sentence with emphasis on unexpectedness of the sun setting in a situation where my car has broken down, it is well formed.[5]

(9) I had a horrible day today. I overslept, had bad hair, and they made me drive two hours for a meeting that's totally meaningless…Yes I knew that my car wasn't working too well…and after the meeting *when it broke down, the sun set*.

---

[4] ! indicates pragmatic infelicity. That is, the sentence is not grammatically ill formed but contains textual incoherence. I distinguish the ! marker from other similar ones, such as: i) *: ungrammaticality; ii) ?: grammatical awkwardness; and #: unavailability of the intended meaning(s).

[5] The idea was first pointed out to me by Carlota Smith (personal communication).

What can be inferred from these two examples is that pragmatic cohererence is a crucial factor in accounting for the oddity of (7). In particular, the *when* and main clause events should be consequentially related.

Given the variety of the meanings of *when* that we looked at above, the first hypothesis, which says that sequentiality is built into the semantics of *when*, seems to need more work. A weaker hypothesis like (10) would perhaps be more appropriate.

(10) *When* is a general purpose connective with…
1. Semantics:
a. connects two events that occur at approximately the same time.
b. If either event is a State, then the two events temporally overlap.
2. Pragmatics: some sort of coherence, e.g. consequential relation, between the events is required.

(10)-1.-a. suggests that the semantics of *when* is not so rich that it rigidly restricts the temporal relations between events. What it would do instead is to assert that the two events (*when* and main) are placed in each other's proximity on the timeline. [6] The only case in which the temporal interpretation is fixed involves a State in at least one of the clauses, expressed in (10)-1.-b.. The pragmatics part, (10)-2, says that the two events are pragmatically related somehow.

I shall call this approach the 'general-purpose' view of *when* and use it as my starting point of this research. Through the above examples, two mixed intuitions must have struck the reader. On one hand it appears that *when* can fit almost anywhere as long as the two events are temporally proximate to each other. On the other hand, it seems wrong to say that it can fit anywhere, as it cannot connect two pragmatically unrelated clauses. It seems that *when* allows for flexible temporal interpretations where the main and

[6] I ignore the 'subevent' reading for the moment.

when clauses exhibit coherence. However, if the two clauses denote non-coherent events, *when* cannot make them coherent.

1.2 Key Questions and Goals

Most arguments in this study center around a key question: how general-purpose is *when*, in English and cross-linguistically? I take three consecutive steps to give my answer to the question. I will refer to those steps as my 'goals' and briefly describe each shortly.

My first goal is to critically review previous approaches on the semantics of when. By way of reviewing the literature, I point out two empirical problems that arise with the general-purpose view. The first problem concerns the State-overlap association. In so-called Inchoative States, a State-containing when sentence can have an ordered reading, as in (11).

(11) When he learned that one of the injured was Reichert, he was visibly shaken. (577) [7]

In (11), the learning and being shaken do not overlap. For 'him' to have learned about Reichert's injury causes him to be visibly shaken. In other words, the interpretation is forward-sequence. According to (10)b., which states association of States with overlapping events, the main clause on (11) should give rise to an overlap reading: be visibly shaken is normally interpreted as a State, containing an adverbial that modifies a State (visibly). However, the prediction is not borne out. The available reading is FWSEQ. The second empirical problem concerns the pragmatic part of the 'general-purpose' view ((10)-2). (10)-2 addresses that the two events in a *when* sentence are somehow related pragmatically. Although I have said *somehow*, the only specified pragmatic relation found in the literature is consequentiality, a weak form of causation that includes both physical

[7] The paranthesized numbers at the end of extracted examples indicate its serial number in the annotation file. See Appendix A.

(direct) causation and indirect triggering. However, the pragmatics of *when* cannot be consequentiality alone: there are a number of *when* sentences in which the events are not consequentially related, but still felicitous. Consider (12).

(12) He was gas in the Laker's tank early and he made the biggest shot of the evening when things got late and tight. (103)

In (12), what is a possible coherence relation between things got late and tight and he made the biggest shot? Not causation, since it is not natural for an athlete to improve performance as time passes during the day. It may be that possible relations are not just one but several, and this example involves one of the non-causal coherence relations. If so, it is worth looking into many examples and come up with a detailed list of such readings.

The second goal, thus, is to propose an analysis that avoids these problems. The core part of my system is constructed on the basis of my analysis of *when* sentences appearing in a newstext corpus.

(13) a. *When*-IWS: The temporal location of the main clause is determined depending on that of the *when* clause. Specifically, e_m is placed as close to e_w as possible, infosar as other constraints are not violated.
b. *When*-FWS: The temporal location of the *when* clause is determined depending on that of the main clause. Specifically, e_w is placed as close to e_m as possible, infosar as other constraints are not violated.

For English, I discuss two cases in which it is preferred that the default interpretation needs to be maintained. I also explore two other cases in which the default interpretation must not be kept. The former cases are when i) the sentence contains a progressive; and ii) the main clause describes a subevent of the *when* clause event. The latter cases are when i) both of the clauses are nondurative; and ii) the main clause describes a consequence of the *when* clause event.

The crosslinguistic part of the dissertation, which constitutes my third goal, concerns an analysis of Japanese under the present assumptions. The Japanese system is built on the analysis I establish for English. I claim that the default-rebuttal scheme proposed for English works somewhat differently in Japanese. One major difference

between these systems is that interpretations of *toki-ni* (“when”) sentences in Japanese are largely affected by morphological factors. This is in contrast with English, where thre rebuttal can be triggered by heterogeneous factors including morphological and pragmatic. To describe these issues, in Chapters 6 and 7 I discuss Japanese *toki(-ni)* ('when' lit. 'time(-at)') sentences. In describing the characteristics of the lexical item, it becomes an interesting point of comparison that Japanese is more prone to conditions associated with grammatical factors than English, where pragmatics and extralinguistic inferences play a major role. I address three grammatical factors that affect temporal readings of toki-ni sentences: polysemy of a verbal infix *te-i*, embedded and matrix tense combinations and presence or absence of a locative particle –ni.

1.3 *When*

In this section, I give an overview of syntactic and semantic characteristics of *when*. Given the objectives of this dissertation, the latter is more weighted than the former. However, there is one important variation in the syntax, namely clausal dislocation of the *when* clause. I discuss this first, followed by detailed descriptions of temporal and pragmatic meanings of *when*.

1.3.1 Simplified Syntax

The *when* sentence in English comes in two different syntactic realizations, depending on the linear order of the clauses. One construction involves a preposed *when* clause, viz. the *when* clause is placed left to the main. (14) and (15) exemplify this category.

(14) **When** a top Impressionist work was up for grabs, however; bidding was competitive. （1236）

(15) **When** the police caught one math teacher accepting a marked 50-euro note from a student... the teachers rebelled against her with a vote of no confidence in her

authority. (1238)

I shall call this type IWS henceforth, for 'Initial *When* Sentences'. Schematically, IWSs are represented as follows.

(16) [[When S1] …S2…]

In the other construction, the order of the clauses is reversed. I shall call this FWS for 'Final When Sentences.' An example of FWS is (17)

(17) Supporters of the law won a big victory on Wednesday *when* the commission rejected an amendment...(1096)

Schematically, the IWS is represented as follows.

(18) […S2…[When S1]]

I have included the IWS/FWS distinction in my annotations. Semantic differences between the two types are discussed in Chapter 4.

1.3.2 Interesting Readings and their Representations

The introductory section briefly touched on three temporal orders, forward sequence, overlap and backward sequence. Each import can be paraphrased in another temporal term in English. The FWSEQ reading roughly corresponds to after, as in John arrived after Mary left. The BWSEQ reading is the mirror-image of FWSEQ, and is paraphrasable as before as in Mary left before John arrived. Finally, the OVERLAP reading is approximately synonymous to while, as in Mary was eating while John played the piano.

These readings will be recurrently referred to in the remaining chapters. For expository purposes, I describe them in detail in this subsection, using identifying colors, pictorial exemplification and set-theoretic depiction.

Table 1.1 List of Temporal Readings for *When* Sentences

	category name	characteristic		Set theoretic description in terms of two intervals i (focus) and i′ (reference)	color
seq	FWSEQ forward sequence	Consequence		i′ < i	
		Conditional			
		Response			
		Enabled			
		None			
	BWSEQ backward sequence	None		i < i′	
^seq	OVERLAP Overlap	None		i′ ° i ∧¬∃ i″[i″⊂i∧ i″⊂i′]	
		Sub-event	Proper subevent	i′ ⊃ i	
			Identity	i′ = I	

Each reading may further be divided into subtypes grouped on the basis of non-temporal characteristics. I have indicated such division in the table. Details of the characteristics are given below.

(19) a.. Consequence: B is a consequence of A
B occurs as a result of A occurring.

b. Conditional: B cannot occur without A also occurring
it can't be the case that B and not A.

c. Response: A occurs immediately before B
B occurs as a reaction or response to A, B upon A

d. Elaboration: B describes a proper part of A
A, and as a part of it, B

e. Identity: B describes A from a different perspective
A, namely B

1.4 Methodology

This section introduces the general methodology I adopt throughout this work. Also, I give a brief description of the corpora I have used. Appendix A contains more detailed information on the corpora, as well as the extraction and markup schemes.

I have chosen two newstext databases, written in English and Japanese respectively. The English corpus, which I refer to as Corpus E, is based on English Gigaword distributed by the Linguistic Data Consortium. Corpus E is a collection of newswire texts from the New York Times. I have used the 2001 version. The Japanese corpus, Corpus J, is based on Yomiuri Bunshokan Archive, an online database of the Yomiuri Shimbun, which is the best-selling national newspaper in Japan. I took a month's worth of newstexts, extracted *when* sentences and manually annotated for the relevant grammatical factors and semantic imports. In making the corpora, no special concordance tool was used. I have simply extracted relevant document files (text or html), got rid of noises, formatted for ease of reading and outputted into an Excel file.

Corpus E contains 1337 sentences. After removing fragmented or noisy examples, valid examples count up to 682. The valid examples are then sorted according to their syntax, namely depending on whether the *when* clause is preposed or postposed. (i.e., IWS or FWS) Then, I have further classified them into aspectual types of the *when* and main clauses, and the semantic imports of the sentence.[8] Corpus J contains 1378 sentences. 1004 valid examples are extracted in the same methodology as Corpus E, except for minor language-particular variations. Aside from these main corpora, I have occasionally made use of examples from the Internet, using search engines. Further, a small amount of constructed examples was also used, mainly when discussing previous works and when reference to ungrammatical or infelicitous examples is necessary in the course of discussion. I have regarded constructed examples as indispensable in theoretical linguistic research even though my main focus was on corpus examples. The reason is that corpora,

[8] The judgments are mostly mine. In some places Carlota Smith's intuitions are reflected.

in general, do not contain ungrammatical examples because they are collections of actually produced language data.

1.5 The Structure of the Dissertation

The dissertation is structured as follows. In Chapter 1 (present chapter), I have given a general overview, have briefly described the two corpora I take my data from and have introduced the issues of interest. In Chapter 2, theoretical assumptions that take effect throughout the dissertation are presented. In Chapter 3, I critically review previous studies related to the semantics of *when* sentences, either directly or indirectly. Chapter 4 takes over the issues I have raised in Chapter 3 and develops an analysis proposed in this study. Chapter 4 elaborates the problems encountered in Chapter 3 and develops a new system that gives solutions to them. In the system, temporal overlap is posited as the default reading. If the context provides information suggesting otherwise, this default interpretation is rebutted, giving rise to an alternative reading, such as sequential. I also formalize the analysis described in the chapter using DRT. Chapter 5 attempts a cross-linguistic extension of the analysis given above. Chapter 6 concludes the dissertation by summarizing the achievements of the present work and discussing possible future avenues of research. In addition to these main chapters, the dissertation contains two appendices. Appendix A gives descriptions of the corpora used in this study. Appendix B provides miscellaneous numerical results that I have obtained while working on the two corpora.

Chapter 2 :

Theoretical Background

2.1 Introduction

This chapter discusses theoretical assumptions I make throughout the dissertation. When I introduced the issues of interest in Chapter 1, I left many terms vague that potentially require precise technical definitions. This was done in order to focus on the presentation of the issues rather than confusing the reader with fine details. To proceed to the main analysis in later chapters, however, it is necessary to have my technical assumptions clearly stated. Sections of this chapter are most informative viewed this way.

I first explain the basic building blocks of temporal semantics, such as eventuality types, tense and aspect. Then, I introduce a theory to formally represent discourse-related features in natural language. The theory is called Discourse Representation Theory (DRT), discussed in Kamp and Reyle (1993). In the present study, the DRT framework is amended with aspectual information, based on Smith's (1997) Two-component Theory.

2.2 Events, States and Eventualities

This section attempts to make clear the way in which terms such as 'event' or 'state' are used in the present study. Situations expressed by clauses allow a dichotomy of State/Event (or equally State/non-State) distinction.[9] In the previous chapter, I used these terms without defining them, relying on the reader's intuitive understanding of the terms. For example, I have pointed out that so called inchoative states involve a lexical "state" being understood as an 'event.' Assumed in the discussion was that a clause such as *be*

[9] Some people argue for a trichotomy, having states, events and processes. (For example, Bach 1989).

mad denotes a state at a surface level but is eventive at the level of interpretation, much like *become mad*. At this point it is worth discussing what it means that a 'state' has an eventive interpretation.

Smith (1997:19) describes the two categories as follows. States consist of a single, undifferentiated period. They hold, rather than occur. Events refer to the class of all non-State situations, which consist of successive stages occurring at different moments. Parsons (1989:21), following Bach (1986), collectively refer to 'states' and 'events' as 'eventualities'. I also follow this convention and represent eventualities as a union set of events and states. Thus, the set of eventualities e exhaustively consists of the set of events ε and the set of States σ , as shown in (20).

(20) $e = \varepsilon \cup \sigma$

Each member of the set e is also a set, containing various eventualities as members. We can assume two levels for which talking about e make sense, namely the surface and interpretational levels. At the surface level, eventualities (verb constellations in Smith's terms) are categorized either as ε or as σ depending on their lexical specification of Statehood. At the interpretational level, the categorization relies on how a given eventuality is understood in context. It is quite common that an eventuality that belongs to ε at the surface level is included in σ at the interpretational level, and vice versa.

At each level the dichotomy of events ε and states σ is absolute. That is, an eventuality is either a state or an event but not both. However, reinterpretation is possible: in examples such as (21), a state eventuality denotes an event, namely the event of coming about of the state.

(21) a. Mary knows the answer.
b. Mary suddenly knew the answer.

The special eventive interpretation of state predicates as exemplified in (21)b. is often referred to as Inchoative State (Smith (1983)). The terminology, as well as the phenomenon itself, will be frequently addressed in the following chapters.

2.3 Tense in English

This section introduces Parsons' ideas on specifying temporal order of the speech time and event time by way of interval I. The key notion here is intervals, as opposed to events. I will later discuss a similar treatment of time in Discourse Representation Theory, which is also interval-based. The discussion in this subsection will turn out helpful there.

I assume that the primary semantic import of tense markers in English is to order eventualities relative to a time point in reference, most often the speech time, following Comrie (1976:1), who says that tenses relate the time point at which a certain situation arises to another time point, usually the speech time.

Three kinds of tense markings most frequently occur in the language, called simple tenses in English. The simple tenses range over past, present and future. Parsons (1989:27-31, 256-263) gives brief descriptions of those tenses. I cite and adopt his explanation of temporal facts because they are intuitively straightforward and precise enough for the purpose of this work.[10] [11] In his semantic representation, Parsons assumes three time-related variables to be existentially quantified. (ibid: 260) I represent the basic temporal semantics of simple English sentences *John walked/walks/will walk* are represented by placing an interval variable i surrounding the time variable t at which the event occurs, and in turn putting t before, after or at speech time constant n.[12]

---

[10] I will modify some aspects in the DRT section, but I will keep the essence of his analysis.

[11] Tense can be the object of more extensive formal research in itself. For example, Ogihara (1996) explores several intriguing issues in natural language tense using a model theoretic approach. I hope to impose the least amount of theoretical constructs that are necessary to properly describe the issues I am interested in. Having different concerns, I do not seriously consider formal details of studies like Ogihara's.

[12] For ease of exposition, I omit or modify irrelevant details. I also assume that the reader is familiar with how existential quantification works.

(22) John walked
∃i∃t∃e[t∈i&i<n&[e:John walk at t]]

(23) John walks
∃i∃t∃e[t∈i&i°n&[e:John walk at t]]

(24) John will walk
∃i∃t∃e[t∈i&i>n&[e:John walk at t]]

I want to call the reader's attention to the fact that these representations do not order eventuality and speech time directly. Common to (38) through (40) is interval I that includes the event time t, and the speech time 'now' are ordered on the timeline. It is through i that t and 'now' are ordered, giving the effect of event time t and speech time also being ordered, such that t<'now' in the past tense, t='now' in the present and t>'now' in the future. Let me put it another way. The past tense, according to Parsons, is used with a verbal predicate when the eventuality denoted by the predicate ends at some relevant time in the past. That is, for every instant t in interval i, t temporally precedes now. The present tense, roughly speaking, is associated to what is happening 'now'--surrounding the speech time.[13] Finally, the future tense in the above representation is simply the mirror image of the past; every instant t of interval I temporally follows speech time n.

2.4 Two-Component Aspect Theory

Aspect, in addition to tense, has been central to the study of temporal semantics. Theories of linguistic aspects classify eventualities with regard to how long they last, whether they hold or occur and how they end if they do at all. Many researchers have become interested in this and numerous works have been proposed on the subject. The present study extensively uses Smith's (1997) Two Component Aspect Theory (2CAT), so named because it consists of two separate modules, which she calls situation and

[13] There are a number of different uses for the present tenses, about which I am not really concerned in this work. I do not go into detailed of this issue on which the present study does not hinge.

viewpoint aspects. The modules, as I explain in the following two subsections, elucidate various phenomena regarding internal structures of eventualities and their linguistic presentations. I employ 2CAT as my primary ground of reference in discussing aspects, for two reasons. One reason is the theory's capability of dealing with flexibility in aspectual interpretations. Under her approach, situation aspects have their basic levels lexically defined, which can be shifted to derived levels triggered by language-internal and language-external factors. Viewpoint aspects allow us to flexibly 'frame' situations as the speaker 'sees' them. The other reason for this choice is that the theory is designed to deal not only with English, but also with other typologically diverse languages, such as Russian, Chinese and French (Smith, ibid). Moreover, Shirai (2000) has already applied the theory to Japanese. As the present study focuses on Japanese as well as English, 2CAT turns out to be a most useful tool.

2.4.1 Situation Types

In this subsection, I introduce Smith's situation aspect types (Smith (1997)). She posits five semantic categories with linguistic correlates. The five categories are States, Activities, Accomplishments, Achievements and Semelfactives. These are basic and have corresponding linguistic forms associated with them. There are also derived forms, in which a situation type is shifted to another type.

The five situation aspect types are distinguished by three binary features. The three features are duration, which separates non-durative events from events that take time; dynamism, which takes the positive value for events that occur and negative for situations that hold; and telicity, whose value depends on whether an event has an inherent final point. Below, I give detailed descriptions of each situation type following Smith (ibid: 22-35)

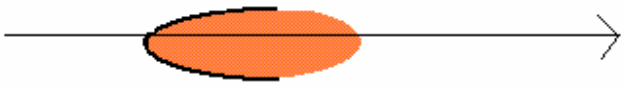
Activities are situations that consist only of homogeneous dynamic actions. (ibid:23-25). They often directly describe physical and mental activities. Actions usually

take some amount of time, so Activities are durative. Their homogeneity entails that their internal structure does not have an inherently defined final point, hence they are atelic.[14] A semantic feature characteristic of Activities is the subinterval property. Predicates (in Smith's terms, verb constellations) with the following entailment pattern are considered to have the subinterval property. If a sentence containing predicate P is true at interval I, then P is also true at every subinterval i of I, where i has temporal duration which is long enough for P to be true. A clearer test for this perhaps is to embed the predicate in a past progressive form. If truth of the sentence entails the truth of a simple past form, the predicate is an activity. (41) a. through b. shows this point.

(25) a. John was walking => John walked. (Activity)
b. John was building a house =/=> John built a house. (not Activity)

Basic level Activities include *sleep* and *eat cherries*. Derived level Activities are Activities that have been shifted as such from another situation type. Examples of derived level Activities are *feed the puppy for an hour* and *cough for an hour*. The internal structure of Activities is schematically represented as (26).

(26) Activity:



[14] In Smith's system, being atelic amounts to having the negative value for telic.

The orange ovel figure represents an eventuality. The boldfaced outline at one end indicates that the eventuality is 'closed' towards that end, where closed means that a change of state is assumed.

Accomplishments describe events with duration, their outcome and result states that ensue. (ibid:26-30). The outcome comes in a variety of types, ranging from objects (affected, constructed and consumed) to experiencers and path-goals. Accomplishments have inherently defined endpoints, so they are telic. Basic level Accomplishments include *build a bridge*, *walk to school.* Derived level Accomplishments include *stroll by the river for 2 hours*. A test for Accomplishments involves the past progressive again, but this time the direction of entailment is reversed. If a simple past tensed Accomplishment sentence is true, the progressive form of the same sentence is also true.

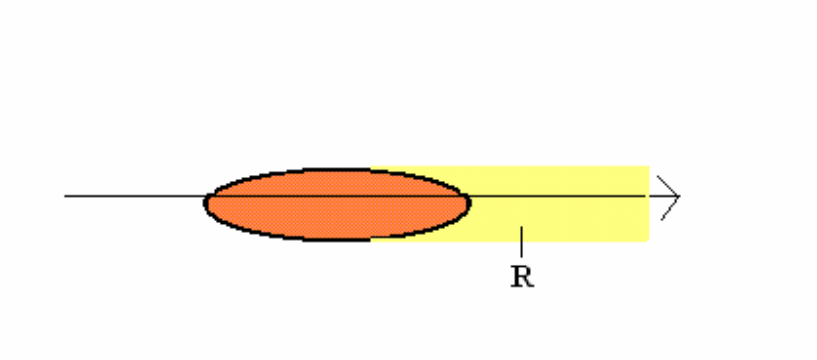
(27) John drew a circle.⇒John was drawing a circle.

The reverse is not true; the truth of a past progressive Accomplishment sentence does not entail the corresponding simple past sentence. (Dowty (1979), Zucchi (1989), Landman (1992))

(28) John was drawing a circle. =/⇒ John drew a circle.

The Schematic representation for Accomplishment is illustrated in (29).

(29)



The yellow-colored region on the line segment representing the timeline indicates the result state(s) of the eventuality in question, shown as the orange-colored oval figure. As Accomplishments are 'closed' for both initial and final endpoints, the figure is outlined by boldface at both ends.

The third situation type Smith considers is Semelfactives. (ibid: 29-30) Unlike Activities or Accomplishments, Semelfactives do not have duration; they denote non-durative, single-occurrence of events. The event does not create any outcome and no result states can be inferred to ensue from it. Being instantanous, Semelfactives are dynamic and non-durative. They are atelic, as they do not have the final endpoint at which an outcome of the action obtains. Basic level Semelfactives include *tap* and *peck*, which denote potentially iterable simple action, as well as *blink* and *cough*, which represent a non-durative bodily activity. At the derived level, Semelfactives are interpreted as iterative events, as in (30).

(30) Mary knocked on the door for two minutes.

A general linguistic feature of semelfactives is their incompatibility with duration-entailing lexical items, such as the progressive or durative adverbials. To test for this type, we can use the fact that Semelfactives cannot take the progressive form and the event is in duration; the derived iterative interpretation is required, as in (31).

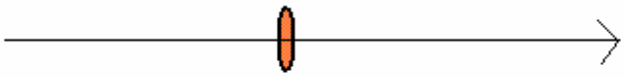
(31) Mary was knocking on the door. => There were multiple knockings.

(32) below shows that the progressive form results in infelicity, if the discourse contains information contradicting the consequence clause.

(32) !Mary was knocking on the door but John did not answer; she only made one knock, which John did not hear.

The schematic representation of the semelfactive is shown in (33).

(33)



The fourth situation type, Achievements, is similar to Semelfactives in that they describe events that occur without duration. A major difference between them is that Achievements consist of a natural endpoint, and ensuing result states. Much like Accomplishments, the natural endpoint for Achievements comes in a variety of ways; it can be objects (affected, constructed, or consumed), experiencers, or path-goals. As Achievements takes place in a very short period of time, it is nondurative and dynamic. It is telic, having a natural endpoint as mentioned above. Basic level Achievements include *find*, *reach the top*, *win the race* and *leave the house*. At the derived level, a preparatory stage culminating to the natural endpoint may be added, as in *Mary was winning the race*. A linguistic feature characteristic to Achievement is the lack of sub-interval property. That is, if an Achievement sentence is true at interval i, then the sentence does not hold true for any proper subintervals of i, if i has any. For example, if *Mary won the race* is true at i, at

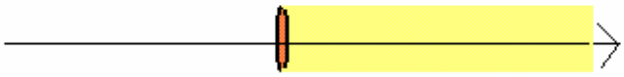
no point leading to her winning, *Mary won the race* is true. Achievements come with the following necessary condition (34).

(34) [[Mary win the race]] is true at i ⇒ ¬[[Mary win the race]] is true at any i-n where n>=1.

Achievements are only true at the timepoint at which it ends, represented as i. This entails that they are not true at any other interval preceding i.

The schematic representation of Achievement is illustrated in (35).

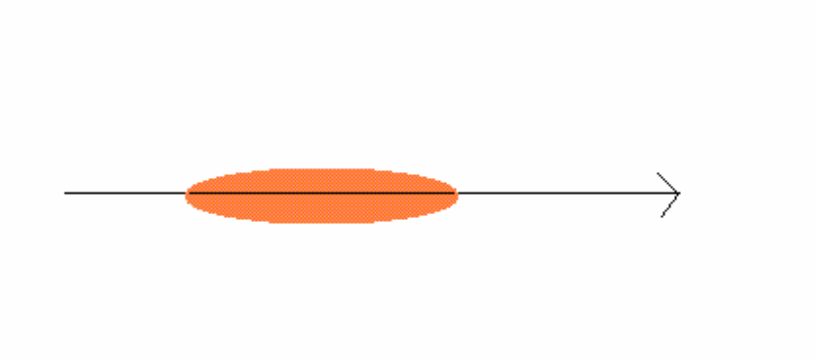
(35)



The last of the five situation types is Statives. (ibid: 32-35) Statives greatly differ from the rest of the situation types in that they do not describe events that occur but depict situations that continue for some duration. As in Activities, Statives have no inherently defined endpoints, and the situation is homogeneous. Stative situations do not imply any change *per se*. If a change of state is implied, it is invoked by an external agent, as in inchoative states. Statives are static (non-dynamic), as they do not 'happen.' They are atelic because they do not have endpoints defined, and are durative because a situation that holds needs to be true for a certain period of time. Basic level Statives include *own the farm*, *be in Austin* and clause-complementing verbs such as *believe that* .... Derived level Statives can have generic and habitual meanings. A linguistic feature, characteristic of statives, is sub-interval property. That is, if a Stative sentence is true at interval I, then it is also true

for every proper subinterval of I. [15] The internal structure of statives is schematically represented as follows.

(36)



To summarize, the five aspectual types in Smith's framework can be identified using a set of "aspectual parameters," as tabulated below. (ibid: 20)

	States	Activities	Accomplishments	Semelfactives	Achievements
State	+	–	–	–	–
Duration	+	+	+	–	–
Telicity	–	–	+	–	+

Table 2.1 Aspectual Parameters of Smith (1997:20)

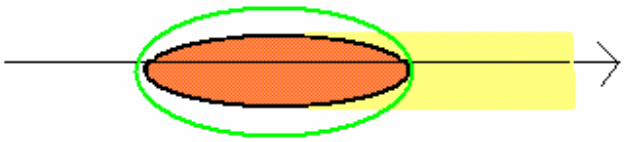
2.4.2 Viewpoint Types

[15] Dowty (1979) mentions a class of momentary statives, which lack the subinterval property. Also, the class of interval statives, such as 'be at rest,' only requires two time points minimally to verify their truth. (John Beavers, p.c.)

In this section, I move on to discussing the way the speaker presents a situation temporally. The central device here is the other component in Smith's 2CAT, which she calls viewpoint aspect. The viewpoint aspect component gives two ways by which the speaker temporally frames and presents a situation, namely the perfective and imperfective viewpoints, and one way to leave the frame unspecified, namely the neutral viewpoint. (ibid: 60-) Viewpoint aspect categories function like a lens of a camera. They take situations as inputs, frame the whole or part of the situation, and present the framed part as the speaker's perspective about the situation. The presented portion of the situation is called visible information. As mentioned above, viewpoint aspect categories range over perfective, imperfective and neutral. They make different amounts of information visible to the hearer. The choice of the viewpoint, therefore, is the choice of the speaker as to how to present the situation to the hearer.

Perfective, the first category, presents a situation in the complete form, including initial and final endpoints. The perfective viewpoint thus makes visible all parts of the internal structure specified by the situation aspect component. An example is given in (37). Visible information is indicated in the green color and resulting states are marked by the orange color.

(37) Mary wrote a letter.



(37)a. involves the perfective viewpoint. Such a sentence is referred to as having a closed interpretation. Closed means the situation is complete as presented. According to Smith, perfectives come with endpoints. effectively it excludes states. The information that the

viewpoint aspect component carries is logically implied, rather than pragmatically implicated. To see this point, let us consider (38).

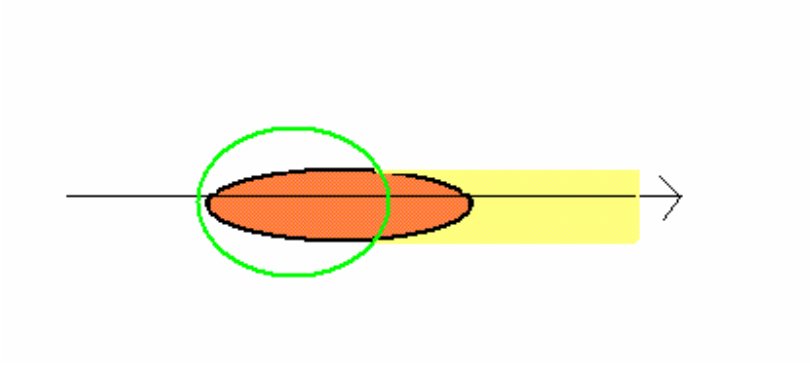
(38) #Mary wrote a letter and she may still be writing it.[16]

The first conjunct of (38) is an Accomplishment situation type and past tensed, presented in the perfective viewpoint. This means that an Accomplishment eventuality is asserted to have taken place before the time of utterance, complete with its final endpoint. The truth of the second conjunct, in turn, requires that it is possible at the time of utterance that the writing event continues. The truth of logical conjunction depends on the truth of all of the conjuncts, so in this example it is necessary that the writing is finished and possibly continues at the same time. These are contradictory propositions, giving no reasonable interpretation for (38). This is a logical implication deriving from linguistic forms: if the closed interpretation of (37)a., namely that the writing has finished, is a pragmatic implicature, it should have been overridden by contradictory information in the context. This does not happen, indicating that the closed interpretation of (37) is not a pragmatic inference that can be canceled (Grice (1989), Levinson (2000)).

The second category is imperfective. This viewpoint presents a portion of a situation, excluding endpoints. (ibid: 73-77) Well-known imperfective forms include general imperfectives, such as French *imparfait*, and progressive imperfectives, such as English *be -ing*. I focus on the latter here, because I will be interested in the progressive form throughout this work. In the following example (39)a., the progressive form bound to the verb constellation introduces the imperfective viewpoint.

(39) Mary was going to Japan.

[16] # signifies a grammatical but logically contradictory discourse. See footnote ##



The schematic representation (39)b. indicates that only a non-final portion of the Accomplishment situation is made visible by the sentence, marked with the lime-green circle above. Sentences with the imperfective viewpoint have open interpretations. This means that some portions of the situation, which are not made visible by the viewpoint, are variable and not asserted. In the present example, (39)a. does not carry information regarding whether the situation was completed, that is, whether Mary eventually arrived in Japan. We can see that in (40), which is a continuation of (39)a., the second conjunct implies that Mary did not reach Japan at all, and it is not contradictory in this discourse.

(40) Mary was going to Japan, but her plane was cancelled due to severe weather.

The final point is not asserted in the imperfective viewpoint. The initial point is asserted. This is a pragmatic implicature deriving from the fact that a part is made visible by the imperfective aspect, since a part of a situation cannot be true if it had not begun. (ibid: 63)

The last viewpoint is neutral. This viewpoint presents the initial point of a situation and at least one part of it. (ibid: 78-81) The neutral viewpoint does not come with any overt morpheme and is interpreted as vague; the sentence with the neutral viewpoint can have either an open or closed interpretation. I do not extensively discuss this viewpoint, as it is not relevant in the present work.

2.4.2.1 Progressive *be -ing* and Statives

The remainder of this section is devoted to more discussion on progressive *be -ing*, and the situation type Stative. I address their similarities and differences. Under Smith's approach to aspect, sentences with the imperfective aspect are presented as part of a situation, excluding endpoints. Endpoints are generally associated with a change of states. As discussed earlier situations with the imperfective viewpoint cannot contain endpoints, so they are similar to the stative situation type in that neither involves a change of state.

Smith (1983:486-488) argues, however, that there are differences between them. Here I repeat one of her arguments; one that deals with *when* sentences. As I have mentioned, two eventualities involved in a *when* sentence that have been discussed need to be related in some way. There are two major such relations namely overlap and sequence. States and progressives behave differently as to which interpretation is preferred. Smith points out that a progressive clause in the position of the *when* clause results in overlap ("durative" in Smith's terms) as the dominant reading. In an alternative reading, which is obtained marginally, the progressive event is interrupted at the time of the main clause event. (41) a. shows the former reading, and (41)b. the latter.

(41) a. Mary was laughing *when* she saw John.
b. Martha was watching TV *when* she fell asleep.

In contrast, *when* sentences that involve a lexical state *when* clause consistently have two interpretations: overlap and the event of coming about, viz. inchoative state. (42) shows this point.

(42) John was angry *when* Mary dropped the brandy snifter.

In the sequence reading, John "gets" or "becomes" angry, as Smith points out. This amounts to saying that the initial endpoint has been added to the situation. The fact that this addition is possible suggests that the stative situation type itself makes no specification regarding endpoints. Turning now to the progressive again, recall that the sentences in (41) lack the sequential, inchoative-state reading just mentioned. The only options available for them are i) either there is no endpoint visible, as in (41)a.; or ii) the

situation is interrupted and aborted before even reaching its end, as in (41)b. In other words, endpoints exist but are irrelevant in (41).

This and other observations led Smith to delineate the difference between situations presented in the progressive form, realizing the imperfective viewpoint, and stative situation types. The difference, she argues, comes down to whether endpoints are underspecified, as in statives, or recognized but not made visible, as in the progressive. I implied in Chapter 1 that the difference has a large effect on semantic imports of *when*. The proposals I develop in Chapter 4 and 5 make use of the distinction.

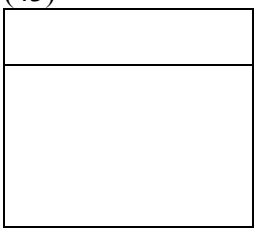
2.5 Discourse Representation Theory

I will now move on to introducing Discourse Representation Theory (DRT, Kamp and Reyle (1993), K&R henceforth). An advantage of DRT is that it captures anaphoric relations between sentences in a discourse. Also, after almost two decades since its introduction there are many descendants of the classical version, including one that adequately captures inter-sentential discourse relations using coordinating and subordinating structures. (Segmented Discourse Representation Theory (Asher (2003); see also Chapter 6). Considering the descriptive nature of the present work, I want my technical devices to be as simple and transparent as possible. For this reason, I adopt the simplest and most classical version of the theory, presented in K&R, as the basic structure of my representation. In addition, I add the aspectual information using Smith's (1997) formalizations. Furthermore, to convert a discourse into a formal representation, I employ Blackman and Bos' (URL2) (Henceforth B&B) structure generation algorithm. The information in the non-temporal component is provided as addenda to the formal representation. In the following sections, I do a detailed walk-through of how the theory works, assuming no background knowledge. I try to keep the explanation as plainly as possible, so that generalizations and analyses demonstrated later in this dissertation will be accessible to non-semanticists as well.

2.5.1 Basic Constructs of Discourse Representation Theory

DRT is a type of representation based on a model theory for formally describing natural language discourses. In DRT, words, phrases and sentences are treated as syntactic trees and sub-trees to which DRS Construction Rules (CRs) apply and yield logical representations. CRs translate a syntactic sub-tree into a box-like formula called a Discourse Representation Structure (DRS), in which a horizontal line separates a box. In the upper box, we list various kinds of logical variables, which we call discourse referents. Sitting in the lower box are conditions imposed on those variables. The variables are understood as existentially bound, and the conditions are all conjoined and interpreted in the matrix scope. At the beginning of a discourse, there is assumed an empty box, as in (43) .

(43)



Some advantages of this theory over "static" semantic theories such as traditional Montague Grammar are as follows. It allows us to see a discourse, roughly taken as a non-singleton set of sentences, as a dynamic chunk to which more information adds up as the discourse proceeds. Furthermore, we can deal with a number of logical operations such as negation, conditional and universal quantification over this two-dimensional logical formula.

Demonstration through a concrete example should be helpful in order to see how this theory works. Let us take a simple present-tensed mini discourse.

(44) Mary owns a Porsche. She likes it.

The variables, henceforth called discourse referents, to be listed are proper nouns *Mary* and *Porsche*, two-place predicates *own* and *likes*, and pronouns *she* and *it*. We first process the first sentence. An assumption in DRT is that proper nouns and indefinite pronouns introduce individual variables, x,y into the upper box, and conditions that predicate of those individuals, namely Mary(x), Porsche(y) in the lower box. The verbal predicate *own* is represented as a relation between x and y, written as a condition in the lower box. Thus, at the point of the end of the first sentence, we have the following DRS.

(45)

x y
Mary (x) Porsche (y) own (x,y)

The second sentence includes two pronouns. In order to process this sentence we need to know how to interpret them. Pronouns pick up individual discourse referents that have already been introduced in the sentence. The picked-up referent should be compatible with morphological information, such as gender and number, provided by the pronoun. In the present discourse, x and y are individual variables already introduced into the discourse. From the condition Mary (x), we know that the individual assigned to x is very likely animate and female. So we let she pick up x. We do so by identifying the referent introduced by the pronoun, let us say u, with x. In the same manner, we identify it with y, by way of the variable v. *like* should be treated just as *own*. Effectively, we have the following DRS (46) for the sample mini discourse.

(46)

x y
Mary (x)
Porsche (y)
own (x,y)
u = x
v = y
like (u,v)

An advantage of DRT is, as shown above, that one can deal with inter-sentential dependencies quite well. It has been shown that this framework is also useful for describing many other semantic phenomena, including generalized quantification and temporal expressions. It is of our particular interest how time is treated in DRT. The next section is devoted to introducing the way time is incorporated into the theory.

2.5.2 Dealing with Time, Events and Aspects in DRT

In addition to the base structure described above, DRT adequately describes temporal ordering relations that natural language expressions may convey. Furthermore, how to specify aspectual features in a DRS was briefly introduced in Kamp and Reyle's (1993) foundational work, and elaborated in Smith (1993, 1997), as well as Hitzeman (1993). This section is devoted to explicating the treatment of tense and aspect that I assume in this dissertation.

2.5.2.1 The Priorean View of Time and Its Position in DRT

When we speak of temporal anteriority/posteriority pertaining to linguistic meanings, we assume the idea of time being a set of linearly ordered points. This view is called the Priorean view, after its originator. (Prior (1969)) In the Priorean view of time, time constants are strictly ordered by the precedence relation <. (K&R: 486) That is, the

structure of time can be assumed to be pairs <T,<>, where T={t| t is a time point} and < is the total-ordering precedence relation of time constants. Namely, for any t1, t2 and t3 in T, we have:

(47) t1<t2⇒~t2<t1
(t1<t2∧t2<t3)⇒t1<t3
t1=/=t2⇒(t1<t2 or t2<t1)

In the current work, however, these time constants are related to linguistic descriptions only indirectly. For DRT, variables corresponding to events and states—eventualities—are assigned their temporal locations by way of being related to a discourse referent called location time t. Location times are sets of time points, so we can order them linearly, observing the above total order properties. So, it is not eventualities themselves that are ordered, but their location times. An effect of this is reflected in the format I adopt when writing DRT conditions. I do not order discourse referents corresponding to eventualities, such as e, e', s, s' etc..[17] Instead, I will indicate ordering relations between location times t, t', etc..

2.5.2.2 Tense

The past tense in English, realized as *–ed*, has two main functions in DRS construction. First, it places the event time prior to n, indicating that the former precedes the speech time.

The first function, simple pastness, is represented as (48).

(48) Simple past
TPpt=t, t<n

[17] Eventualities are, however, contained in the domain of set-theoretic relations such as ⊆.

As a past tensed clause is introduced into the discourse, the value for the current narrative time TPpt is set to some point t which precedes the speech time. t corresponds to the time of the eventuality described by the clause is placed. This makes the eventuality to be also placed prior to the speech time, carrying the pastness entailment.

The second function concerns the distinction between Events and States. The temporal location of an eventuality is defined relative to TPpt, the current narrative time which moves forward as the discourse proceeds. Events and States relate to TPpt in different ways. Events introduce a new TPpt t' and get surrounded by it. This gives the effect of narrative progression. States describe a situation surrounding the current TPpt. Thus:

(49) a. $t<t'$, $e \subseteq t'$ (Events move the narrative time forward and are surrounded by it)
b. $s \supseteq t$ (States surround the current narrative time, which has been unmoved)

For the present tense, I minimally modify the semantics of the past tense just described. Namely, I assume that TPpt is simultaneous to the speech time.[18] Thus,

(50) Simple past
TPpt=t, t=n.

2.5.2.3 Situation and Viewpoint Aspects

This subsection explains how the two-component theory of aspect is incorporated into DRT. Kamp and Reyle (1993) refer to the STAT feature in their set of construction

[18] I gloss over marginal meanings associated with the present tense, such as immediate future or habitual. (Parsons (1990))

rules. The STAT feature is binary, and it distinguishes between States and non-States. Other aspectual features are not considered in K&R's framework. In the meantime, Smith (1997) expresses that an eventuality is of a certain aspectual type as follows. An eventuality e (or s) belongs to the set consisting of all eventualities of the same type in the domain. Specifically, the set of State predicates is written as follows.

(51) {e: e is a State}

In Smith's system, it is also possible to state an aspectual type in terms of feature value specifications. In such terms, a State entails a set of feature description: < +durative, -telic, +stative, ...>. So, (51) is equivalent to saying that

(52) {e: e is +durative, -telic, +stative}.

Other situation aspect types can be likewise represented. Activities are durative, atelic and dynamic. So, the set of Activity predicates is:

(53) {e: e is an Activity} = {e: e is +durative, -telic, -stative}.

Accomplishment is durative, telic and dynamic. Thus:

(54) {e: e is an Accomplishment} = {e: e is +durative, -telic, -stative}

Achievement is minimally different from Accomplishment in duration. It is not durative. So,

(55) {e: e is an Achievement} = {e: e is -durative, +telic, -stative}

Finally, Semelfactive is non-durative and atelic. They assign the negative value to all of the three criteria.

(56) {e: e is a Semelfactive} = {e: e is -durative, -telic, -stative}

2.5.3 Construction of DRSs

2.5.3.1 Blackurn and Bos' DRT Construction Algorithm

I have introduced the basic building blocks of DRT that I will use in later discussions. To facilitate presentation of my analysis of *when* sentences in Chapter 4, I introduce Blackburn and Bos' (URL1) construction algorithm using the remainder of this chapter. The algorithm is an intuitively transparent strategy, directly translating syntactic representations into DRSs by top-down, left-right fashion. I shall call their formalization as B&B's Construction Algorithm, and use it as the presentational device in the rest of this work.

To see how it works, let us construct a DRS for the mini discourse below.

(57) Mary owns a Porche. She hit it hard.

I assume that the syntactic representation of (57) is as follows.[19]

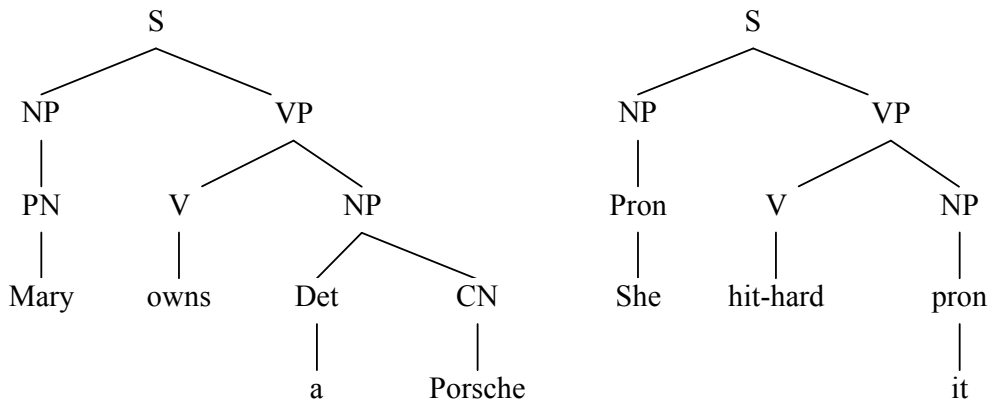


Figure 2.1 Phrase Structure Trees for (57)

[19] I simplify the verbal predicate of the second sentence as *hit-hard*.

First, we create a box corresponding to the top S node of the first sentence.

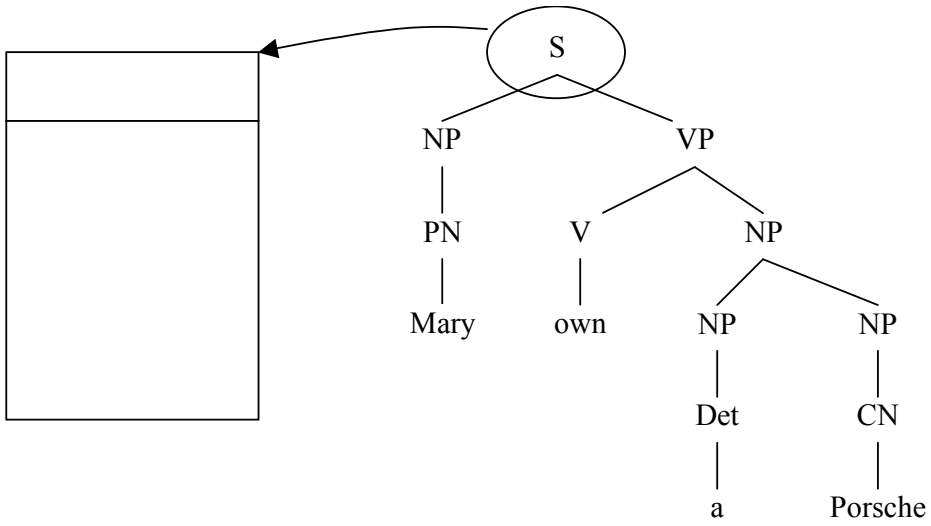


Figure 2.2 S node of (57)and the corresponding DRS box

Starting at the empty box just created, we fill in the discourse referents and conditions in a top-down, left-right fashion. So, what is to be done next is to translate the proper noun *Mary*. The job of the proper noun is to introduce a new discourse referent and attribute the name *Mary* to it.

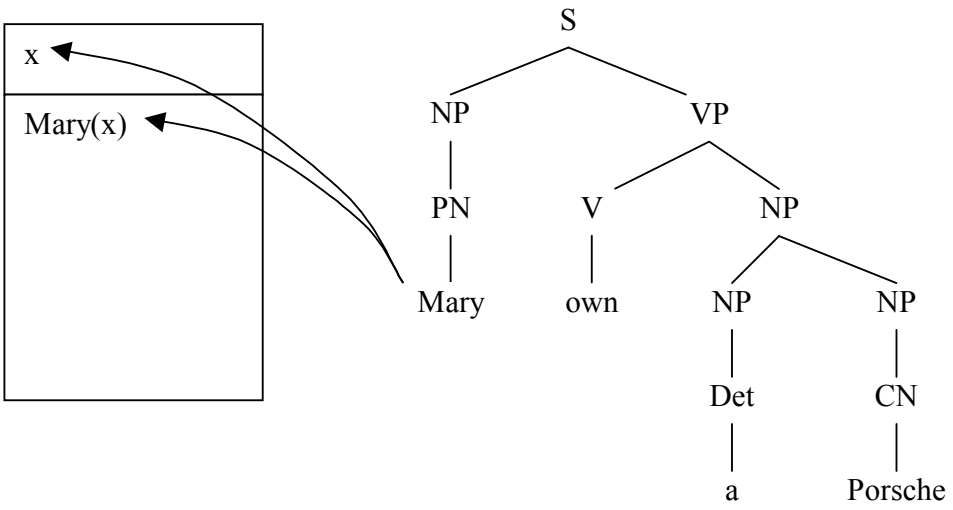


Figure 2.3 Inserting the subject

The current node ends here, so we go back to the S we started at, and then down to the VP node immediately right to the NP we have just interpreted. The VP node is a transitive one, containing a transitive verb *own* and the object NP *a Porsche*. The NP we dealt with earlier serves as the subject argument of the verb. So the verb *own* adds a condition that the introduced argument is the subject of the situation described by the verb. At the same time, the eventuality discourse referent corresponding to *own* is introduced. The non-past tense ∅ assumed on the verb own newly introduces two temporal discourse referents: n denotes the speech time and t the current narrative time, respectively. Added to the conditions box are statements that the reference point is n and the State eventuality surrounds the narrative time. This is written as follows.

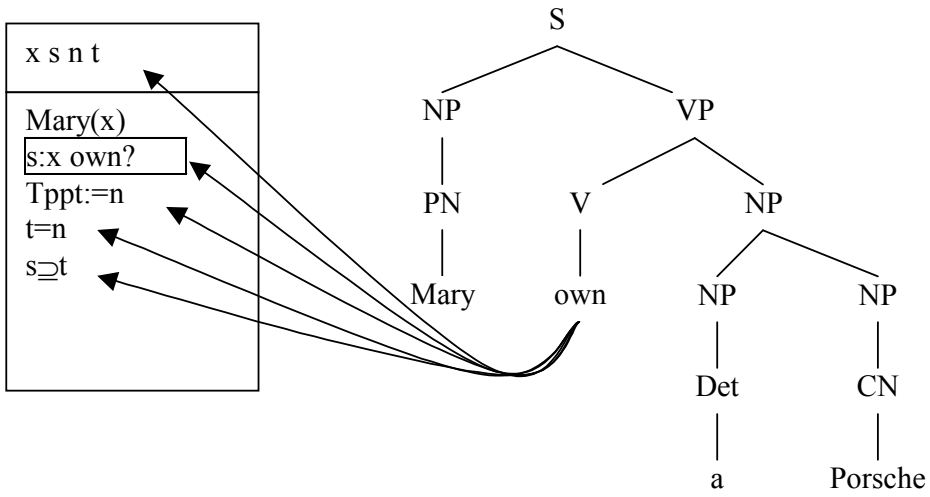


Figure 2.4 Inserting the predicate minus the object

We have reached the bottom of the current node, so we move back up to the NP immediately right to it. There, we find an indefinite NP *a Porsche*. Such an NP introduces a new individual discourse referent and a condition that it is a Porsche. As we have had an event description lacking the object argument, and as this NP indeed sits at the right position for it, we fill the object position with the newly introduced argument. So we have:

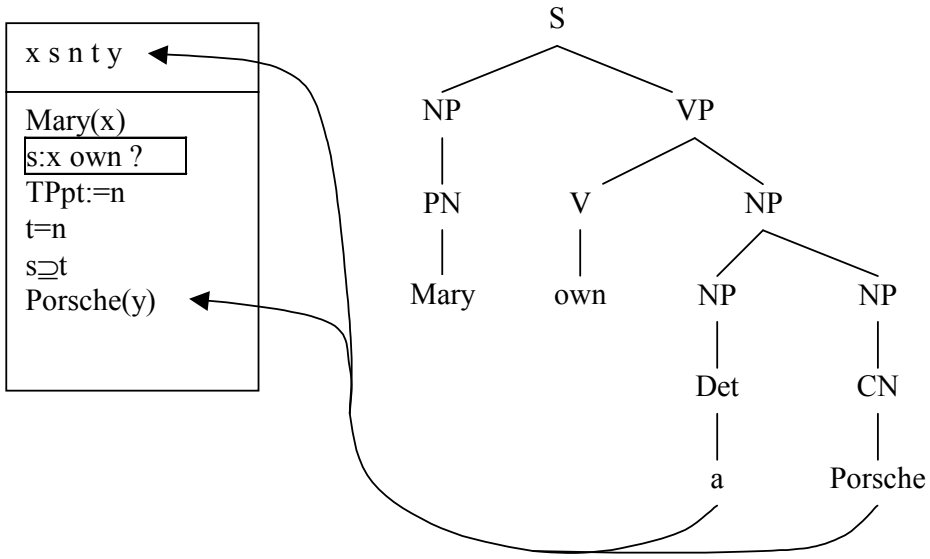


Figure 2.5 Inserting the object

We have now arrived at the bottom right end of the first tree. Keeping what we have written down in the current DRS box, we proceed to the top S node of the second tree. The leftmost NP ends at a pronoun *she*. Pronouns introduce a new individual discourse referent, so we add z in the referents box. In addition, they add a condition of the form [z=?] in the conditions box, where [?] is to be filled by an accessible discourse referent already introduced into the discourse. x matches the requirements, so we enrich the DRS with the referent and condition just introduced.

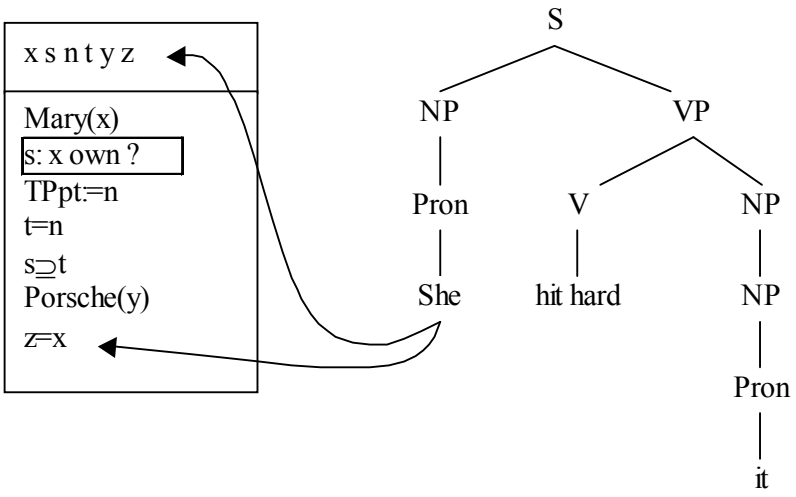


Figure 2.6 Inserting a coreferring pronoun

The next relevant node will be the verb *hit-hard*. It is past tensed and denotes a non-State eventuality. As for the pastness, we deal with it by introducing a temporal discourse referent t2, which becomes the new narrative time. The Reichenbachean reference time TPpt is intact and n. The past tense morpheme *-ed* on the verb will allow us to add a condition that t2 is prior to n. The non-State predicate *hit-hard* introduces a new eventuality discourse referent e, of the form [z hit ?] Further, it adds a condition that e occurs at t2.

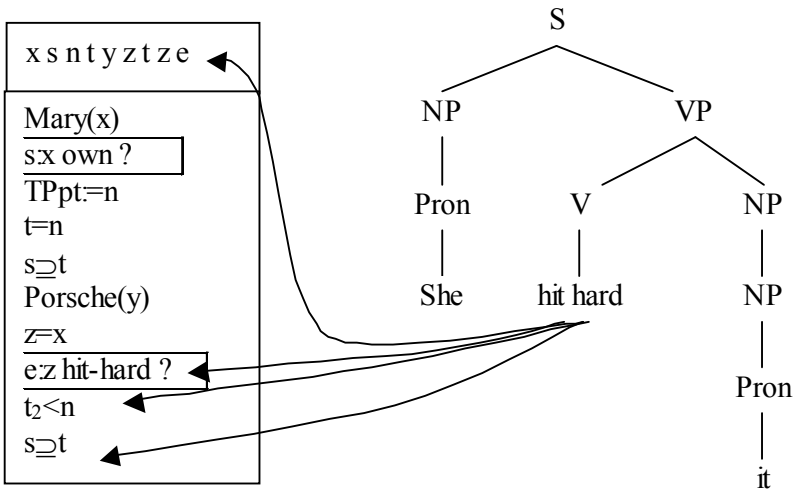


Figure 2.7 Insert the predicate *hit-hard* minus the object

What to do with the last NP is straightforward. As it is a pronoun, we introduce a new individual discourse referent u and fill the object position of e by it. Thus,

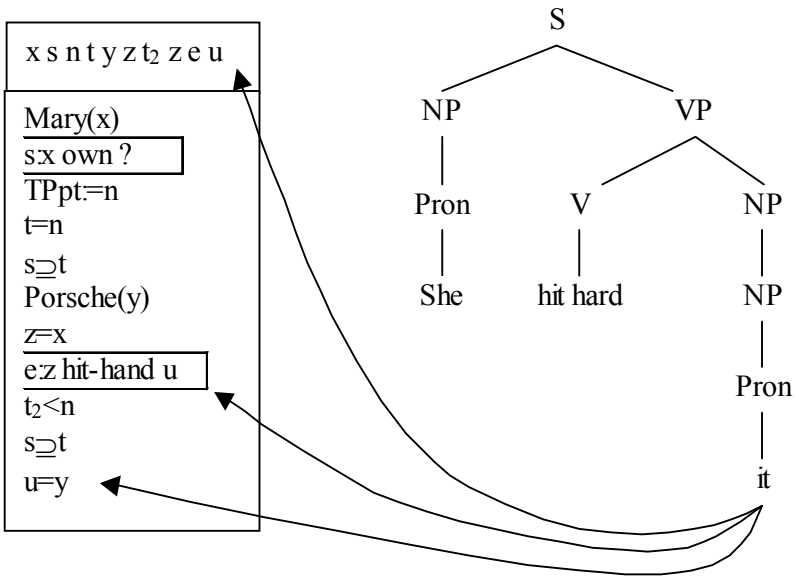


Figure 2.8 Inserting the other coreferring pronoun

This way, the syntactic trees are fully translated into one DRS, capturing their anaphoric and temporal relations.

2.5.4 DRS for A simple *When* Sentence

To some extent, *when* sentences can be translated into a DRS only using the assumptions and techniques that have been introduced. As a starting point, consider K&R's (1993:651) DRS for *Mary left after Bill arrived*.

(58)

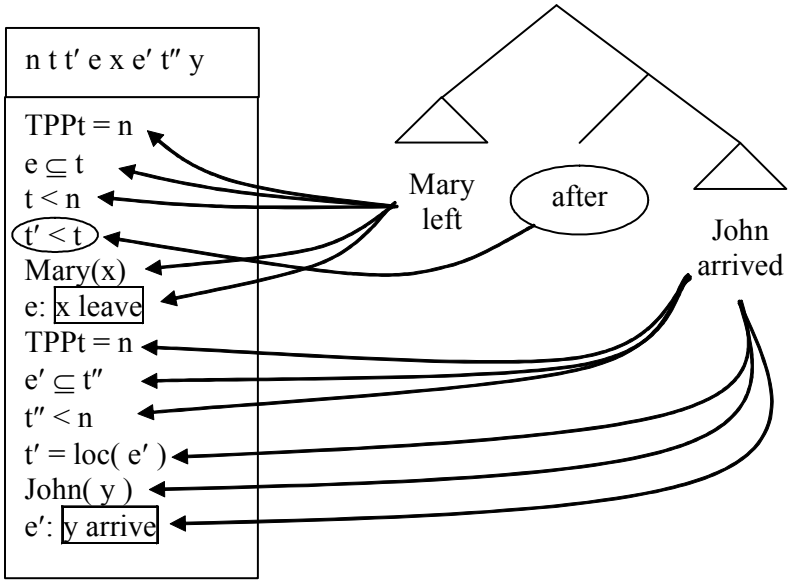
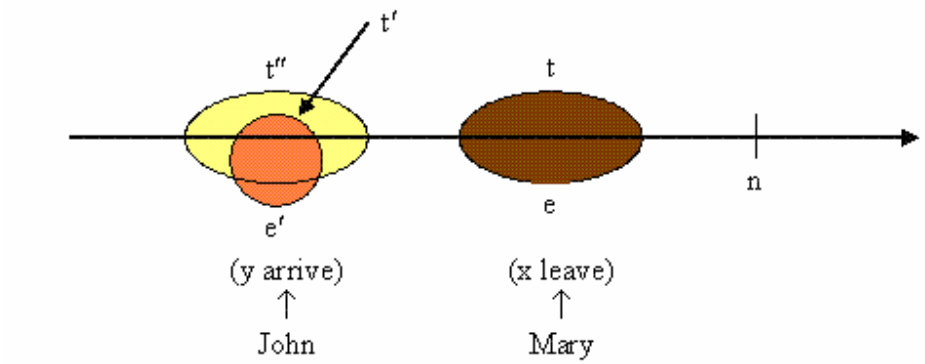


Figure 2.9 <DRS for a *when* sentence: first try>

The temporal locations in this representation can also be expressed as intervals on the timeline, as in

(59)



The meaning of *after* is expressed in Line 4 of (58), where t' (main clause event time) precedes t (*after* clause event time). The most straightforward way to apply this semantics of the *after* sentence to the *when* sentence is to allow when a three-way polysemy. That is, three different *when*'s are assumed, corresponding to the forward sequence, overlap and backward sequence readings.

The forward reading is equivalent to the *after* reading, so K&R's definition of *after* can be used to partially fulfill the semantic description of *when*. The overlap reading can be represented by modifying the temporal order between the two temporal locations, t and t', as shown below.

(60) t' = t

Similarly, the backward sequence reading can be expressed using the following temporal order between t'and t.

(61) t'<t

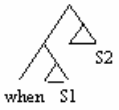
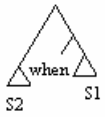
An immediate problem with this polysemy analysis is that it does not give any dividing condition among the readings. Three separate *when*'s are postulated, and it is not

possible to associate any grammatical forms or pragmatic implicatures with any of the readings. I will deal with this problem in Chapter 4.

2.6 A Simple Construction Rule for *When*

So far, I have not focused on how the DRSs discussed above are constructed. In general, lexical items are assigned construction rules (CRs) on the basis of which the items are translated into DRS variables and conditions. In this subsection, I would like to reconstruct a CR for *when* from K&R's DRS for *after* (58). The core meaning of *after* in (58) is the condition t'<t. These time variables correspond to two eventualities denoted by the main and *when* clauses. Then, the two past tensed sentences are translated, feeding information concerning the individual referent, eventuality referent and temporal restrictions. By this stage, εw is replaced by the eventuality referent that the *when* clause eventuality denotes. After interpreting the *when* clause, we go back up to the top node of the tree, move to the right and down to the main clause. The same routine translating a past sentence takes effect, writing more information down in the DRS.

Table 2.2 A Construction Rule for the *after* (FWSEQ) reading

CR: When		
Triggering Configuration	 OR 	
Introduce to U	e_w, e_m, n, t, t'	
Introduce to Con	IF tense (S1) = past THEN t<n, ELSE t>n	
	$e_w \subset t$ $e_m \subset t'$ $t < t'$	

Chapter 3 :

Previous Analyses of *When* Sentences

3.1 Introduction

This chapter presents previous theories concerning the topics addressed in Chapter 1, and reviews them critically. The topics include two unsolved issues pertaining to English *when* and Japanese *toki-ni*. While Japanese *toki-ni* has not been paid so much attention (Chapter 5), English *when* has been explored to some extent, and there are three representative views as to how to treat its temporal ambiguity. Moens and Steedman (M&S henceforth) (1989:1) present three views on how temporal ambiguity concerning *when* arises.

(62) Temporal Ambiguity of *when* arises:
- i) because *when* is polysemous.
- ii) because the meaning of *when* is underspecified.
- iii) because the primary meaning of *when* is atemporal.

The studies to be reviewed in this chapter can all be categorized into one of the above three types. I start by discussing Heinamaki (1979), who is in support of i). She gives a specific condition to separate the overlap reading from the sequence. Then I address Ritchie (1979)'s article, who supports ii). He claims that *when* semantically conveys only approximate coincidence between two eventualities. The next study, Hinrichs (1986), is again in favor of ii), where he says that the readings are essentially in free variation. The first two approaches can be supercategorized as the general purpose analysis, because they entail that *when* can be used for multiple purposes as far as the surrounding grammatical environments are concerned. M&S, who approach the issue from a completely different tack, argue for iii). The final study that I review for English, Sändström (1993), shares the basic insight with M&S and is thus in favor of (iii.

3.2 Studies on English *when*

In this section, I give extensive reviews of past works on the semantics of English *when*. I start by re-addressing the distribution rule discussed in Chapter 1, this time tracing the original works.

(63) The main clause event overlaps the *when* clause event if there is at least one Stative predicate in the sentence; otherwise the temporal relation varies.

I discuss several different versions of (63) in the original format of the studies from which they originate, namely Heinämäki (1978), Ritchie (1979) and Hinrichs (1986). Then, I go on to introducing treatments of *when* that are primarily atemporal. I give reviews of Moens and Steedman (1986) and Sandström (1993). In both studies, authors emphasize the role of consequentiality.

3.2.1 Heinëmäki (1974):

The first study I address is Heinëmäki's (1978:8-12, 36-42) dissertation. The work is a semantic overview of English temporal connectives. The study itself dates back to 1970's, but due to its comprehensive nature it is frequently referred to by more recent researchers interested in temporal sentences,. Heinëmäki's analysis is of special importance to studies of English *when* sentences, since it gives most basic facts that set the ground for discussion.

Heinëmäki's claim on *when* sentences centers on giving a condition that separates the overlap reading from the sequence. Specifically, she postulates a dichotomy of predicates, durative and nondurative Accomplishment. She argues that sentences containing at least one durative clause give rise to the overlap interpretation, while the sequence reading results otherwise.

She analyzes sequence and overlap interpretations of English *when* sentences on the basis of the aspectual feature "durativity". Heinëmäki claims that "durative" predicates consist of the four aspectual types: an Activity, an Accomplishment, a Stative, or a progressive. This definition of durativity is different from the standard one, adopted by

Smith (1997) among other works. The set is the union of +durative predicates (Activity, Accomplishment and Stative)[20, 21] and the progressive. I use Durative∪Prog where Heinëmäki uses Durative. Heinamaki argues that *when* sentences with the overlap reading contain at least one Durative∪Prog predicate, whereas there is no Durative∪Prog involved in a *when* interpreted as sequence. (64) illustrates some examples.

(64) a. Everybody was away *when* John destroyed the documents.
b. We were crossing the street *when* John noticed us.

Heinëmäki considers four possibilities. Each clause in a *when* sentence is either Durative∪Prog or –Durative∪Prog. There are two clauses in a *when* sentence, so there are four options in total. They are associated with, according to Heinëmäki, one of two temporal orders, introduced as sequence or overlap in the present terms.

If both clauses are Durative∪Prog, background overlap is obtained. It is ambiguous as to which eventuality includes which. An example Heinëmäki gives is (65). (ibid: 36)

(65) It was raining in New Orleans *when* we were there. (Heinëmäki's (15))

If only one of the clauses is a Durative∪Prog, that clause temporally includes the other eventuality in the same sentence, yielding again background overlap. She gives the following examples (67).

(66) a. Everybody was away *when* John destroyed the documents. (H's (16))

---

[20] Heinemaki does not consider Semelfactive as a separate category.

[21] Duration, according to Heinëmäki, can be tested in two ways. One is to add a *for* adverbial and see if the sentence retains grammaticality. The other is to consider subintervals of the interval at which the proposition in question is true. If it is true at any such subinterval, the predicate is considered durative. Of the predicate types she considers, only States, Activities and Progressive forms pass these tests.

b. We were crossing the street when John noticed us. (H's (17))

c. The balloon broke when Lydia was playing with it. (H's (18))

d. They built the wall when bricks were still very cheap (H's (19))

If there is no Durative∪Prog involved in the sentence, the clauses are ordered temporally, giving rise to forward sequence. (ibid: 38-41) She gives a number of examples to show this point. [22]

(67) a. *When* John wrecked the car, Bill fixed it. (H's (21))

b. *When* John broke his leg, he made a pair of crutches. (H's (22))

c. John built a sailboat *when* Bill wrote a detective story. (H's (23))

d. Bill got surprised *when* John built a sailboat. (H's (24))

e. *When* John pushed the button, the bomb exploded. (H's (25))

In addition, Heinëmäki claims that the eventuality described in the *when* clause *always* takes precedence over the one in the main, *regardless of the presentational order of the clauses*. Thus, in (82)a., John's wrecking the car precedes Bill's fixing it. The same follows in (82)c.: Bill's writing a detective story should precede John's building a sailboat. These examples exhibit different presentational orders, but this does not affect the interpretations of the sentences.

---

[22] All of them are Accomplishments. She seems to categorize them as Achievements, because otherwise her arguments would be inconsistent. I am not sure if this is an error or she had any intention. I will leave this point open, as the current project does not hinge upon what she really means by this categorization.

Lastly, Heinëmäki briefly mentions Inchoative State. She discusses a case in which the eventualities are sequentially ordered despite the fact that the main clause eventuality is a State. (ibid: 40-41)

(68) We were happy *when* John came. (H's (27))

The main clause of (83) can be taken as stative or eventive.[23] It is possible to interpret the sentence in such a way that the main clause eventuality does not temporally include the one in the subordinate. Instead, the initial bound of the main clause eventuality coincides with the time at which the *when* clause eventuality occurs. Heinëmäki points out (ibid: 40-41) that inchoative state is an exceptional reading and generally ambiguous between the sequence and overlap readings.

In summary, Heinëmäki presented a taxonomy of verb (phrase) categories by which the overlap and forward sequence readings of *when* sentences are separated. She gives a dichotomy of Durative∪Prog and -Durative∪Prog. The background overlap reading arises with *when* sentences containing at least one Durative∪Prog, while other *when* sentences result in forward sequence. She notes on Inchoative States, where a Durative∪Prog predicate does not give rise to overlap, but is rather interpreted as forward sequence.

Heinëmäki's analysis distinguishes the overlap and forward sequence reading on the basis of situation and viewpoint aspects. The distribution is illustrated in the chart below.

---

[23] I am not going to defend the view that Inchoative States are generally ambiguous. They are the states that are ambiguous only in certain expressions.

			overlap	fwseq	bwseq
	prog		ok	*	*
nonprog		Activities	ok	*	*
		Accomplishments	*	ok	*
		Achievements	*	ok	*
		States	ok	ok	*

Figure 3.1 Distribution of Meanings by Heinëmäki

The contribution of her work with regard to when sentences has been that it clearly states that two readings—overlap and forward sequencing--emerge with the temporal adverbial interpreted in context. A drawback would be that it ignores the backward sequence reading. In addition, an empirical problem with Heinëmäki's analysis is that she categorizes Activity-containing sentences to give rise to the overlap reading, which is not always correct.

3.2.2 Ritchie (1979)

Ritchie's (1979) article deals with sentences with temporal adverbials in general. As far as *when* sentences are concerned, his claim is similar to Heinamaki's. The reason I review this work here is that it addresses the backward sequence, which is unrecognized in Heinëmäki's work. We will later see that the backward sequence is a central issue for Hinrichs (1986).

(69) exemplifies the backward sequence, which appears in Ritchie (ibid).

(69) a. *When* they built the fifth bridge, they took several tenders.
b. *When* they burgled our house, they phoned to check if we were out.

There are two other kinds of readings, which are more familiar to us by now. The readings are forward sequence and overlap. The sentences in (72) exemplify forward sequence, while those in (71) illustrate overlap.

(70) a. *When* they built the fifth bridge, they used the best materials.
b. *When* they burgled our house, they ransacked every room.

(71) a. *When* they built the fifth bridge, there was a gala opening.
b. *When* they burgled our house, the police caught them very easily.

Ritchie accounts for the way in which these three readings come about as follows. (ibid: 89-90, 108-109) He stipulates that the primary function of *when* is to set up the reference time or reference interval for the discourse. The main clause eventuality is then temporally interpreted *relative to the given reference time/interval*. In this sense, the *when* clause works as a time binder for the whole *when* sentence (ibid: 91-92). An effect is that the main clause eventuality is always interpreted as temporally proximate to the *when* clause eventuality. He further states that *when* is the most basic of various time binders, such as *before*, *after* and *during*. Compared to *before* and *after*, which order two eventualities without overlapping, a *when* clause provides the whole situation as duration (ibid: 92). The main clause event is then placed near that duration in terms of the timeline.

The variety of readings that Ritchie considers is accounted for by a Stativity-based dichotomy, again. He groups States and the progressive on one hand and Activities, Accomplishments and Achievements on the other. Ritchie argues that if there is a State or progressive predicate in a *when* sentence, it temporally includes the other. Namely, the result is background overlap. On contrary, *when* sentences that consist only of an Activity, an Accomplishment or an Achievement only yield an "approximate coincidence" relation, which can be broken down to forward sequence, coincidence (=overlap: MN) or backward sequence. (ibid: 94-95, 108-109) The following three examples in (131) illustrate each reading.

(72) a. *When* they burgled our house, they phoned to check if we were out.

b. *When* they burgled our house, they ransacked every room.
c. *When* they burgled our house, the police caught them very easily.

Ritchie argues that it is not possible to come up with a grammatical condition that predicts what kind of temporal proximity is obtained. (ibid: 95). According to him, one needs to resort to extra-linguistic considerations to make the relevant division. What is necessary is world knowledge that ”sort[s] out the exact relationship between the two events…the syntax/semantics can provide only the ‘approximate coincidence’ relationship.” He then adds a disclaimer that “[i]t may seem rather glib to keep allo[ca]ting various problems to ‘world knowledge’ and ‘higher-level inferences,’ but there are limits to what should be crammed into the grammar." (ibid: 94) .

A major drawback of Ritchie’s analysis is that he is not very articulate about what constitutes his “world” knowledge. He only notes that “the slight implication of causality” can be extracted from an example like (73).

(73) *When* the Americans dropped the atomic bomb, Japan surrendered.
(Ritchie's 23(b.))

The implication, however, is not due to *when* proper. He says that "this nuance [=causality: MN] does not come directly from the use of '*when*', but rather from the juxtaposition of the events." The fact that sequences of main clauses may carry similar causative meaning, he argues, works in support of his view. Consider (133).

(74) The Americans dropped the atomic bombs. Japan surrendered.
(Ritchie's (24))

To sum up, Ritchie claims that States and the progressive give rise to coincidence, in our terms the overlap interpretation, for *when* sentences. Meanwhile, Activities, Accomplishments and Achievements appearing in *when* sentences are not associated with any temporal specification other than "approximate coincidence." All other inferences, Ritchie says, will be obtained depending upon ‘world knowledge’ and ‘higher-level

inferences.' One specific example of such extralinguistic knowledge is causality, as shown in (73) above. Ritchie further argues that *when* is not responsible for bringing about such extra-linguistic information; sequences of main clauses can also be linked with causality as shown in (74) above.

Ritchie's work has separated the overlap reading and ambiguous cases based on the Stativity criterion: sentences that contain either a lexical stative or progressive predicate yield the overlap reading. Otherwise, the temporal interpretation is indeterminate among the overlap, forward sequence and backward sequence readings. To identify the temporal interpretation in such cases, world knowledge must be called for. Ritchie's conclusions are illustrated below.

			overlap	fwseq	bwseq
	Prog		ok	*	*
nonprog		Activities	ok	ok	ok
		Accomplishments	ok	ok	ok
		Achievements	ok	ok	ok
		States	ok	*	*

Figure 3.2 Distribution of Meanings by Ritchie

Ritchie's analysis has contributed to the research of *when* by claiming that *when* is basically underspecified and can take on the three readings, overlap, forward sequence and backward sequence on a free-choice basis. His approach leads to some empirical inadequacies that Ritchie does not mention. Chapter 4 addresses such tendencies.

3.2.3 Hinrichs (1986): Underspecification and Temporal Update

Hinrichs (1986) approaches the mixed semantics of *when* emphasizing its underspecified nature. By underspecification, I mean that a semantic description of a

lexical item is intentionally left vague, allowing the item to have more than one meaning depending on the context. According to Hinrichs, (75)a.-d. exemplify forward sequence, overlap and backward sequence readings.

(75) a. *When* John wrecked the piano, he broke his arm. (forward sequence)
b. *When* the Smiths moved in, they threw a party. (forward sequence)
c. *When* we were in New Orleans, it was raining all day. (overlap)
d. *When* the Smiths threw a party, they invited all their old friends. (backward sequence)

Hinrichs is of the opinion that these readings are not distinguishable in terms of the grammar, and extra-linguistic knowledge must be called for. To defend his claim on underspecification, Hinrichs argues against Heinëmäki, who proposes that "durativity" separates the forward sequence and overlap readings while ignoring the backward sequence reading.

Hinrichs begins by reviewing Heinëmäki's examples (76). (ibid: 74)

(76) a. *When* John wrecked the car, Bill fixed it.
b. When John broke his leg, he made a pair of crutches.
c. John built a sailboat when Bill wrote a detective story.

Heinëmäki's hypothesis predicts that there are only two kinds of readings for (76): overlap and forward sequence. Thus if the sentence is not interpreted as overlap, the only remaining option is forward sequence. Heinëmäki would expect that the sentences in (76) are all interpreted as forward sequence. Hinrichs claims that *when* sentences in this environment may be understood in three ways. The three interpretations correspond to the three temporal imports in which I am interested, namely forward sequence, overlap and backward sequence. Hinrichs claims that Heinëmäki's prediction does not have empirical support, stating: "[v]irtually all native speakers of English that I have asked interpret (29) (=(76)) in such a way that the two events overlap each other.(ibid: 73)" Hinrichs argues that what is crucial in determining the temporal reading of *when* sentences is world knowledge, citing the following set of examples.

(77) a. John broke his arm *when* he wrecked the piano.
b. *When* the Smiths moved in, they threw a party.
c. *When* the Smiths threw a party, they invited all their old friends.

Hinrichs claims that the two eventualities described in (77)a. occur "simultaneously" (ibid: 74). The most natural understanding of the sentence is that John's wrecking the piano and breaking of his arm occur very close to each other temporally. In (77)b., on the other hand, the invitation temporally precedes the party itself, Hinrichs argues. According to Hinrichs, both inferences come from world knowledge; wrecking of the piano is likely to lead to breaking the subject's arm, and an invitation to a party cannot possibly precede the party itself. What these examples show then, Hinrichs contends, is that event order is not fixed for pairs like (77).

Hinrichs proposes a DRT-based theory which is essentially similar to Ritchie's "approximate coincidence" analysis. Hinrichs constructs a rule for temporal *when* in such a way that the primary function of *when* is to set up a new reference time, which is for him an interval, within which the *when* and main eventualities are interpreted. He assumes the standard DRT mechanism by which eventualities either include or get included in the reference time depending on their Stativity feature. As I have addressed in Chapter 2, States include the reference time, whereas Events are included in the reference time. The construction rule Hinrichs gives specifically deals with *when* sentences with two past-tensed clauses, such as (78).

(78) *When* he poured the drink, his actions were stiff and deliberate.

Below, I discuss Hinrichs construction rule in detail. First, I state the rule in prose, then I move on to formalization. The rule takes a *when* sentence with two past tensed clauses. What *when* does, in terms of variable introduction, is to introduce two temporal referents, e_{i+1} and e_{i+2}, corresponding to the intervals mapping to the *when* and main

clause events respectively. [24] Then, conditions in Con_k determine how these eventualities are related. Pastness of the two eventualities is dealt with in the lines i. and ii. Then, the rule posits the reference interval e_r, which is updated to e_{i+2}. That is, After the *when* sentence is uttered, the reference interval, which includes the current narrative time e_r, is updated to coincide with e_{i+2}, the main clause event time interval. Finally, the relative order between the *when* clause eventuality and the reference interval, set to the main clause event time, e_{i+2}, is determined. If the *when* clause is an Accomplishment or Achievement, the *when* clause event is included in the current reference interval. e_{i+2}. Note that this move effectively places the *when* clause eventuality 'one step ahead' of the old reference interval, which Hinrichs notates as e_r. In contrast, the order between the *when* and main clause eventualities remains unfixed throughout the rule: the only restriction is that both are included in the reference interval. This is as Hinrichs intends, as he assumes that the order is undetermined among the three readings, forward and backward sequences and overlap at the end of grammar. Finally, if the *when* clause is either Activity, State or in the progressive form, then the *when* clause event includes the reference interval, giving rise to the overlap reading.

As Hinrichs' formal presentation of the rule is differently formatted than the classic DRT adopted here (K&R), I need to accordingly make non-trivial modifications to spell out his analysis in my format. Hinrichs' original rule is given in (79) in the form of a construction rule, with minimal notational changes.

(79)

[24] Despite the symbols used, these variables denote times, rather than events.

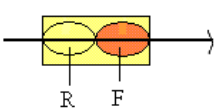
CR.*when*[past-past]
Triggering Configuration: γ =[*when*[C_1[past]]C_2[past]] Introduce to U_k: 1. e_i+1; 2. e_i+2 Introduce to Con_k: i. e_i+1 < n; ii. e_i+2 <n; iii. e_r < e_{i+2}; iv. replace e_r by e_{i+2} v. If C_1 ∈{Accomplishment} ∨ {Achievement} $e_{i+1} \subseteq e_{i+2}$; If C_1 ∈{Activity} ∨ {State} ∨ {Progressive} $e_{i+1} \supseteq e_{i+2}$ Replace γ by C_1 C_2.

Unmentioned in the above rule is the aspect type of the main clause eventuality. Line v. does not refer to the main clause at all. Hinrichs provides Venn diagrams for the rule shows that the same mechanism as the *when* clause, viz. being included or including in the reference interval depending on its aspectual type.

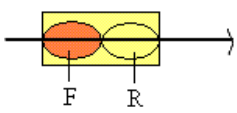
(80) Adaptation of Hinrichs' Diagrams

Case 1. For two Accomplishments or Achievements:

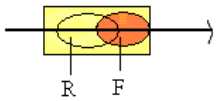
a. e_w precedes e_m



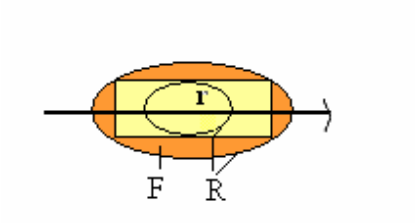
b. e_m precedes e_w



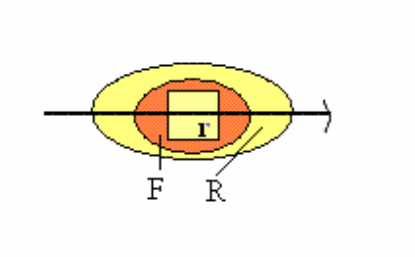
c. e_w and e_m overlap



Case 2. For an Accomplishment or Achievement *when* clause and a "durative" main clause:



Case 3. For two "durative" clauses:



Case 1 includes three possibilities. The possibility (a) corresponds to forward sequence. The reference interval r is introduced by *when*, within which *when* and main clause eventualities are placed. This is due to the aspectual specification of the eventualities. Note that for Hinrichs it is just a coincidence that the former temporally precedes the latter. In fact, the order is reversed in the possibility (b) and the two eventualities are not ordered in the possibility (c). In Case 2, the main clause is either an Activity, State or in the progressive form. The main clause interval includes the reference interval, which in turn includes the *when* clause interval. The diagram for Case 2 reflects the fact that Hinrichs assumes that the main clause is treated the same as the *when* clause as to whether the former includes or is included in the reference time. Case 3 describes the situation reversed from Case 2. In both of these options, the overlap reading is obtained.

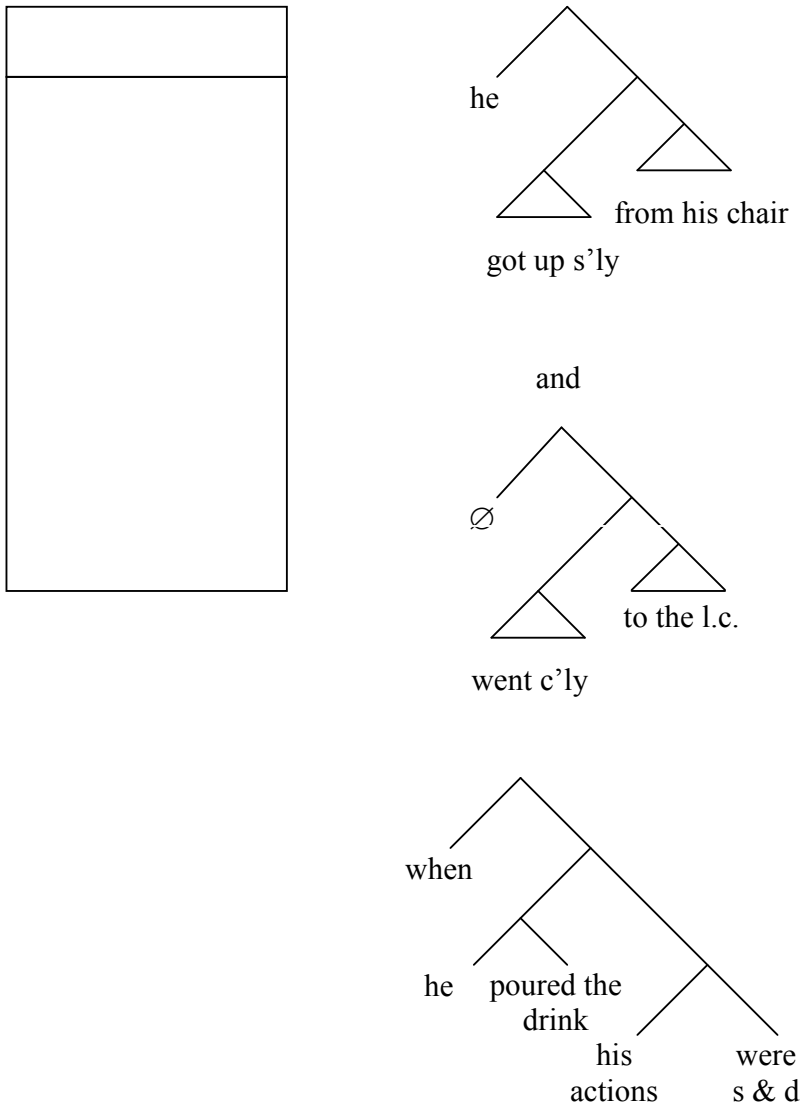
With these basic assumptions given, let me now reproduce a DRS that Hinrichs would assume for a mini discourse that appears in Hinrichs' article (ibid: 76), using B&B's style DRS construction algorithm.

(81)

1. He got up slowly from the chair and went cautiously to the liquor cabinet.
2. *When* he poured the drink, his actions were stiff and deliberate.

For expository purposes, the utterances are numbered as 1 and 2. Suppose 1 is the initial utterance in the discourse, and the pronoun *he* has a non-ambiguous referent, that is, the participants of the discourse agree on a variable x to be as the referent of *he*. We start with (82).

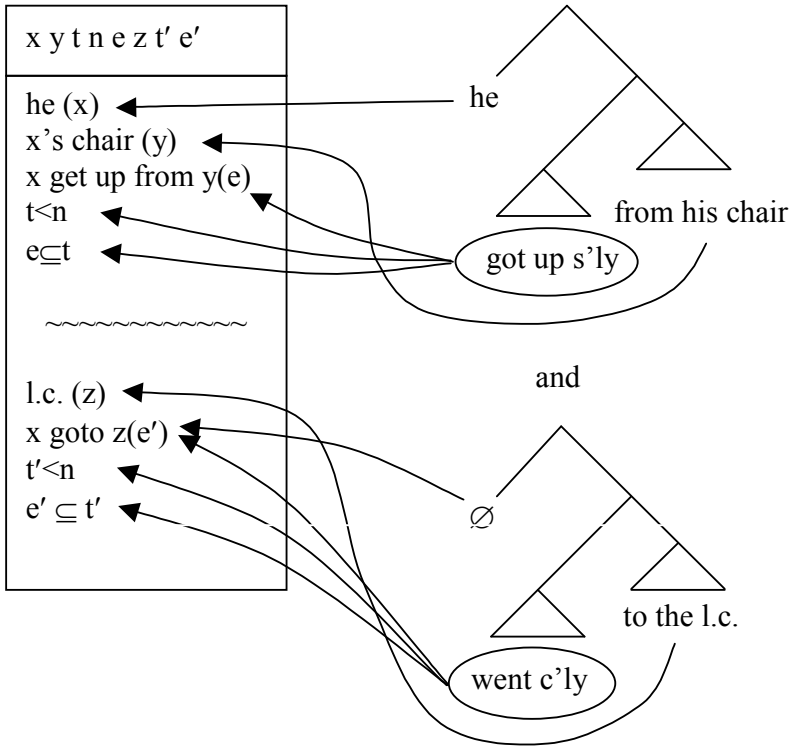
(82) discourse-initial DRS for (81)



1 is broken down into two separate events, connected by the conjunction *and*. These are presented in the first two tree diagrams. By the utterance of the first true diagram, *he got up slowly from the chair*, a new discourse referent for *chair* is introduced, let us say y, and a condition about x's change of posture, namely x get up slowly from y, is added to the DRS. At the same time, the past tense *-ed* adds Rpt t, one step ahead from the

initial value t_0, and the pastness condition, namely t<n. The second diagram uses the same pronoun *he*, and a new verbal predicate, *went cautiously to the liquor cabinet.* The eventuality described by the predicate is understood to take place in the past, as it bears *-ed*. Note that this is an Accomplishment eventuality. As discussed in Chapter 2, the past tense may partake in temporal update, i.e. overwriting of the then-current narrative time t, giving t', such that t<t'. This happens here, as Accomplishment eventualities are very likely to invoke temporal update. Being an Accomplishment, the eventuality itself is represented as being included in t. The interim DRS up to this point is given in (83).

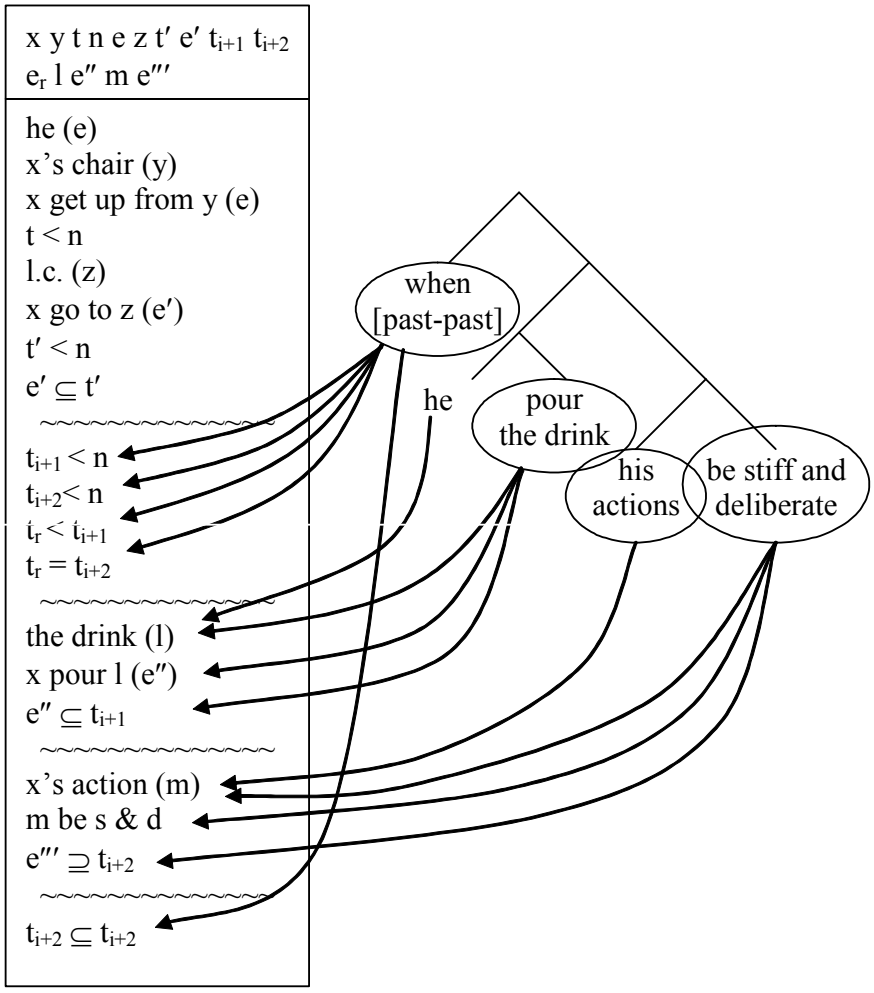
(83) DRS for (141-1)



Then, at the beginning of the *when* sentence, the reference interval e_r is introduced. This reference interval t_r advances the reference time, one step ahead from the then-current reference time, which is implicit in the rule. Past tenses of the *when* and main clauses are also introduced. Finally the contents of the two clauses are introduced, and included in the

reference interval. As the *when* clause eventuality is an Accomplishment and the main clause eventuality is a State, the former is included in the latter, giving the inclusion condition in the last line of the DRS.

(84) DRS for (141-1,2)



Note that it is necessary in *CR.when* as given in (79) that the reference time updates in a *when* sentence. The relevant clauses are repeated below.

(85)

iii. $e_r < e_{i+2}$;

iv. replace er by e_{i+2}

Hinrichs (ibid:76) actually defends this move. His example is (86).

(86) Jackson tried the door. It was locked. *When* he opened it with his master key, a siren went off.

After Jackson trying the door, and before the siren goes off, there must be a temporal point at which he opens the door. That is, a new Rpt is introduced into the discourse. Schematically represented, temporal progression of the fragment (86) would look like (147).

(87) try the door>open door with master key>siren go off
door locked <u>intermediate reference time update</u> door not locked

Hinrichs states that "[the *when* clauses] lead to a new identifiable instant in the instant structure of the discourse (p.76)." In other words, *when* creates a reference point by introducing an event that occurs after the then-latest event in the discourse.

In sum, Hinrichs takes over and extended Ritchie's basic insights, as described in a summary chart below.

			overlap	fwseq	bwseq
	prog		ok	ok	ok
nonprog		Activities	ok	*	ok
		Accomplishments	ok	ok	*
		Achievements	ok	ok	*
		States	ok	*	ok

Figure 3.3 Distribution of Meanings by Hinrichs

The main contribution of Hinrichs' development is a well-defined formalization of the 'general-purpose' approach. He successfully translated Ritchie's basic ideas to DRS conditions. Another advantage of Hinrichs' theory is the incorporation of narrative progression into discourse representations of when sentences. A difficulty in Hinrichs' system is essentially the same as Ritchie's: it is too underspecified to allow for adequate dividing conditions in some cases.

3.2.4 Moens (1987)/Moens and Steedman (1986): The Non-temporal Approach

The three studies on English *when* introduced so far all have a crucial commonality. The commonality is an assertion that the meaning of *when* sentences is primarily temporal, and that proper semantics of the construction should describe *temporal order relations between two eventualities*. Some of them recognize 'world knowledge' and 'higher-level inferences,' to play a major role in their interpretations. However, incorporation of such extra-linguistic information largely sat outside the domain of their analyses. I will present two approaches that emphasize such non-temporal implications. I first introduce Moens and Steedman (1989), M&S henceforth, and then Sandströem's (1993) development of M&S.

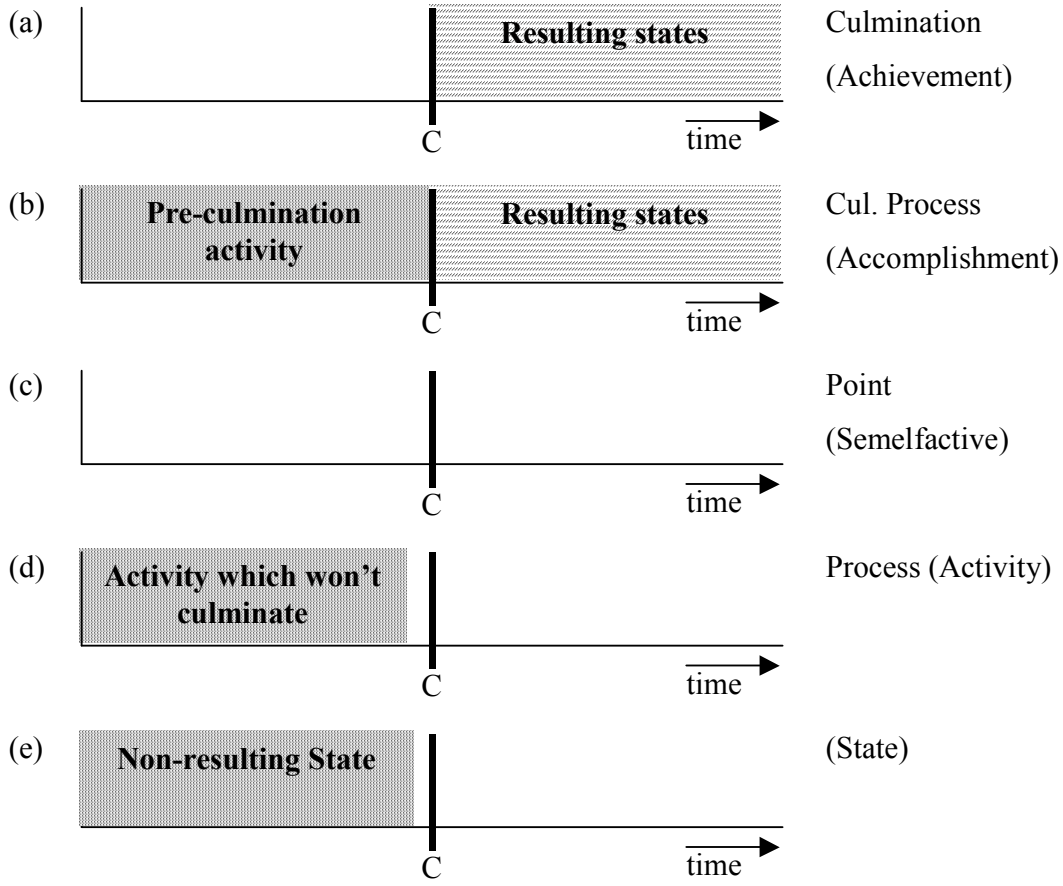
M&S present a conceptual analysis of *when* sentences in which non-temporal information is foregrounded. They claim that the temporal implications of a *when* sentence, ranging over forward sequence, backward sequence and overlap, are not incorporated in the grammar *per se*, but are consequences of non-temporal features.[25] Their analysis is based on Moens' doctoral dissertation (1987). In the following discussion, I refer to Moens' work when addressing basic ideas and to M&S when I focus on application to *when* sentences.

---

[25] M&S do not consider the variation in presentational order of *when* sentences. They assume that the *when* clause is interpreted first, and then the main clause gets integrated to it.

Moens (1987) and M&S propose a theory of aspect types, aspectual coercion and narrative progression. Then classify verbal predicates into five types' below, giving each a unique internally-structured event template, which Moens calls 'event nuclei.'

(88) Moens's aspect types and corresponding event nucleus



C= Culmination

As indicated in the addenda above in parentheses, these types neatly match Smith's five situation aspect types, introduced in Chapter 2. Event nuclei, also, can be best understood by way of Smith's situation aspect types. To review, situation aspect types can be characterized by two types of duration, activity/preparation period and result state, and initial and final points of the durations, natural or arbitrary. Accomplishments are defined

by non-trivial periods in which a certain activity takes place and a result state following from completion of such activity. Both of the activity and the result state are obligatory. At the transition between the two durations, there is a natural endpoint, which marks the end of the activity and the beginning of the result state. Examples of Accomplishment are *build the house*, *go to Japan*. In the above schemes of M&S,  indicates the activity period which could be preparatory. | corresponds to the natural endpoint, which is followed by the result state  . Culminated process (CP) has a preparatory period, natural end points and ensuing result states, and Achievements are Culminations, (C). C has | and  . Semelfactives are called Points. Points are non-durative and are associated with any duration or end points. Activities are Processes. Processes focus on actions that take non-trivial periods of time, but they do not have natural endpoints nor result states. States are States. States are situations that hold over time. M&S's representation is  . They do not have energy input, so no action is assumed. They do not involve change of state, so they do not imply result states either.

Another point in M&S's theory is coercion, context-triggered shift of aspectual types. As mentioned in Chapter 2, aspectual coercion is triggered by a number of factors, most often in the context. For example, (89) shows that an adverbial denoting a time frame triggers an Accomplishment to be interpreted as an Activity.

(89) a. Mary read a book.
b. Mary read a book for an hour.

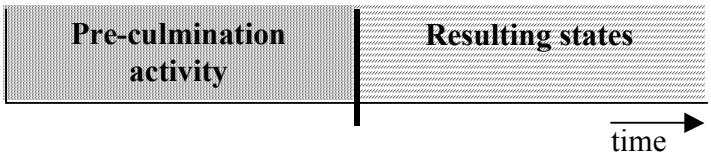
M&S assume that utterances in a discourse, more precisely their event nuclei, are linked to each other anaphorically. They call such anaphoric linking as integration. Let us see how it works using a set of *when* sentences (141) from Ritchie (1981).

(90) a. When they burgled our house, they phoned to check if we were out.
b. When they burgled our house, they ransacked every room.
c. When they burgled our house, the police caught them very easily.

M&S propose that the main clause eventuality, notated as e_m, is linked to a durative part of the event nucleus of the *when* clause eventuality. (91) illustrates that.

(91)

(a) e_w



(b) e_m Option1 Option2

The two options indicated in (91) b. describe possible interpretations of the main clause eventuality (e_m) relative to the *when* clause eventuality (e_w). The options are stated on the basis of the assumption that e_m somehow depicts a situation coherently related to e_w, the process they call integration, either by elaborating or presenting a narrative continuation of it. In Option 1, em elaborates the pre-culmination part of e_w, whereas in Option2 e_m describes an eventuality that follows e_w. There, em integrates into the result state of e_w. If this occurs, the reading that arises is a sequence. (91) c. exemplifies this possibility.

(91)c When they burgled our house, the police caught them very easily.

The main clause eventuality in (91)c is temporally located after the culmination of the *when* clause eventuality, overlapping with its result state. Effectively, the *when* and the main clause events are ordered.

A major advantage of this approach is that it gives a natural account of why consequentiality seems strongly relevant in licensing of *when* sentences. By directly referring to result states of the *when* clause, their system makes it crucial that a *when* sentence come with a pragmatic meaning, viz., consequentiality. Further, their system

does not have to resort to 'underspecification' as Ritchie and Hinrichs do. However, a flaw may be apparent in their system. Under the system, as I presented it above, the sequence reading is only available for *when* clause eventuality with resulting states. This appears contrary to the facts; Points (Semelfactives) and Processes (Activities) do allow the sequence reading. M&S's system has a way to deal with this apparent problem. They stipulate that *when* is a function that takes an Event and gives back a Culminated Process (Accomplishment). The formulation of the function is discussed in Moens (1987:77, format modified by MN for expository purposes).

(92) *When* as an aspect changing marker, narrowing down the event structural type of *when* from EVENT (Non-states) into CULMINATED PROCESS (Accomplishment)

Given (92), it follows that every Event *when* clause is coerced into a Culminated Process (Accomplishment). In this way, an Event *when* clause always has resulting states, to which the main clause eventuality integrates into.

There are three drawbacks in M&S's system, two of which are interrelated and one independent. The first point is their lack of clarity regarding the process of integration. They introduce the notion of integration, but do not discuss what it technically is. The only clue can be found in another part of their article. They claim that integration is deeply connected to narrative progression, i.e. advancement of time within a text. Perhaps what M&S desired to achieve was to provide a conceptual insight rather than technical details, leaving the latter open to be worked out in the future.

Still, association of integration with narrative progression raises a real problem. As M&S propose, that integration of the main clause eventuality into resulting states of the *when* clause eventuality is a necessary part of the process involved in narrative progression. Let us suppose also that integration always come with consequentiality. It follows that in two consecutive clauses C_1 and C_2, where C_2 advances narrative time, C_2 is always consequential to C_1. This amounts to saying that the sequence reading is always consequential. This conclusion is problematic; as we have seen in Chapter 1, there are examples with the sequence reading that are not consequential.

The third point is the fact that M&S's system overgenerates interpretations. Their coercion rule successfully captures the fact that eventuality types that do not come with resulting states--a pre-requisite for the sequence reading--may also have the sequence reading. As a trade-off, they would predict that in *when* sentences with the Event *when* clause, the interpretation is always ambiguous between the sequence and subevent readings. The reason is as follows. The output of the function is always a Culminated Process, which allows two integration options, pre- and post- culmination. This is not the case. Achievements and Semelfactives, embedded in *when* clauses only have the sequence reading, as Sändström argues, to whose review I will turn shortly.

To summarize M&S, they claim that the temporal implications are by-products rather than the central semantic function of *when*. In their system, *when* sentences are pragmatically licensed if and only if the eventualities involved are connected via a consequentiality relation. An illustration is given in Figure 3.4 below.

			overlap	fwseq	bwseq
	prog				
nonprog		Activities			
		Accomplishments			
		Achievements			
		States			

-analysis not depend on grammatical features
--consequential > forward sequence
---~consequential > any of the three readings

Figure 3.4 Moens & Steedman

M&S's analysis contributes to the previous research by placing a pragmatic meaning in the center of discussion. By doing so, the analysis successfully explains the forward sequence reading. However, this shift of perspective has brought about a major problem; it virtually

ignores all the other temporal imports than forward sequence, namely overlap and backward sequence.

3.2.5 Sandström (1993)

Sandström's (1993) dissertation proposes a semiformal analysis of English *when* sentences spelled out in a DRT-familiar manner. The main contribution of her work is a refinement of M&S's analysis, where her work takes into consideration more empirical data.[26] Sändström claims that the meaning of a *when* sentence *must* imply either consequentiality, sub-event or temporal overlap. A *when* sentence is not licensed unless one of these inferences is present.

The first empirical difficulty of M&S's analysis lies in their coercion mechanism. Sandströem points out that it makes too strong a prediction, to a degree incompatible with what actually happens with *when* sentences. Let us consider example (93) below.

(93) *When* I turned the key, the engine started. (p.55)

If, as M&S claim, the function of *when* is to invoke the type change of Event EN's into Culminated Process (Accomplishment), the *when* clause in (93) must have been coerced to a Culminated Process. Then, M&S's prediction would be that two parts of the coerced event, namely the activity part pre- culmination and resultant states post- culmination, must be able to host integration of the main clause eventuality into the *when* clause one. In other words, we expect temporal ambiguity. In actuality, (93) is not ambiguous. The sentence can only be understood as the main clause is integrated into resulting states of the *when* clause eventuality. That is, the engine started after I have turned the key. [27] [28]To deal

[26] Sandstroem refers to Moens (1987) most of the time. M&S adopt Moens (ibid) work without changing its central claim, so I will not make distinction between these works unless necessary.

[27] A situation where the reading in which the engine starts before my key-turning is *when* the car is malfunctioning. In that case, a more appropriate expression would have been chosen.

[28] The claim that the hypothesized two readings arise from ambiguity of the sentence may be

with this problem, Sandströem proposes to modify M&S's function description for *when*, allowing EN's with consequences as inputs and giving back either CP (Accomplishment) or Cul (Achievement). To write this function in M&S's way :

(94) *When* as aspect changing marker narrows the event structural type of the *when* clause even from EVENT into CP (Accomplishment) or Cul (Achievement)

An immediate question would be how to decide a given EN is coerced into a CP or a Cul. According to M&S, A CP (Accomplishment) has a complete nucleus, including a pre-culmination activity, culmination and resulting states ensuing from it. On the other hand, a Cul (Achievement) lacks a pre-culmination activity and only has culmination and resulting states. Sandström assumes that only those Events lexically specified with an activity part -- Process or Culminated Process -- are mapped to CPs. Otherwise, the output type of the function is always Cul. In light of this modification, let us consider (95) below.

(95) *When* I turned the key, the engine started.

Here, the *when* clause eventuality is a Cul, which does not entail a pre-culmination activity. In such a case, Sandströem argues, the function trivially maps to Cul. The only integration possible then is into resulting states of *I turn the key*, resulting in the sequence reading. To rewrite the function:

(96) If the event nucleus EN includes a pre-culmination activity, the event is CP; otherwise, the event is Cul

The second fundamental modification that Sandströem makes of M&S's analysis is a more elaborate discussion of consequentiality. Sandströem recognizes sentences that are

---

weakened by a situation in which John turns the house key in his house lock, while his wife turns the engine key to start her car. In this situation the interpretation is unambiguous, suggesting that the sentence in question is temporally vague, rather than ambiguous (John Beavers, p.c.)

sequentially, but not consequentially, related. In order to deal with them, she extends consequentiality to involve two more relations other than causation. The added relations are response and enablement, which I illustrate shortly. Let us consider her example (112). (ibid: 199)

(97) a. *When* the telephone rang, I jumped for it eagerly.

In (97), Sandströem claims that the main clause eventuality takes place in response to the *when* clause eventuality. What connects the two eventualities together is the relation which she calls response.

Let us now look at (98).

(98) a. *When* she reached him she said into his ear . (Continuation)
b. *When* she reached herself from the effort she tried in vain to catch a glimpse of the canoe...
c. *When* it came to my turn, I drank...

Again, there is no causal relation inferred from these sentences. Common to them this time is that the *when* clause eventuality plays a role of providing a sufficient environment in which the main clause eventuality may be realized. Sandströem call this kind of inference enablement.

Based on these modifications, Sandströem gives a redefinition of M&S's consequentiality as a nonatomic notion involving subtypes. This new version of consequentiality comprises of the three sub-types, illustrated below.

(99) Subtypes of consequentiality:
a. causation
b. enablement
c. response

According to Sandströem, causation and enablement require that the precursor eventuality (the *when* clause eventuality in this case) to have resultant states. In contrast, response

does not need resultant states. Under M&S's approach on which her work is based, eventualities with resultant states host integration, a process deeply linked to a consequential inference. What this implies is that causation and enablement involve consequentiality, while response does not necessarily do so. By extending the notion of consequentiality, Sandströem successfully incorporates examples such as (97)-(98) above.

In sum, Sändström has proposed an extension of M&S's general scheme, adding more concrete arguments. She has specified sub-event and consequential as the pragmatic meanings for which when may be licensed. Further, she has added a grammatical condition--the presence of an Achievement in the *when* clause--that gives rise to the forward sequence reading. The chart below summarizes her claims.

			overlap	fwseq	bwseq
	prog				
nonprog		Activities			
		Accomplishments			
		Achievements	(in *when* clause) *	(in *when* clause) ok	(in *when* clause) *
		States			

-analysis not depend on grammatical features

Figure 3.5 Distribution of Meanings by Sändström

A major contribution of Sändström's analysis has been articulation of a pragmatic meaning, namely consequentiality. Consequentiality, in her definition, exhaustively includes causal, conditional and responsive. A disadvantage of her analysis is that she has conflated pragmatic and grammatical conditions together. It is not immediately clear how to construct a system of semantic representation based on her assumptions.

Chapter 4 : Data and Analysis (1): English

4.1 Introduction and Interim Summary

In this chapter, I first discuss the previous approaches critically, focusing on a problem surrounding a heterogeneous nature of stative predicates. Then, I propose defining factors in determining the temporal distribution of *when* sentences. One is predicates' lexical boundedness, which are essentially semantic and provide basic dividing conditions for the sequence and non-sequence readings. The other has to do with inferences based on world knowledge and Gricean cooperative principles. These extra-grammatical informative contents shall be referred to as Pragmatic Strengthening and be used as supplementary information to finalize the temporal reading when the semantic information only provides ambiguous results. I draw examples from Corpus E, a collection of newswire texts of American English. (Cf. Appendix A for details)

The analyses discussed in the previous chapter can be super-classified into two types. One is a group of approaches that are essentially pragmatic. M&S's main claim, which represents such an approach, was that textual coherence is the one and only source of temporal meanings arising with *when* sentences. Their analyses entail that *when* does not come with much semantic import and that all temporal meanings that seemingly associate with the lexical item come extralinguistically. Sändström shares the same insights. The other stream of analyses is advocated by Ritchie, Heinëmäki and Hinrichs. This latter approach is more semantic in essence than the pragmatic analysis, but also leaves much explanation up to 'Pragmatics,' a term not very well defined within their studies. They would agree that the presence of a 'stative' predicate in the sentence is the triggering factor to the overlap reading, while in all other environments the forward sequence reading would arise. For them, any phenomenon beyond this simple rule falls outside their domains of explanation, to be taken care of in Pragmatics. In other words, they assert that *when*'s sole function is to place two eventualities in a discourse system

involving temporal updates. By saying 'a discourse system involving temporal updates,' I have a Hinrichs-style mechanism in which differences between the overlap and forward sequence readings are captured by the presence or absence of a narrative time update. As discussed by Hinrichs, as well as Kamp and Roerer (1979), a stative eventuality in a discourse does not advance the current narrative time but surrounds the current speech time, whereas a non-stative one updates the narrative time and is included in the new current narrative time. The behavior of constituent eventualities in a *when* sentence, they would say, is consistent with this generalization.

The two approaches are summarized in the table below.

Table 4.1 Summary Table of Chapter 3

	Proponents	Features	
Pragmatic Approach	-Moens & Steedman -Sändström	-extra-linguistic factors central "Consequentiality" relation causes surface temporal meanings to arise -*when* itself is semantically underspecified	
Temporal Approach	-Ritchie -Heinëmäki -Hinrichs	-stativity-driven partition of forward sequence and overlap readings -*when*'s function is to place two eventualities 'proximate to each other on the timeline'	

4.2 Observations

4.2.1 Observation (1): Two Statives Observation from Corpus E (1) Two Statives

In the introduction section above, I have summarized the previous approaches. An implicit but recurrent theme common to these approaches, especially highlighted in the

temporal approach, is assumed homogeneity of stative predicates. By saying 'homogeneous,' I mean behavioral indistinction of multiple classes of lexical items in all grammatical environments. In the present concern, the temporal approach regards Stative predicates as one class, ignoring their subcategories such as the progressive and the lexical stative. This one-way classification has led to the following statement concerning a grammatical correlate of the overlap reading.

(100) A stative predicate triggers the overlap reading.

The principle (100) is verified by examples such as (101).

(101) when Pressler was being considered by President George H.W. Bush to head a new Office of Government Ethics, some moderators told the FBI that Presler was a bigot... (292)

However, this subsection provides a counterexample for (100), based on a corpus observation. (100) predicts, for example, that all lexical statives uniformly give rise to the reading in which two eventualities temporally coincide. Already within the domain of constructed examples, we can see that this is not always true. Consider (102).

(102) When she broke the vase, he was mad.

The most salient temporal interpretation of (102) is forward sequence, where the final point of the *when* clause eventuality temporally precedes the initial point of the main clause eventuality.[29] This is in contradiction to what the temporal approach predicts. The approach would have assigned (102) the overlap reading, because the sentence contains *be mad*, a Stative predicate.

Traditionally, the type of stative-involving sentences that give rise to an eventive interpretation has been called Inchoative States (Smith 1983). To my knowledge, there is

[29] The overlap reading is secondarily available for some speakers (John Beavers, p.c.).

little research done on the conditions under which an Inchoative State arises, inclusive of the temporal approach of *when*. For example, Smith's article (ibid) notes the phenomenon but does not go into a detailed discussion. What this means is that previous knowledge does not offer an account of the pair presented in (103).

(103) a. When she broke the vase, he was mad.
b. When she broke the vase, she was being aggressive.

The temporal approach predicts that both sentences in (103) result in the overlap reading, precisely because they contain a Stative predicate. In actuality, the interpretations are distinct: a. typically ends up in forward sequence, while b. yields overlap.

Expanding the domain of observation to corpus examples, a result of manual annotation of Corpus E is not in favor of the temporal approach's prediction (100). Let us look at Figure 4.1.

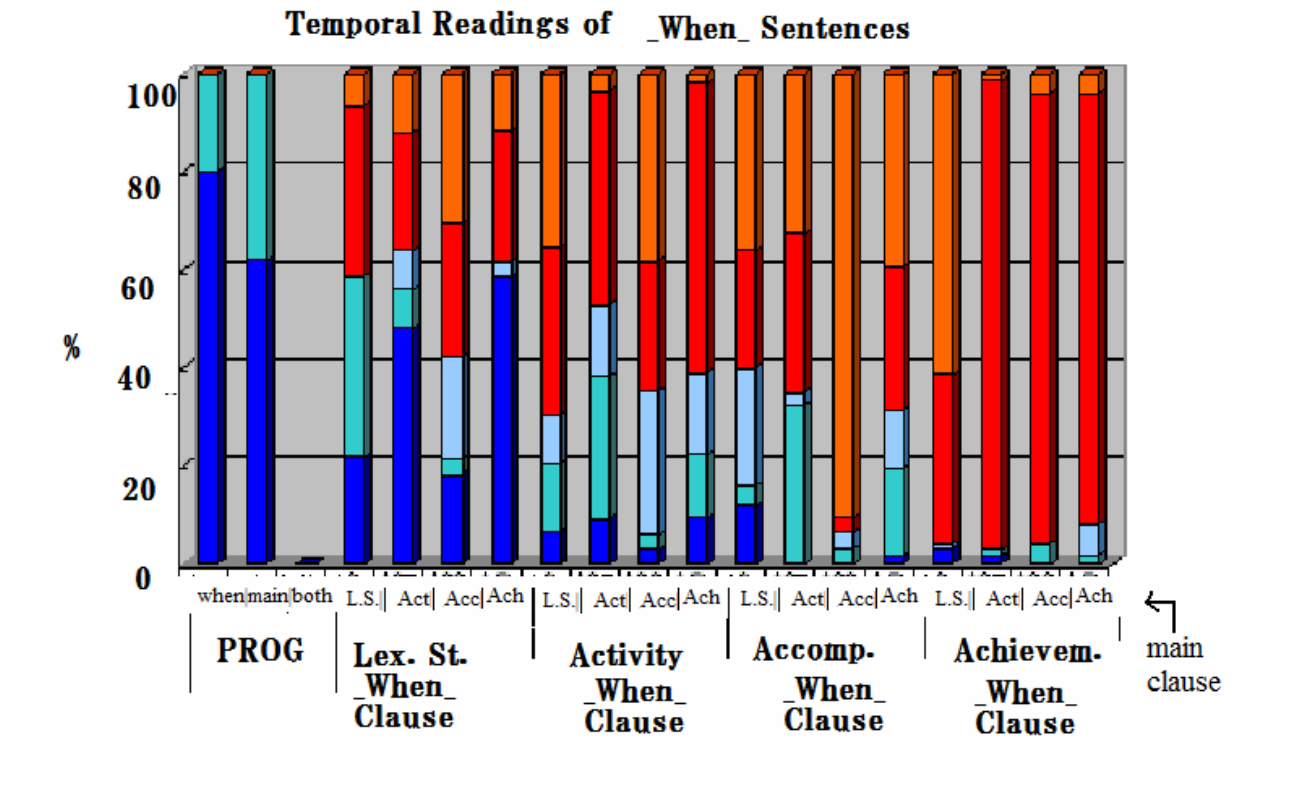


Figure 4.1 Distribution of Temporal Meaning with Sentences Containing at Least One Stative Predicate

The chart shows the percentages of each temporal reading, i.e., forward sequence, backward sequence and overlap, with respect to aspectual properties of the discourse fragments examined. The leftmost three bars represent progressive-containing *when* sentences. The three bars correspond to sentences with the progressive form in i) the *when* clause only, ii) the main clause only and iii) both. The next four bars describe temporal distributions with *when* sentences containing a Lexical State in the *when* clause. The four-way subclassification parallels the situation aspect type of the main clause, namely Lexical State, Activity, Accomplishment and Achievement/Semelfactive. In the rest of the chart, every fourth bar is colored, to indicate temporal distribution of *when* sentences containing a Lexical State main clause. The three colored bars are differentiated by the situation aspect of the *when* clause, Activity, Accomplishment and Achievement/Semelfactive respectively. The rest of the bars are defocused because they do not contain a Stative. A

clear borderline is in between the progressive and non-progressive bars: If the sentence contains a progressive, as in the leftmost three bars, the temporal meaning of the sentence is exclusively overlap.[30] When it comes to Lexical Statives, the results are mixed among forward sequence (red), backward sequence (orange) and overlap (blue and light blue). This described finding is consistent with the constructed pair (103), which has shown that progressive and lexical statives may behave differently. As this distinction is an unaccounted-for phenomenon within past studies, the present observation provides a good starting point of a discussion as to how progressive and lexical states are theoretically differentiated. Once such a discussion is put in a clear form, it will lead to an account of Inchoative States, which will be discussed in a later section.

4.2.2 Observation (2): State Runtimes and Inchoative State

The second observation from Corpus E consists of a qualitative discussion of subclasses of Lexical State predicates. I point out that i) Lexical State predicates are often vaguely interpreted between forward sequence and overlap readings and ii) a subset of Lexical State predicates yields biased interpretations between these temporal readings. A characteristic property to give rise to the overlap reading that I suggest towards the end of this section is lexical specification of state runtimes of eventuality, t(e).

The first observation from Corpus E described in 4.1.1 has shown that progressive and lexical statives do not form a homogeneous class with regards to temporal interpretations in *when* sentences, in particular overlap versus sequence readings. There, I did not mention another related fact that Lexical State is often vague between these two temporal interpretations, as shown in (104) below.

(104) When she broke the vase, she was mad.
Reading 1. She became mad after breaking the vase (forward sequence)

[30] Here and henceforth, I refer the reader to Appendix B for specific numbers.

Reading 2. She was already mad when she broke the vase. (overlap)

The vagueness, which cannot be found with progressive states, might at first seem to suggest that Lexical State is generally underspecified as to whether it triggers Narrative Progression in a discourse, resulting in Reading 1 or in Reading 2, the one without Narrative Progression. Furthermore, given that one surface form maps to two separate interpretations, a tentative conclusion would be that the choice of meaning depends on the surrounding contexts alone.

There are, however, clear cases which counterexemplify this tentative analysis. With some Lexical States, one interpretation is strongly preferred over the other. Consider (105), a pair of constructed examples inspired by actual discourses appearing in Corpus E.

(105) a. When Mary learned about the terror attack, she was on a day-off.
b. When Mary learned about the terror attack, she was visibly shaken.

The salient interpretation for (105)a. is overlap, where Mary is taking a day-off, relaxing, when she hears the news. In (105)b., fwseq is most strongly obtained, where Mary is not shaken before she hears the news, and she becomes shaken after learning it, caused by the content of the news. Both sentences involve a Lexical State predicate, *be on a day-off* and *be visibly shaken*. Why they differ in preferred interpretations as shown in (105) does not follow from any Lexical Semantic tools accessible to me at this time. Glossing over these predicates simply as Lexical State would wrongly predict vagueness in both (105) a. and b.

Then, what distinguishes between *be on a day off* and *be shaken*? Asking this question in the context of *when* sentences is worthwhile because the temporal approach would assign both sentences at least the overlap reading, because they involve a Lexical State predicate. The approach does not explain, in contrast, why these two classes of Stative predicates differ in their preferred reading. Specifically, *be on a day off* tends to be interpreted as overlap, while *be shaken* is not. Exploring this issue would help us better

understand the mechanism underlying the semantics of *when*, and enable us to propose a better alternative to what the temporal approach has to offer.

I attempt to solve this question by acknowledging that the two classes of Lexical State predicates entail different lexically specified runtimes. Runtimes, or eventuality runtimes are written as t(e) and express the temporal duration of a given eventuality. [31] Runtimes may be fixed as in *be on a day off*, or variable as in *be visibly shaken*. Let us consider some examples from Corpus E, belonging to the fixed class variable class (106) and fixed class (107).

(106) a. ...when they considered the possible uses of spider silk, they were astounded. (720)
b. When second baseman Craig Biggio coaxed a base-loaded walk..., the Astros believed they could see the beginning of the end of the ad times. (36)

(107) a. When she was 50 years old, she left him.
b. Beatrice had a near-death experience when she was young.... (810)

Interestingly, the fixed class (Fixed Runtime States or FRS henceforth) predicates in (107) have association with the overlap reading, whereas the variable class (106) (Variable Runtime States or VRS henceforth) predicates strongly prefer the forward sequence reading. As this is an observation section, I limit myself to noting the finding and do not go into a further consideration. Later in this chapter (4.3.2.2), I propose an account that relates the dual nature of Lexical State and availability of Narrative Progression in Stative sentences (i.e., Inchoative State).

4.2.3 Observation (3): Forward Sequence is Predominant with Nondurative *When* Clauses

[31] Ogihara (1998).

This subsection entirely consists of discussions pertaining to non-statives. Corpus E not only contains counterexamples to previous theories, but also provides samples that support an existing view. In particular, I would like to discuss a direct linkage of an Achievement/Semelfactive *when* clause with the forward sequence reading.

Sandström (1993) provides the following example to argue for the linkage.

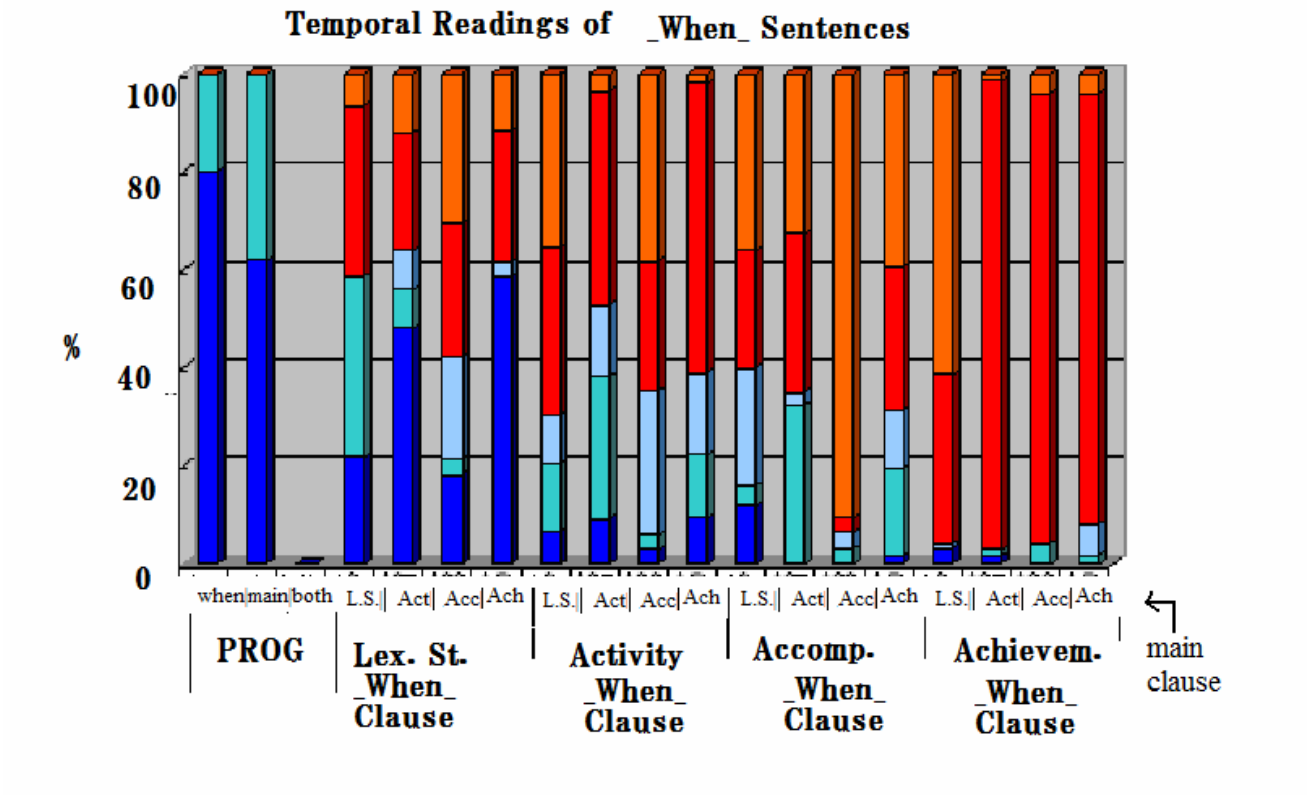
(108) When she turned the key, the engine started.
Possible reading: forward sequence
Impossible or less preferred readings: backward sequence, overlap

As discussed earlier, the key-turning typically precedes the starting of the engine. Neither the reverse order nor temporal coincidence will be allowed as the interpretation of (108). Sandström's observation can be generalized in the following way.

Sandström's generalization
(109) An Achievement in the *when* clause triggers the forward sequence reading.

Sandsrtoem notes, but does not elaborate on, this generalization. At this stage, the observation stands alone, without being related to other phenomena occurring in *when* sentences, such as the various kinds of stative predicates and associated temporal meanings (4.2.1, 4.2.2). The described observation becomes important only when it is asked why it is so in the theory one is proposing, as well as to what extent it is so. I will readdress the first question later in this chapter, when I sketch my own analysis (4.3.3.1)

The remainder of this subsection addresses the second question. I draw on a quantitative result from Corpus E, which may be interpreted in favor of Sandström's generalization. The right chart in Figure 4.2 below highlights the bars involving an Achievement *when* clause. For the purpose of comparison, the chart including all examples is placed on the left.


Temporal Readings of _When_ Sentences
100
80
60
%
40
20
0
when main both L.S. Act Acc Ach L.S. Act Acc Ach L.S. Act Acc Ach L.S. Act Acc Ach
PROG
Lex. St. _When_ Clause
Activity _When_ Clause
Accomp. _When_ Clause
Achievem. _When_ Clause
main clause

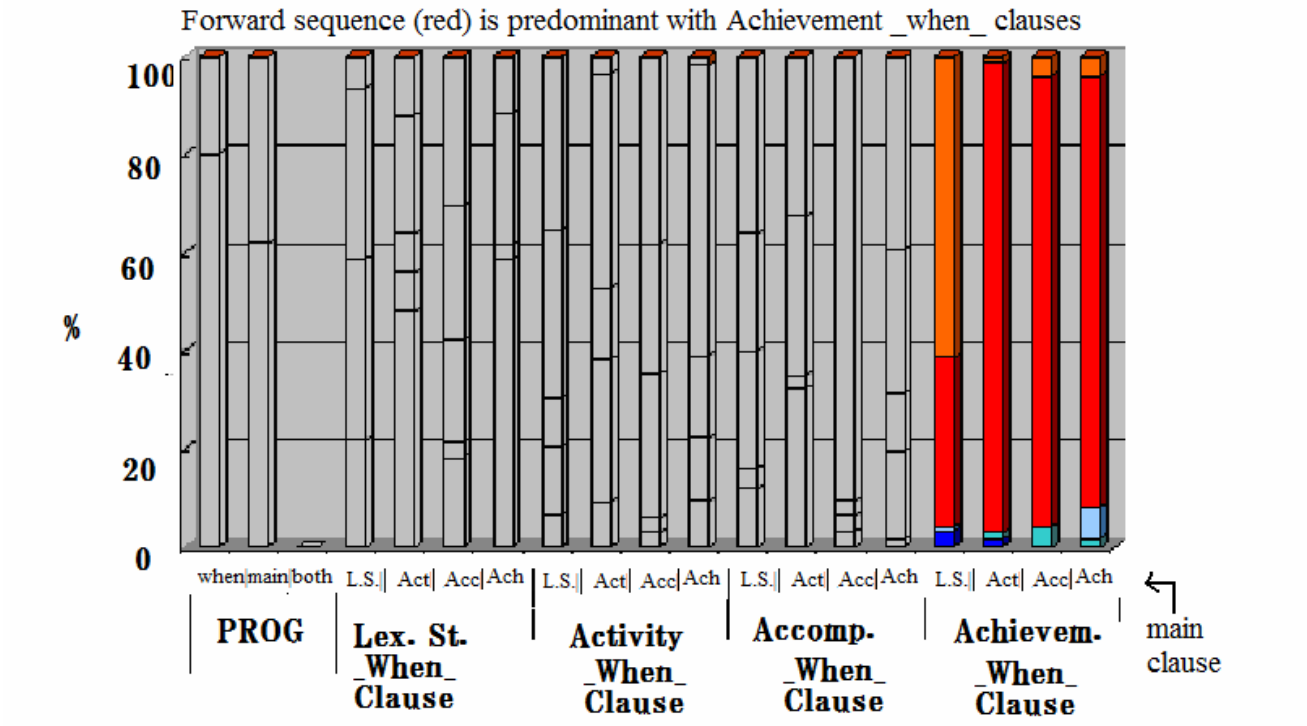

Forward sequence (red) is predominant with Achievement _when_ clauses
100
80
60
%
40
20
0
when main both L.S. Act Acc Ach L.S. Act Acc Ach L.S. Act Acc Ach L.S. Act Acc Ach
PROG
Lex. St. _When_ Clause
Activity _When_ Clause
Accomp. _When_ Clause
Achievem. _When_ Clause
main clause

Figure 4.2 Forward Sequence is Predominant with Sentences Containing an Achievement *When* clause (previous page)

A straightforward conclusion drawn from the figure is that if the *when* clause contains an Achievement, the most predominant interpretation is forward sequence (red). The conclusion is consistent with Sandström's generalization, opening a path towards a general theory of *when* sentences that includes full reference to Sandström's generalization.

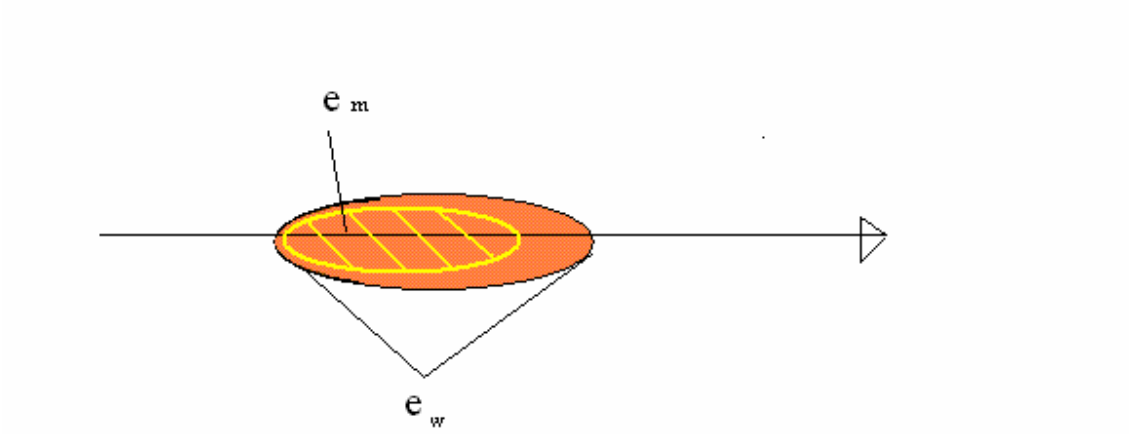
4.2.4 Observation (4): 'Party' Sentences and the overlap Reading[32]

This is the last observation section regarding Corpus E. I discuss a subtype of the overlap reading where the two eventualities are not separate, but stand in the whole-part relation. I first question the previous view that assumes whole-part *when* sentences to involve a backward sequence, proposing to include such sentences in the category of overlap. Then, I explore grammatical correlates for the subeventive overlap reading. I argue that the reading in question often associates an durative, low-granular *when* clause.

An image of a whole-part *when* sentence is given in (110).

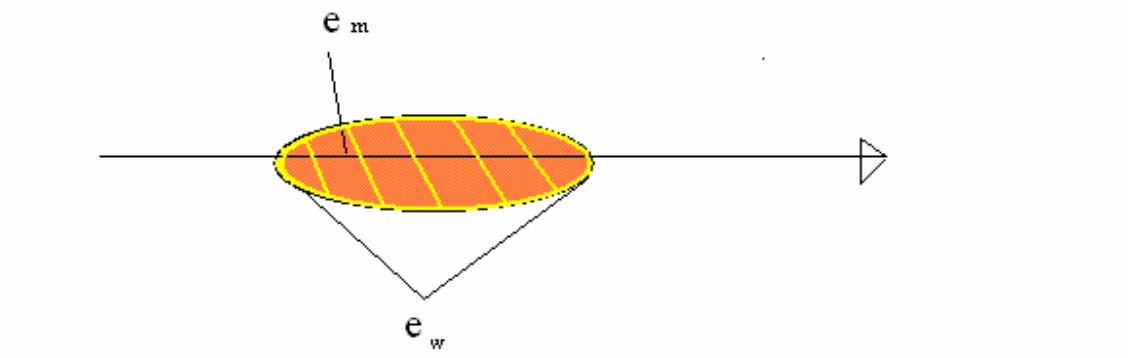
(110)

[32] The basic idea of this section is addressed in Irie (2003).



The shaded area indicates the runtime of the main clause eventuality. This area is a proper subset of the *when* clause eventuality, expressed in a solid oval with the orange color. The subevent part can also be nonproper, as in (111).

(111)



A representative example of this kind of sentences can be found in Hinrichs' (1986) work, among others. Hinrichs' example is repeated below as (112).

(112) When the Smiths threw a party, they invited all their old friends.

In Hinrichs' work, (112) is categorized as having a backward sequence. He argues that this inference comes from world knowledge that invitations to parties usually precede parties themselves. This means that the main clause event precedes the *when* clause event in (111), making the sentence an instance of backward sequence.

I propose an alternative view which categorizes (112) and similar sentences--henceforth 'party' sentences--as overlap, rather than backward sequence. This is a natural move, considering the nature of party-sentences, which I will explain shortly. Assumed in the present study is that the Sequence readings (forward sequence and backward sequence) involve two separate eventualities, as the following set-theoretic description illustrates.

The non-subeventive overlap between two intervals:
(113) $i' \circ i \wedge \neg\exists\, i''[\, i'' \subset i \wedge i'' \subset i']$

This notation seems to fit better to sentences such as (114) than (112).

(114) Lowe took a 3-1 lead when he finally surrendered his first home run of the season.

Taking a lead and surrendering a home run are completely separate events. Furthermore, the main clause eventuality takes precedence over the *when* clause eventuality here, because once the home run has occurred, the 3-1 lead described in the main clause would not be true any longer.[33] In comparison, a party-sentence (112) describes a situation, throwing a party, and as a part of its preparation the invitation is made. Seeing the situation this way, an inclusion relation is more appropriate for party sentences than a sequential relation.

Another diverging characteristic between two different types of 'backward sequences' is a selectional restriction of the aspect type of the *when*-clause event. Consider (115), where the *when* clause of (112) has been changed to a non-durative clause.

[33] Some speakers find the sentence odd with the intended reading in mind. (John Beavers, p.c.).

(115) !When John Smith fell on a rock, he invited all his friends.

There is something quite odd with (115), regarding the nature of the eventualities involved. In particular, falling on a rock is a non-durative event which allows no proper subpart.[34] The intended reading, in comparison with other party sentences, would be that John Smith invited all his friends to fall on a rock with him. The sentence does not have that interpretation. Non-party-type backward sequence sentences are not restricted in this way: observe that non-durative *when* clause does not affect the well-formedness of the sentence (116).

(116) When she died, she left a big fortune.[35]

Looking into party-sentences in Corpus E, Figure 4.3 shows examples of sentences with the interpretation relevant to the current interest, distributed over various situation aspectual categories, predominantly durative.

[34] This depends on how much one decomposes the falling-on-a rock activity.

[35] For some speakers, it is possible to interpret the sentence as two overlapping Achievements (John Beavers, p.c.).

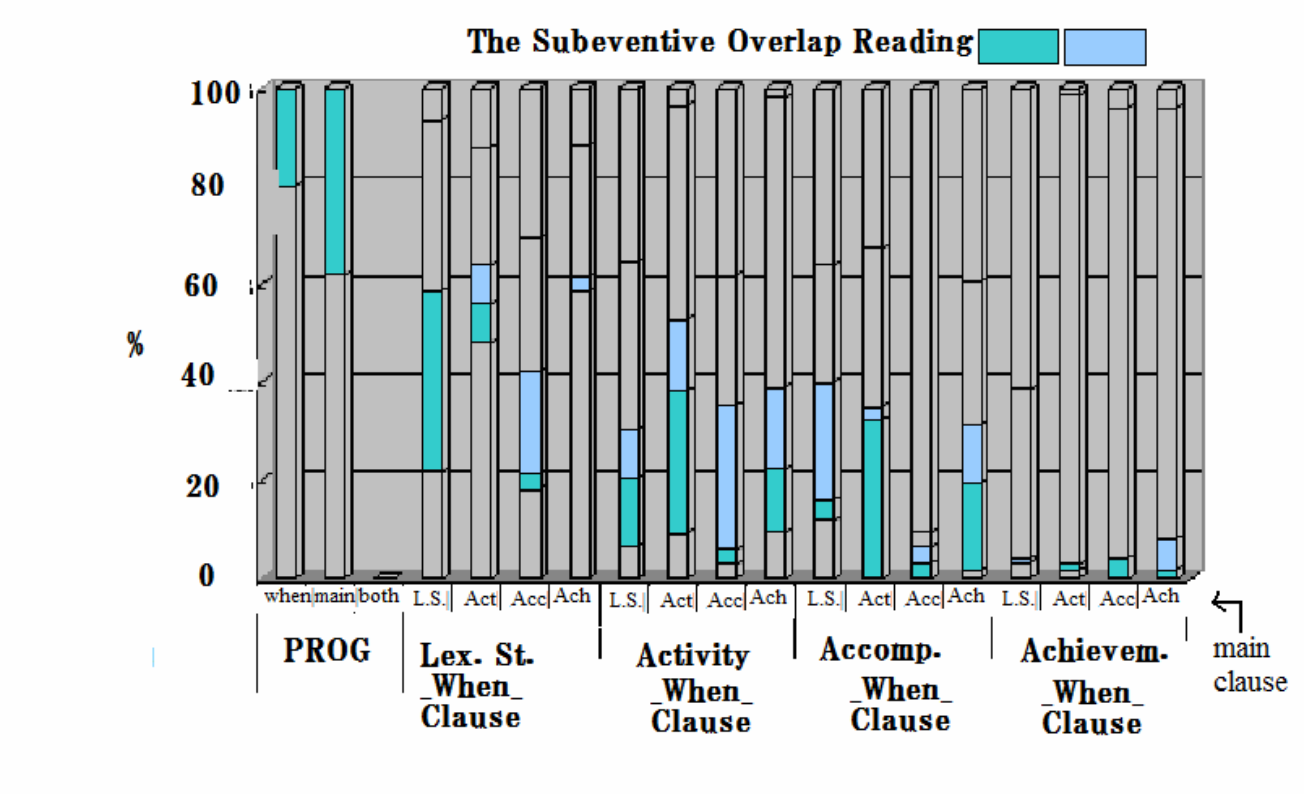


Figure 4.3 The Subeventive Overlap Examples Distribute over Various Aspectual Categories

The numerical spell-out and pie chart of the breakdown are given in Figure 4.6.

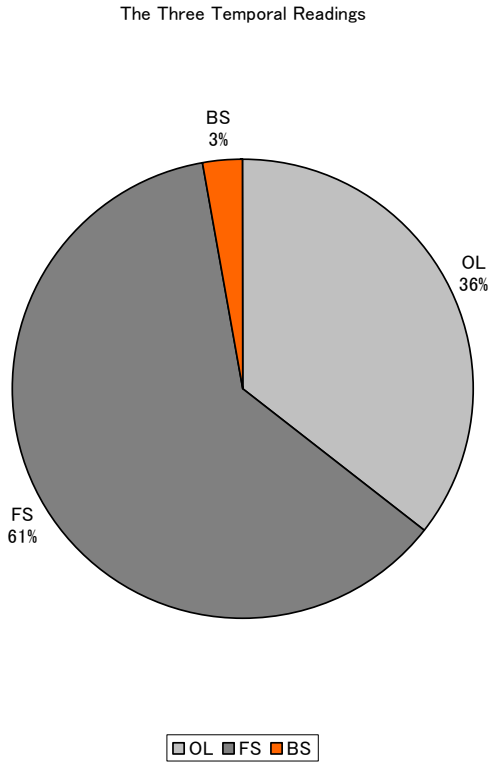


Figure 4.4 There are Few 'Real' Backward Sequence Sentences in Corpus E

Activities are the most frequently-occurring type, followed by Accomplishments. Non-durative types, namely Achievements/Semelfactives, in this situation are rather rare. Non-party type backward sequences are not frequent in Corpus E, but when they do occur, it is clear that a subevent relation does not hold between the eventualities.

Shifting focus to the nature of the subeventive overlap reading, it often arises with durative *when* clauses. I list two examples below, (117) and (118).

(117) ...when he visited France..., Bush assured foreign leaders that he has no plans for military action against Iraq...(764)

(118) When I put him to sleep, I would watch his chest, to make sure it went up and down.(707)

A typical kind of verb that appears in the *when* clause with the reading in question is durative and low-granular, such as *go*, *play*, *perform* and *visit*. (Irie (2005)). Figure 4.4 below shows that the majority of the when clauses involved in examples with the overlap reading are durative, particularly Activities and Accomplishments.

L State		0
Activity	announce	1
	ask	1
	discuss	1
	examine	1
	fight	1
	fly	1
	go after ea	1
	insist	1
	meet with	1
	plan	1
	play	1
	pledge	1
	prerform	2
	reinstate	1
	say	6
	seek	1
	study	1
	take the to	1
	test	1
	travel	2
	try	2
	visit	1
	walk	1
Accomplish	birdy	1
	call their dc	1
	commute t	1
	do a film	1
	found	2
	go to	1
	merge	1
	put him to	1
	rule	1
	subdivide pr	1
	take up the	1
Achieveme	allow	1
	challenge	1
	name	1
	take on	1
Semelfactive		0

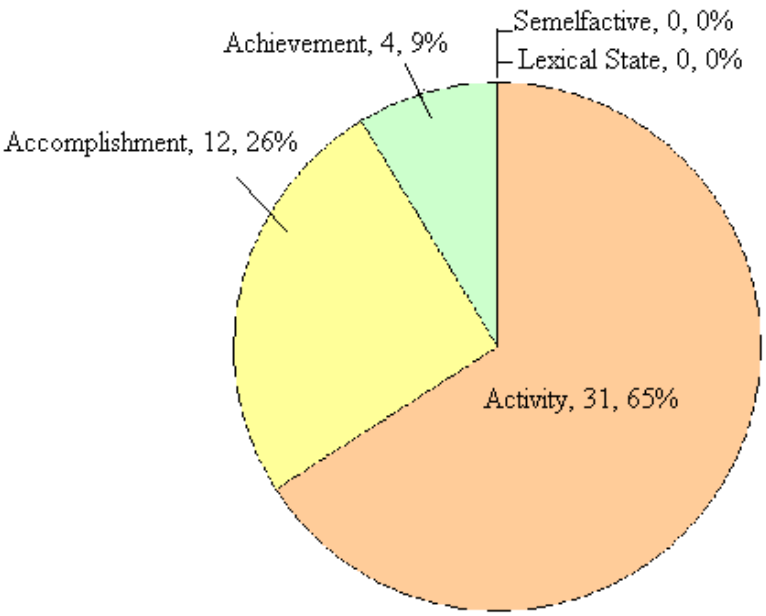


Figure 4.4 Breakdown of Aspectual Types of When Clauses with the Subevent Overlap Reading

To keep the discussion simple, I do not go into further lexical details of these verbs in the present study.

Reflecting on these observations, I propose to distinguish ‘party’-sentences and 'true' backward sequences, such as (114) and (116), repeated below.

(112) Lowe took a 3-1 lead when he finally surrendered his first home run of the season.

(114) When she died, she left a big fortune.

Specifically, party-sentences will be included in overlap, namely the subeventive one. 'True' backward sequence examples are categorized independently as backward sequence. This modification naturally derives from the characteristics of these sentence types as addressed above. Moreover, it facilitates incorporation of ‘party’-examples in a system to be developed in 4.3.. Finally, it captures a previously unmentioned feature of ‘party’ verbs that they strongly prefer a durative *when* clause.

4.3 An Analysis for English *When*

4.3.1 *When* in a Nutshell

I propose a system with two separate components, applied linearly to derive the intended interpretation for a given *when* sentence.

The first component decides the temporal location of the *when* sentence to be interpreted. Either the *when* or the main clause, whichever comes first--the *when* clause in an IWS and the main in an FWS--is determined its temporal location according to speech time, and then the other clause is placed on the closest proximity of the temporal point just specified, insofar as the placement does not contradict with other requirements.

The second component is responsible for choosing the preferred reading from potentially multiple possible readings compatible with the output of the first component. This is done by way of assuming Grice's maxims of conversation among communication participants in which the when sentence in question is uttered and understood.

The informal description of *when* introduced in Chapter 1 is repeated in in (119).

(119) a. *When*-IWS: The temporal location of the main clause is determined depending on that of the *when* clause. Specifically, e_m is placed maximally close to e_w, unless other constraints are not violated.
b. *When*-FWS: The temporal location of the *when* clause is determined depending on that of the main clause. Specifically, e_w is placed maximally close to e_m, unless other constraints are not violated.

(119) amounts to saying that the overlap reading is the default interpretation for a when sentence, where there is no 'other constraints' in effect. The reason is that the closest distance between the two eventualities (or any two discrete objects) is complete occlusion. As I have addressed above, overlapping options is the optimal choice. The next preferred option is where the main clause eventuality is placed on, or adjacent to that of the when clause eventuality. If there is an external factor forcing the two eventualities apart, then they may be separated, although this is the least preferred option. In the next section, I further connect the stipulated semantics of *when* to the issues in question by a pragmatics tool, namely Gricean maxims o conversation.

4.3.1.1 Using Gricean Maxims of Conversation to Choose the Preferred Meaning

It is not always clear how would one go about choosing one of multiple available options for a given *when* sentence. For example, take a durative *when* clause. Observation/Case (4) suggests that the resulting interpretation is the overlap, because durative predicates have nontrivial duration and the Proximity Constraint requires that the main clause event falls within that interval rather than sequentially ordered with it. In actuality, however, both the overlap and sequential readings are possible for this subclass.

Where necessary, I would like to use Grice's (1989) maxims of conversation ad cooperative principles as tools for explanation. The four maxims are summarized in table 4.2.

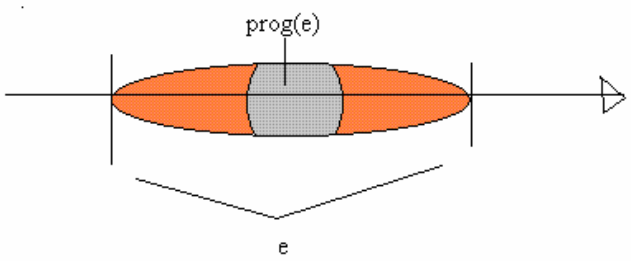
Table 4.2 Grice's Conversational Maxims: applied as best-effort principles in communication

	Maxim of	
	Quality	Provide only information which you believe to be true on reasonable grounds
	Quantity	Provide just as much information as necessary
	Relation	Provide relevant, and only relevant, information
	Manner	Provide information in a clear, nonambiguous, succinct and orderly manner.

4.3.1.2 The Proximity Constraint and the Progressive

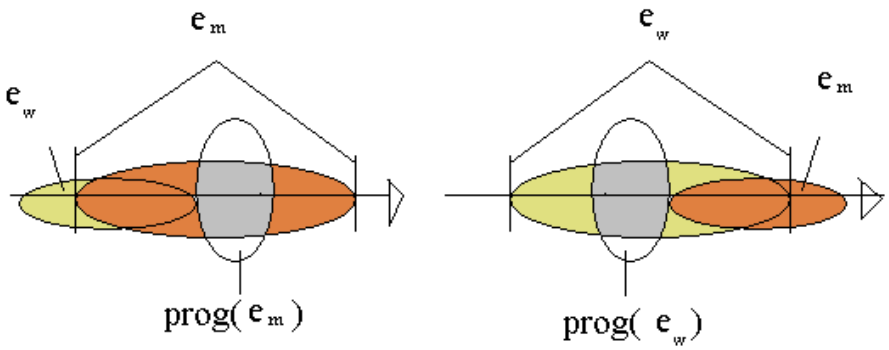
In *when* sentences containing progressive statives, the *when* and main clause eventualities coincide and the progressivized eventuality seems to contain the non-progressive one. I have said 'seem' because the view of the progressive introduced in chapter 2 compels that the containment involved is actually reversed. Recall that Smith's (1997) analysis of the progressive entails that the progressive picks up (in her metaphor 'includes in a camera lens') a nonfinal and fairly short subinterval. Under this assumption, the progressivized eventuality is a proper subinterval of what the host predicate denotes. A pictorial presentation is given in (120).

(120)



Combining this scheme with the temporal trace of the *when* clause eventuality gives out the two possibilities in (121) if the two eventualities temporally coincide.

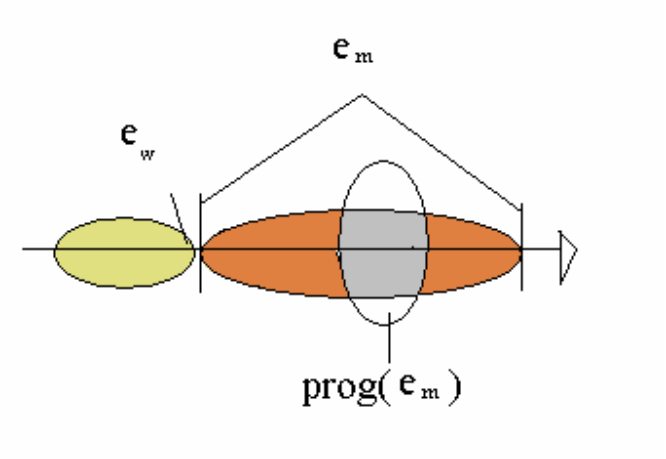
(121) i) *when* clause is a progressive; ii) main clause is a progressive



Note, if focusing on e_m and e_w, that the resulting interpretation is overlap in both cases. This is consistent with the corpus data, where progressive-containing *when* sentences always end up in the overlap reading.

None of what I have said, however, compels that the non-progressive eventuality abuts the progressive eventuality (grayed). Alternatives are allowed where the non-progressivized eventuality is farther apart, as in (122).

(122)



This is an unwanted possibility, because it does not actually happen; progressive-containing *when* sentences give rise to the overlap reading, not the sequence readings. In ruling out this possibility, I would like to reverse-engineer my system: I start with the observation, stipulate a rule in which the configuration in (122) is prohibited and those in (122) are ruled in, and create the rest of the system to be compatible with the rule. The rule I stipulate is the following [36]:

The Proximity Constraint

(123) $t(e_w)$ and $t(e_m)$ are as close to each other as possible, insofar as other requirements (grammatical and pragmatic) are not violated.

By (123), the temporal trace of the *when* clause eventuality must be adjacent to that of the main clause eventuality, which is progressivized and occupies the grayed area in (121). In (122), the two areas are separated by no compelling reason, violating (123).

At this point, however, (123) is an ad-hoc rule that can only explain the overlap reading surrounding progressive predicates. In the next subsection I show that the Proximity Constraint benefits another phenomenon in my domain of explanation. Having such an extended use is a strong reason for me to incorporate the constraint in my system.

---

[36] An alternative tack to take is to impose the constraint as a hypothesis, and test it in developing the system. (David Beaver, p.c.)

4.3.2 The Proximity Constraint and Eventuality Bounds and Runtimes

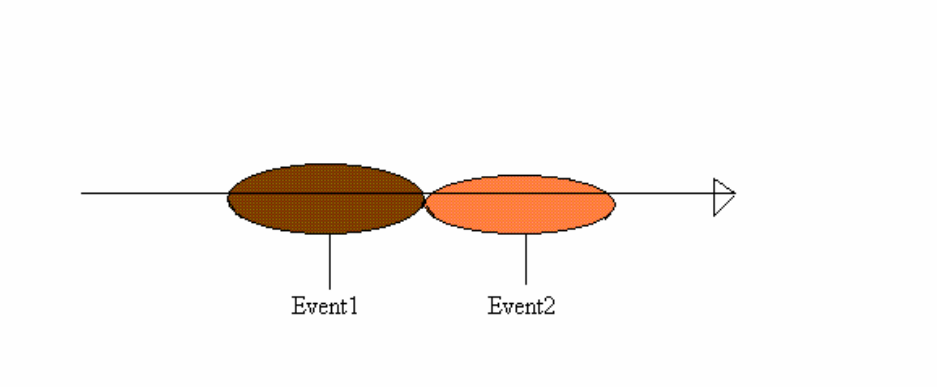
What is another area in the domain of explanation where the Proximity Constraint can also be applied? The observation on which I would like to focus is Runtimes of Lexical State predicates, which have been introduced in 4.2.2 to describe a vagueness regarding certain *when* sentences, repeated below as (124).

(124) a. When Mary learned about the terror attack, she was on a day-off.
b. When Mary learned about the terror attack, she was visibly shaken.

As discussed in 4.2.2, Lexical State is classified into two different subtypes in terms of availability of Inchoative State. In the above examples, (124)b. most likely yields the Inchoative State interpretation, because the main clause state *be visibly shaken* is typically interpreted to sequentially follow the preceding eventuality, learn about the terror attack. In (124)a., on the other hand, such an interpretation is much less focused, if not unavailable. The defining factor stipulated there was two different types of state runtimes. I posited Fixed Runtime States (FRS) such as *be on a day-off* and Variable Runtime States (VRS) such as *be visibly shaken*. Below, I describe how these types become relevant in accounting for Inchoative State in *when* sentences, together with the Proximity Constraint, observed insofar as other requirements are not violated.

To start, let me call attention to a general property of event sequences. For two eventualities to be in sequence, it is required that they do not temporally coincide and that the final bound of one eventuality precedes the initial bound of the other. (125) is a visual representation of a typical event sequence.

(125)



I pay particular attention to the two bounds, one at the end of event1 and the other at the beginning of event2. Presence of those bounds is a prerequisite for ordering the eventualities, in other words, if one of the bounds cannot be specified in a right place, a sequential interpretation is not possible.

Lexical State's two subclasses discussed earlier offer two different options as to whether a sequential interpretation can be obtained. Suppose that there is an external trigger for a sequential interpretation, such as a consequential entailment. That is, suppose we know that the two eventualities presented in a *when* sentence stand in the trigger-consequence relation. The entailment comes from a general knowledge that causality subsumes sequentiality, such that the cause precedes the result. (Tapiero et. al. (2002) **,** Trabasso et. al. (1989), Galiatou and Ligozat (2001))

With this in mind, consider (126) for an example.

(126) When Mary broke the vase, she was mad.

It is assumed, for the purpose of discussion, that Mary's breaking of the vase caused her to become mad (at herself). Then we have to also assume that the breaking the vase and her being mad occur sequentially, for the reason given right above. Also as previously addressed, at least two bounds must be specified in order to establish a sequence between eventualities. One is the final bound of the triggering eventuality; Mary's breaking of the vase in this case. This is obtained quite naturally, as the predicate is an Achievement, and all Achievement predicates have their initial and final bounds lexically specified. (Smith

(1997); Chapter 2) The other bound to be specified is the initial bound of the consequence eventuality, her being mad in the present case. Being a Lexical State, this predicate is not obligatorily bounded but bound-compatible, that is, bounds can be added as required by other linguistic and pragmatic factors. Furthermore, being mad is a VRS so its bounds can be determined randomly. To establish a sequence, the initial bound of being mad is added to follow the existing final bound of breaking of the vase. This is my account of Inchoative State, including the present example. Note that the Proximity Constraint is being violated here: the optimal form of proximity is overlapping, but the sentence is not semantically realized as such because an external requirement of consequentiality is more weighted.[37]

The case just discussed sharply contrasts with the semantics of (124)a., an overlap sentence. The issue was how to derive the forward sequence reading for (126) as well as (124)b. and the overlap reading for (124)a.. The forward sequence reading, also referred to as Inchoative State (Chapter 2), has been analyzed to derive from the pragmatic requirement of being consequential and VRSs' flexible bounds. I use the fact that the bounds for FRSs such as be on a day-off canNOT be moved or modified. Take, for example, *be on a day-off*, appearing in (124)a. repeated below.

(118) a. When Mary learned about the terror attack, she was on a day-off.

The main clause state entails a fixed temporal duration lasting 24 hours, *which cannot be affected by other factors*. Assume, for discussion, the same consequentiality pragmatics as (124)b. for (124)a.. To achieve an event sequence, a prerequisite for the consequential reading, the initial bound of the state would have to be affected by an external factor. This conflicts the lexical specification of VRSs, making sequencing unavailable. (124)a., effectively, does not have the intended consequential entailment assumed for expository purposes. What the sentence does have is the overlap reading which falls out from the Proximity Constraint.

[37] Some speakers do get both readings (John Beavers, p.c.).

In this subsection I have offered an account for Inchoative State, hitherto unexplored but an important issue surrounding *when* sentences. Without the analysis given above, an open question would remain uninvestigated of why otherwise indistinguishable Lexical State predicates give rise to different temporal readings. By proposing the present analysis which relies on different options on State Runtimes and the Proximity Constraint, I have attempted to achieve a descriptive adequacy of a phenomenon central to the topic of this dissertation.

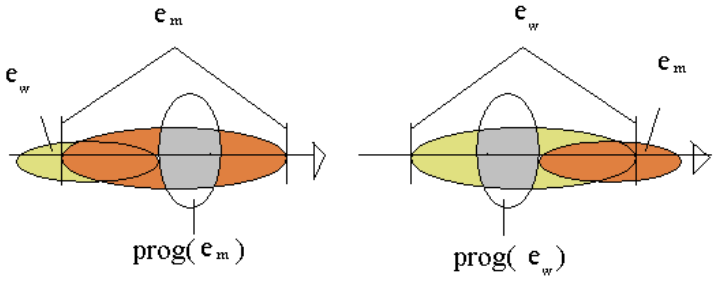
4.3.3 Specific Cases

The issue of two Statives (Observation (1)), receives the following account. For progressive-containing discourse fragment such as (103)b, as soon as the hearer is exposed to it she knows that a sequential reading is not possible, as progressives lack bounds. This is in contrast with (103)a., where such a reading is natural.

(102) a. When she broke the vase, he was mad.
b. When she broke the vase, she was being aggressive.

Avoiding the sequential interpretation that is not possible with a progressive in the sentence, the hearer seeks what IS possible. The temporal scheme following from the present study allows one such interpretation, namely overlap. I explain shortly how it follows in the present system. Let us look at a pair of diagrams in (127).

(127)
a. b.



In both cases in (127), the non-prgressive eventuality, represented as the smaller oval in the landscape orientation is placed adjacent to the partially grayed oval, which represents the progressive eventuality. By the Proximity Constraint, these two eventualities must be as close to each other as possible. An effect of this is that the non-progressive eventuality overlaps the progressivized eventuality, represented as the larger oval in the landscape orientation.

The two different types of Lexical Stative, whose examples are repeated below, receive the following account in the present system.

(101) a. When Mary learned about the terror attack, she was on a day-off.
b. When Mary learned about the terror attack, she was visibly shaken.

We have seen earlier that non-durative *when* clauses are strongly associated with the forward sequence reading. The overlap reading is not logically compatible with a non-durative *when* clause, because if an interval has no duration it cannot include any subinterval properly. [38]

My analysis for the last of the four issues introduced above is probably the most open to debate of all cases discussed. The observation concerns preference of the overlap

[38] In exclusion of the identity/equal readings (Allen's #7).

reading over the forward sequence reading when the *when* clause is durative. The preference is realized in examples such as (117) which I have already introduced.

(117) ...when he visited France..., Bush assured foreign leaders that he has no plans for military action against Iraq...(764)

Visit is a durative eventuality which usually lasts for an extended period of time, within which multiple subevents are implied.

Lexical info about visit saying relevant things

Note however that this process is prone to rebuttal. Consider example (128).

(128) When M.F and S.F. moved to Atlanta..., they discovered things were not exactly what they expected.(1160)

Move to [loc], in the sense of relocate, is an Accomplishment predicate. The reason is that the event includes a process of traversing from one place to another with an endpoint. The overlap reading would not be contradictory to any information in the sentence, with the main clause eventuality, discovered things were not exactly what they expected, serving as a proper subevent of the moving elaborating what happened in the course of relocating. (128) does not have such an interpretation: the main clause eventuality describes what happened after the moving, namely the forward sequence reading. I leave this exceptional forward sequence reading with sentences with the durative when clause for future research.

4.4 System Description and Demonstrations (E)

The system I develop in this chapter is designed as an alternative to the simple analysis in K&R with the points mentioned in the previous chapter being incorporated. I attempt to derive the various temporal meanings from two parts: i) a simple semantics of *when* which imposes two eventualities to stand in a not-yet-known temporal order; and ii) pragmatic-inference-driven system to give the finalized reading. The latter process utilize

Grice's (1979) conversational maxims as well as information from lexicon and world knowledge, and takes on a major role in determining one preferred meaning out of potentially more than one possible meanings entailed by the former process. I show how the present analysis works, by way of demonstrating discourse representations on six actual discourse fragments drawn from Corpus E.

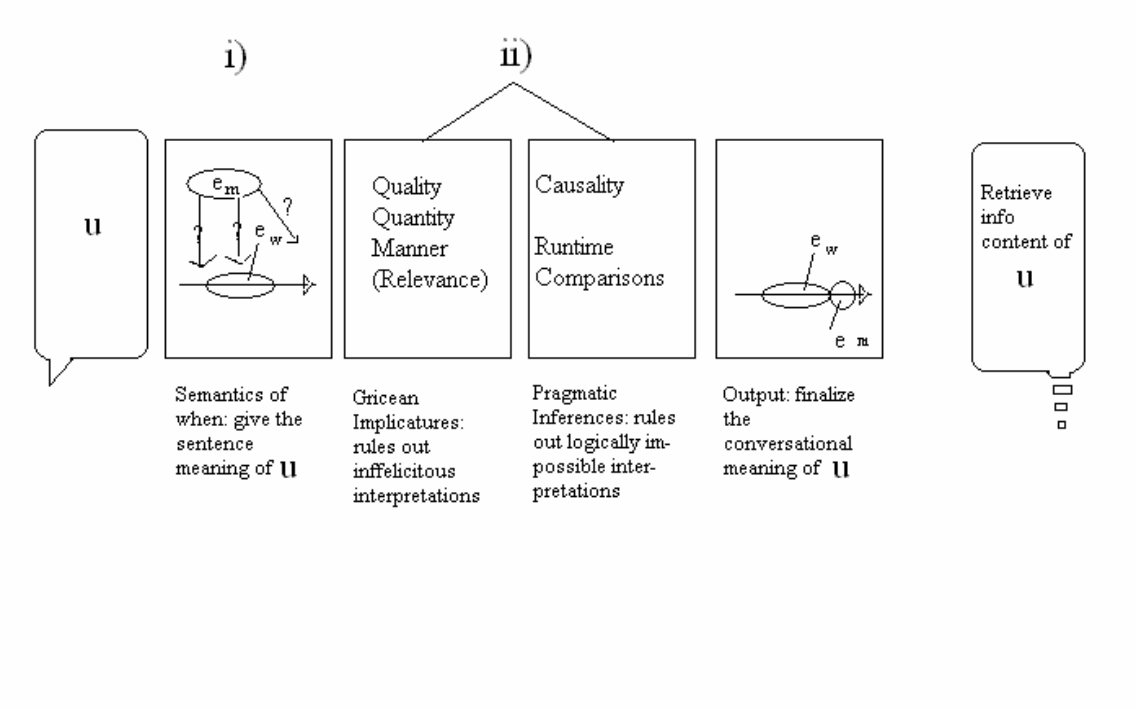


Figure 4.5 System Image for English

4.4.1 What *When* Does: Two Eventualities and Temporal Relation ®

The semantic description of *when* that I propose is rather simple.

(129) *When*:

a) introduce to U_k: e_w e_m

b) introduce to Con_k: e_w ® e_m, where ® $\in R$ = {o, <, >}

*Choice of ® to be pragmatically strengthened by conversational implicatures and lexical information.

c) e_w and e_m are maximally close to each other.

Put informally, this rule says that when requires two eventualities in the discourse which are either overlapped or ordered in sequence. Which of these options to be chosen depends on conversational implicatures and lexical information, but the default reading is one in which the two eventualities are maximally close to each other, i.e. overlap. This proposal entails that *when* actually bears a general-purpose flavor at its lexical specification. It also implies that at the end of interpretation the sentence is rarely interpreted vaguely, due to pragmatic strengthening triggered by conversational implicatures and lexical properties within the sentence. In this very respect the present analysis differs from the early temporal approach, from which it follows that, in principle, just about any temporal meaning is possible with any *when* sentence. This is the direction I hope to go for, given that vagueness is not so much frequent in the actual data.

4.4.2 What *When* does not Do: Pragmatic Strengthening

The simplicity of the construction rule in (129) leaves a lot on the * part, corresponding to ii) in Figure 5.1 above. In fact, every case except for progressive-containing ones will have their temporal reading determined by way of the pragmatic strengthening.

4.4.2.1 Pragmatic Strengthening (1): Boundedness Considerations

I discussed two types of pragmatic strengthening that use lexical boundedness information. Progressive clauses, lacking any bounds, give rise to the overlap reading. Consequentially-related *when* sentences containing a lexical stative clause may adjust bounds of the stative clause to comply with the consequential entailment. Specific mechanisms are described in the following.

Case (1): **Phenomenon**: The sentence contains a progressive clause gives rise to the overlap reading. **Mechanism**: By aspect-type description of the imperfective aspect including the progressive, the progressivized eventuality cannot contain bounds. By the Proximity Constraint, the *when* and main clauses must be maximally close to each other, insofar as not to contradict other pragmatic requirements. This means that the focused nonfinal interval of the progressivized eventuality is adjacent to the *when* clause eventuality, resulting in the overlap reading. **Strengthening Description**: Progressive in the sentence entails that ® = o.

Case (2): **Phenomenon**: A Lexical State that appears in a when sentence where consequentiality is present is interpreted as nonstative, giving rise to the forward sequence reading to the whole sentence. Such coercion is easier with variable runtime states like *be visibly shaken* than with fixed runtime states like *be 50 years Old*. **Mechanism**: Since consequentiality subsumes two the right bound of the antecedent and the left bound of the consequence. A necessary bound should be contextually added to the state. The addition amounts to creating a new temporal bound on the timeline. If the bounds for a state is fixed, as in *be 50 years Old*, this process would not be possible, while flexible bound states like *be visibly shaken* will easily accommodate it. **Strengthening Description**: IF S_0 contains an external trigger to prefer e_m and e_w apart and S_0 also contains a variable runtime state, THEN ® = <. An example of this case is the contrast between two lexical statives *be on a day off* and *be visibly shaken*, as in (101) repeated below.

(101) a. When Mary learned about the terror attack, she was on a day-off.
b. When Mary learned about the terror attack, she was visibly shaken.

4.4.2.2 Pragmatic Strengthening (2): Runtime Comparison

Case (3): **Phenomenon**: A non-durative *when* clause gives rise to the forward sequence reading. **Mechanism**: Achievement has no duration. The overlap reading requires that the

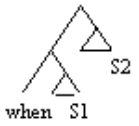
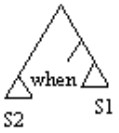
when clause event includes the main clause event. The reading is not available since, by the usual definition of inclusion, intervals without duration cannot contain another interval. The forward sequence reading is chosen as the next preferred interpretation. The same mechanism applies to *when* sentences with two Achievements. **Strengthening Description**: IF the *when* clause is non-durative, THEN = ® = <.

Case (4): **Phenomenon**: A durative *when* clause tends to be associated with the special kind of the overlap reading, subeventive. **Mechanism**: Durative predicates have a fairly extended duration, making them more capable, in comparison to other predicates, of temporally including another interval. **Strengthening Description**: IF the *when* clause contains a durative predicate, THEN DEFEASIBLY ® = o & [subevent from Chapter 1].

4.5 Construction Rules

I base my DRT formulation on the construction rule for *when* which I discussed at the end of Chapter 2, repeated below. The rule captures the forward sequence meaning of *when*, synonymous to *after*.

Table 4.3 Kamp and Reyle-Style Construction Rule for *when* corresponding to the forward sequence reading

CR. When		
Triggering Configuration	 OR 	
Introduce to U	e_w, e_m, n, t, t'	
Introduce to Con	IF tense (S1) = past THEN t<n, ELSE t>n	
	$e_w \subset t$ $e_m \subset t'$ $t < t'$	

The key to the forward sequence reading namely, the 'after' meaning, is the following condition at the end of the rule.

(130) t<t′

This construction rule is not sufficient as a proper description of *when*, as it ignores the cases giving rise to the overlap and backward sequence readings. First, consider a syntactic requirement for *when* sentences is that two full clauses, main and *when* clauses, be introduced in immediate proximity of *when*. I propose that each of the clauses introduces an eventuality into the discourse. I shall call them e_m (for main clause eventuality) and e_w (for *when* clause eventuality). My rule involves an operation that adds

two eventuality variables into the universe of individuals in the discourse U_k, along with speech time n, the narrative time t corresponding to e_m and a reference time t′ corresponding to e_w.

(131) Introduce to U_k: e_w, e_m, n, t, t′

Next, tense marking is dealt with.[39] If the *when* clause bears the past marker *-ed*, t is set prior to n, indicating that the discourse describes a past situation. Otherwise, t is set posterior to n, handling present and future tenses ((132)). The same conditioning applies to the main clause. The relevant conditions are as follows.

(132) IF tense (S_1) = past THEN t<n and tense (S_2) = past
ELSE t>n and tense (S_2) ≠ past

The relation between time points and eventualities—t, t' and e_1 e_2--depends on the type of the eventuality.

(133) a. IF e_1 is a (non-stative) event, THEN $e_1 \subset$ t
ELSE $e_1 \supset$ t

b. IF e_2 is a (non-stative) event, THEN $e_2 \subset$ t'
ELSE $e_2 \supset$ t'

At this point, we do not always know which temporal meaning holds between e_m and e_w. The hearer must allude to further properties of the discourse she is being input to. All that she knows, at this point, is that the temporal reading is to be eventually picked out

[39] In the present system, the name 'tense marking' does not necessary mean that the corresponding morphemes, ∅, *-s* and *–ed,* always denote tenses. Although effects of this decision is implicit in English, in a system dealing with Japanese, to be discussed in Chapters 6 and 7, it is necessary because 'tense markers' in embedded positions are assumed to refer to (im)perfectivity, rather than tenses.

from three possible relations, overlap, forward sequence and backward sequence. The set of such relations is expressed as ® and written as (138).

(134) e_w ® e_m, where ® ∈ R = {o, <, >}

The choice of ® depends on various different factors, the presence of the progressive morphology being one of them. With the progressive in the sentence, the reading is almost deterministic, thus I propose (135):

(135) IF S_0 contains a progressive
THEN ® = o

(135) describes the correlation of the progressive form with the overlap reading. In other words, if either *when* or main clause contains a progressive, then the interpretation of the whole sentence is overlap. Note in passing that this entailment must go in the indicated direction because the overlap reading is not only associated with the progressive but also with others.

With a consequentiality entailment, distinguishing two kinds of Lexical States, viz. FRS and VRS, play a role in choosing the forward sequence reading: the consequential requires that the two bounded eventualities are apart from each other. This is expressed using a logical implicative statement IF a, THEN b, as follows.[40]

(136) IF e_m is a consequence of e_w,
THEN ® = <.

In the case of FRSs, the antecedent clause of (136) does not hold true because FRSs do not entail a change-of-state necessary for the consequential relation. If the antecedent does not hold true, then the consequence does not hold true either. An effect of this is that the

[40] For more discussions on defeasible implication, Asher and Lascarides (1993) is helpful.

temporal meaning will be open for other factors to be finalized. In the present case, the default interpretation, the overlap, will be chosen.

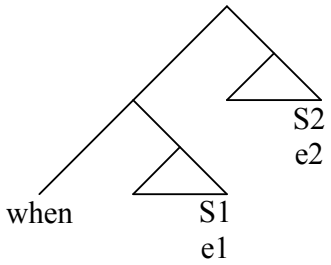
Lastly, runtimes (temporal durations) of e_w and e_m are compared. I propose the following condition to deal with the Achievement *when* case (triggers forward sequence) and the durative *when* case (triggers the subeventive overlap).

(137) IF $t(e_w) < t(e_m)$
THEN ® ≠ o.

In this conditional statement, the overlap reading requires that the runtime of e_w is longer than that of e_m. The non-durative (Achievement) *when* case fails to meet this condition, because non-duratives' runtimes must be shorter than those of any other situation aspect type. This case involves defeasible reasoning, as having a durative *when* clause does not entail the subeventive overlap reading of the sentence. The actual choice is made with detailed contextual factors taken into consideration. (See the demonstration section)

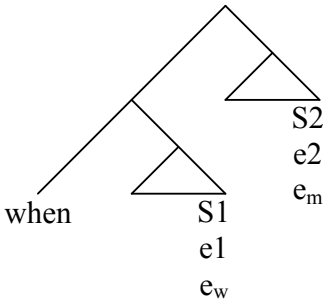
As the last step, the syntactic variation is handled. There are two options, IWS and the FWS, which lead to two separate but similar CR.*When*'s. I first describe the one for the IWS, followed by the one for FWS. IWSs have the following syntactic structure. In the configurational representation (138), the *when* clause S_1 comes immediately after *when*, followed by the main clause S_2.

(138)



S_1 and S_2 each introduces an eventuality into the discourse. Let us call them e_1 and e_2 respectively. e_1, which is introduced by S_1, corresponds to the *when* clause eventuality. So we substitute e_w introduced earlier with e_1, whereby (139) is obtained.

(139)



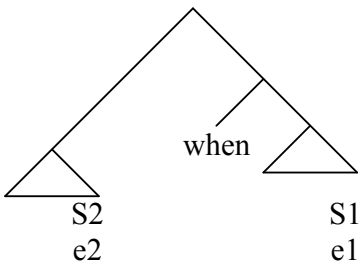
Thus the following conditions will be added to Con_k:

Clause-Eventuality Matching for IWS

(140) i. $e_w = e_1$, where e_1 is the eventuality introduced immediately after *when*;
j. $e_m = e_2$, where e_2 is the eventuality introduced immediately after e_1.

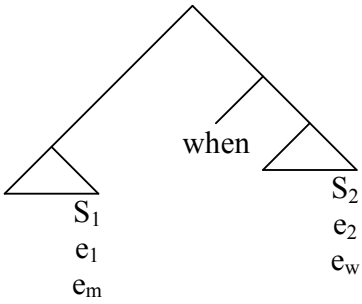
CR.*when* (FWS) is minimally different from CR.When (IWS), in that the positions of e_w and e_m are reversed. The FWS has the syntactic structure shown in (141), represented in a configurational fashion.

(141)



In the above tree, the main clause is introduced immediately before *when*, and the *when* clause immediately after *when*, resulting in (142) and the condition (143).

(142)

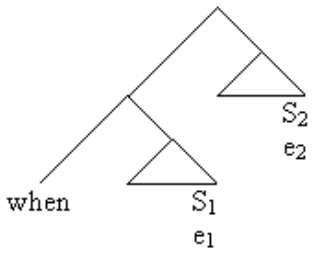
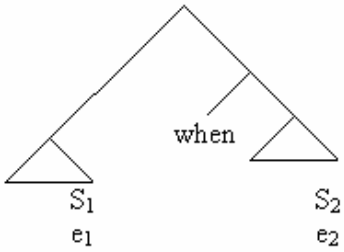


Clause-Eventuality Matching FWS

(143) i'. $e_m = e_1$, where e_1 is the eventuality introduced immediately before *when*,
j'. $e_w = e_2$, where e_2 is the eventuality introduced immediately after *when*.

To summarize, the conditions discussed above are presented in (144).

(144) CR.*when*

CR.When				
Triggering Configuration	i) 		ii) 	
Introduce to U	e_w, e_m, n, t, t′, e_1, e_2			
Introduce to Con	IF tense (S_1) = past THEN t<n and tense (S_2) = past ELSE t>n and tense (S_1) ≠ past;			
	*IF e_1 is a (non-stative) event, THEN $e_1 \subset t$ ELSE $e_2 \supset t$; *IF e_2 is a (non-stative) event, THEN $e_2 \subset t'$ ELSE $e_2 \supset t'$; * e_w, ® e_m, where * ® ∈ **R** = {o, <, >} * IF the *when* sentence contains a progressive * THEN ® = o; * IF e_m is a consequence of e_w, * THEN ® = <; *IF $t(e_w) < t(e_m)$ * THEN ® ≠ o.			
	i)	$e_w = e_1$	ii)	$e_m = e_1$
		$e_m = e_2$		$e_w = e_2$

4.6 Demonstrations

4.6.1 Progressive in the Sentence: Strongly Associated with Overlap (Case (1))

The first fragment concerns a past-tensed IWS involving the progressive morphology *–ing*.

Excerpt 1

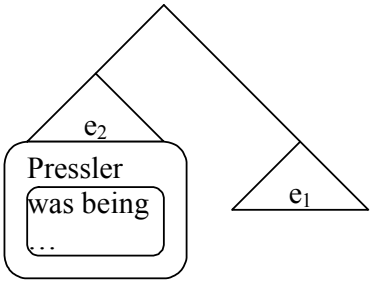
> In 1989, when Pressler was being considered by President George H.W. Bush to head a new Office of Government Ethics, some moderators told the FBI that Presler was a bigot and that he had unethically taped phone conversations without the knowledge of people he was talking to, so as to gather evidence against Baptist moderates. (292)

The DRS is given below for a shortened discourse fragment of Excerpt 1, namely (145).[41]

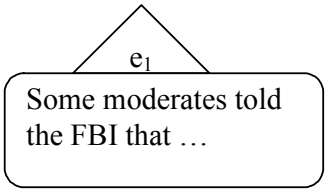
(145)

[41] In the demonstrations below, I will only explicate the initial (tree-and-blank box) and final (completed) DRSs, in order not to complicate the representations with immaterial details.

e_w e_m n t e_2 x t′ e_2
1. TPpt = n 2. t < n 3. t′ = t (e_2 is a Prog.) 4. $e_2 \supseteq$ t′ (e_2 is a Prog.) 5. x=Pressler 6. e_2: x be considered … 7. e_w=e_2



e_w e_m n t t′e_1 x e_2 y z p
... 8. $e_1 \subseteq$ t (e_1 is Act) 9. y = some moderates 10.z = the FBI 11.p : that … 12.e_1 : y tell z p 13.e_m = e_1 14.® = o (lns. 2,3,4,8)



The relevant portion of the CR that determines the temporal reading is ® = o, triggered by the progressive. This strengthening overrides the other options for the value of ®. In doing so, a maxim of manner is followed: The speaker have used the progressive form over others, intending to convey that ® = o. By using an unbounded clause, the speaker

commits to positively conveying that that the two eventualities overlap. If it had not been the speaker's intention he would have used an alternative expression like *before*.

4.6.1.1 LS and State Runtimes (Case (2))

In Chapter 4, I used a pair of constructed examples to facilitate the explanation. The relevant examples are repeated below.

(101) a. When Mary learned about the terror attack, she was on a day-off.
b. When Mary learned about the terror attack, she was visibly shaken.

Demonstrations in this subsection are done for actual examples. Taken from real texts, (146) does not look like a minimal pair, but I believe that it does not complicate my point.

(146) a. When the results were negligible, Gladwin asked why. (703).
b. When she was 50, she left him (301).

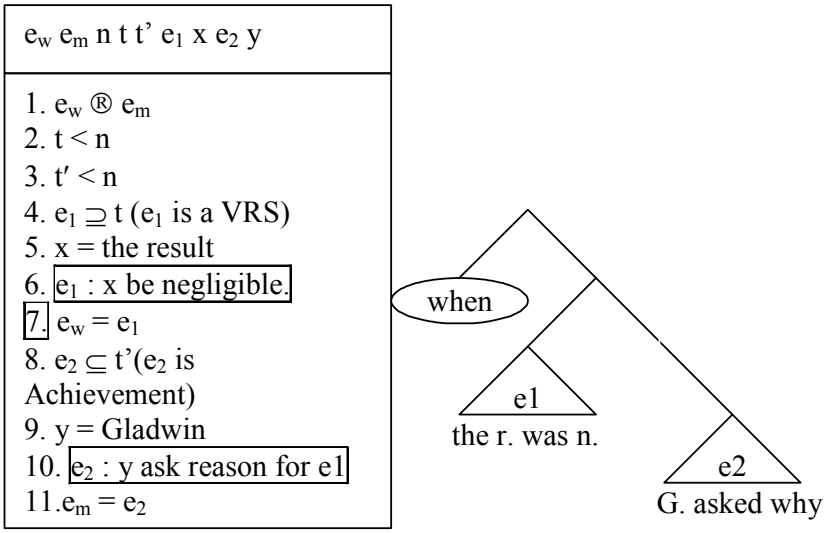
Let me start with the forward sequence option, involving an Inchoative State.

Excerpt #2

When the results were negligible, Gladwin asked why.

(141) a. When the results were negligible, Gladwin asked why. (703).

The lexical state contained in (146)b. is *be negligible*, whose bounds are not lexically fixed. The key to an explanation lies in explaining why the speaker, supposed to be cooperative, did not pick other expressions such as *while the results were negligible*.



Line 4 says that *the results were negligible* is a VRS, i.e., has movable bounds. Two eventualities are consequentially related (not shown in the DRS). By world knowledge on consequential events, these eventualities must be sequentially ordered. This is possible precisely because e_1 = e_w = *the results were negligible* can move its bounds to be sequential with another eventuality.

Let us move on to the other type, where the intended interpretation is overlap.

Excerpt #3

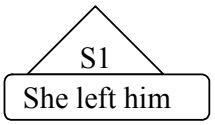
Like others in the gang, Smith had affairs. He began beating her, she said, and in 1951, when she was 50, she left him. (301)

(141) b. When she was 50, she left him (301).

The key to arrive at the intended interpretation is to the fact that the sentence contains an FRS; overlap-triggering predicate *be 50 years old*. This predicate has lexically defined bounds, namely the period in one's life between her 50 and 51 years old birthdays. A present assumption in the system does not allow these bounds to be flexibly moved, because they are lexically fixed. In this situation, the speaker does not have to resort to

another expression such as *while* to indicate the intended overlap meaning. The reasons are that *be 50 years old* is a nonbounded state, which prefers overlap, and that no contextual overwriting that reverse the interpretation is fond in the context. The resulting interpretation is overlap.

e_w e_m n t t' e_1 x e_2 y
1. e_w ® e_m 2. t < n 3. t′ < n 4. $e_1 \supseteq$ t (e_1 is aFRS) 5. x = she 6. e_1 : x be 50 7. $e_2 \subseteq$ t' ($e_2 \in$ {Act}) 8. y = him 9. e_2 : x have y 10.$e_m = e_2$ 11.® = o (ln. 4)



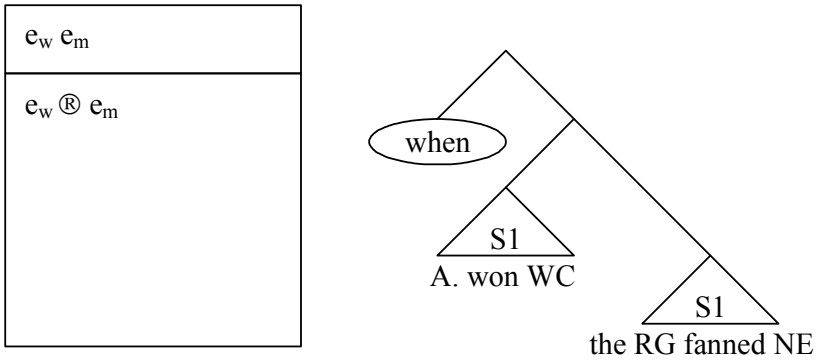
4.6.2 The Non-durative in the *When* Clause: Strongly Associated with forward sequence (Case (3))

The fourth fragment contains a sentence with an Achievement *when* clause, where forward sequence is strongly preferred.

Excerpt 4

In 1978, when Argentina won the World Cup, the ruling generals fanned a nationalist euphoria, which distracted the public from the torture and 'disappearances' of thousands of 'subversives.' (321)

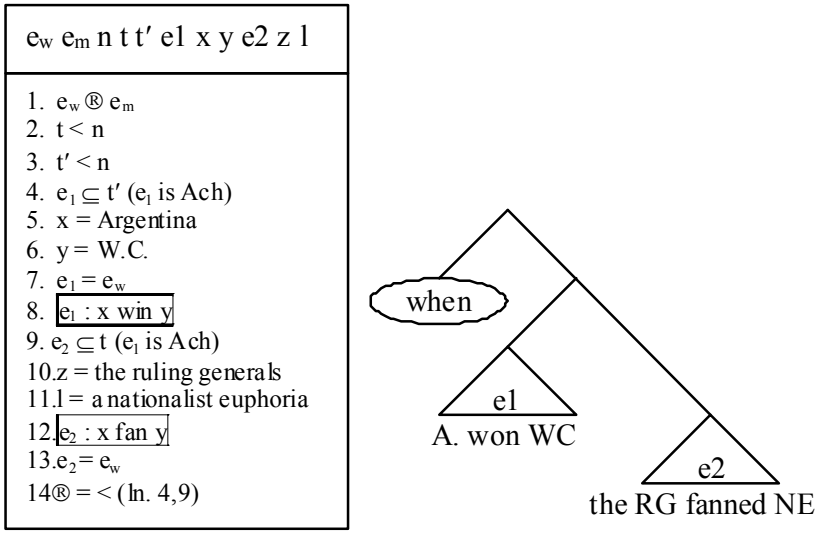
(147) When Argentina won the world Cup, the ruling generals fanned a nationalist euphoria.



In this case, the temporal order < is chosen, by inferences derived from runtime comparison.

(148) $t(e_w) > t(e_m)$

In addition, since there is no clue suggesting that backward sequence is preferred, forward sequence is chosen. Thus ® = <.



4.6.3 The Durative in the *When* clause: Defeasible Association with the Subeventive Overlap (Case (4))

Excerpts 5 and 6 both contain a durative predicate in the *when* clause. .However, the interpretation of the *when* sentence in these examples is distinct. In particular, Excerpt 5 has the subeventive overlap reading, while Excerpt 6 has the forward sequence reading. Below, I demonstrate how the differing readings arise, triggered by contextual information that prefers one reading over the other.

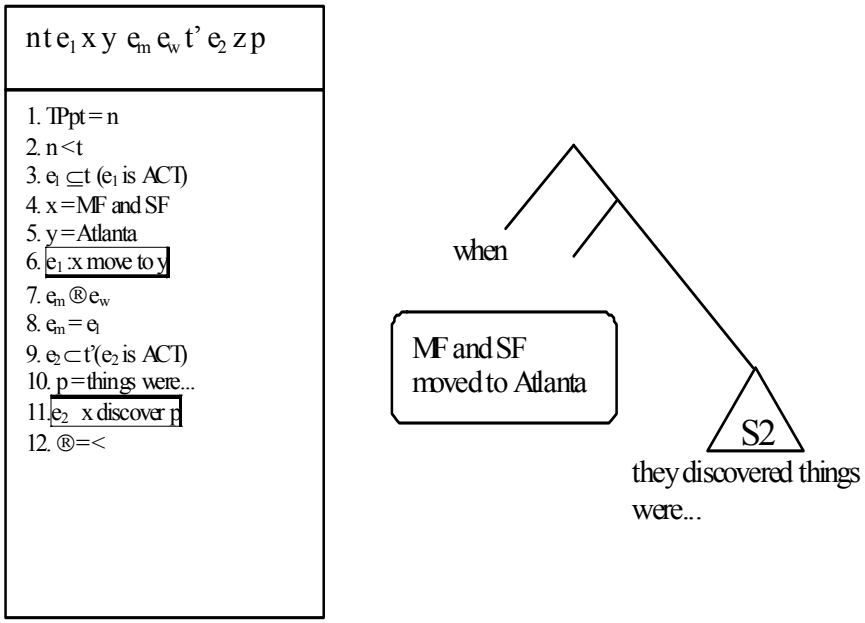
Excerpt 5

(117) ...when he visited France..., Bush assured foreign leaders that he has no plans for military action against Iraq...(764)

In this excerpt, part of the informational content of the main clause, namely that Bush talked to foreign leaders is suggestive that the main clause eventuality took place in a country foreign to the American president, including France that had already appeared in the preceding context. Thus, the reader infers that the main clause event Bush *assured foreign leaders that*...happened *during* the president's visit to France, arriving at the overlap reading.

Excerpt 6

(131) When Maura and Scott Figura moved to Atlanta from Connecticut a few months ago, they discovered things were not exactly what they expected. (1160).



In contrast, Excerpt 6 contains information that suggests the forward sequence reading: The when clause describes the event of moving from one place to another. World knowledge tells us that you are less familiar with the place you are moving to than the one you currently live in. Some verbs contained in the main clause, specifically *discover* and *expect*, are most naturally used for things or events about which you do not know much. Thus, the reader infers that the main clause event takes place in a place about which the subjects do not know much, viz. Atlanta, GA. Since the subjects can only reach the city *after* moving event is over, the two eventualities in Excerpt 6 are most naturally interpreted as forward sequence.

4.7 Chapter summary

I have discussed the system for English that derives the variety of temporal readings of *when* sentences. The system requires that the main clause eventuality sits maximally close to the *when* clause eventuality, without specific contexts to suggest

otherwise. In some cases, such as progressive-containing *when* sentences retain the default overlap reading, because the temporal scheme required for such sentences entail that the main and *when* clause eventualities are close to each other. Diverging from the overlap reading, in this particular case, would contradict the requirement of the progressive aspect claimed by Smith (1993) and assumed in the present work. In other cases I have discussed, the overlap and sequential readings are distributed primarily on the basis of contextual information.

Chapter 5 : A Cross-Linguistic Extension: *Toki(-ni)* in Japanese

5.1 Introduction

This chapter extends the approach I have developed in Chapters 4 and 5, and discusses *when* sentences, in a language that is typologically different from English. I have chosen *toki-ni* "when" sentences in Japanese. One motivation for choosing Japanese is the fact that Japanese allows different types of grammatical variations in *when* sentences, compared to English. Specifically, Japanese embedded tense marking is determined independently of the matrix tense. Thus, Japanese embedded clauses are tense-marked independently of that of the main clause. As the main clause tense does not narrow down the possibilities, Japanese complex clauses generally have more number of variants than their English equivalents. In addition, *toki(-ni)* “when” allows the postposition to be dropped, which is a free variation. With these language-particular characteristics, Japanese offers a challenging terrain on which to extend the present analysis.

The discussion I am presenting for Japanese has a simpler structure than that for English. This is because most background assumptions common to both languages have already been addressed. I start with introducing some syntactic and semantic features characteristic of *toki-ni* sentences. The preliminary discussion will also include a brief literature review. My assumption is that this is sufficient for the present purpose because there are fewer relevant studies for the Japanese *toki-ni* than for the English *when*, available to me at this time. Then, I discuss examples from a Japanese newstext corpus designed for this study. I use the same set of criteria as I have adopted for English. I describe numerical results particular to Japanese, as well as seek commonalities with and differences from the equivalent construction in English. The findings will be formally extended in Chapter 7.

5.2 Tense, Aspect and Beyond

In Chapters 4 and 5 I mentioned that temporal semantics of English *when* is heavily connected to situation and viewpoint aspects. I assume that this conclusion carries over to Japanese for the most part. Also, information on how tense is expressed in a language is indispensable when discussing temporal semantics in the language. For these reasons, in this section I provide background information on Japanese tense and aspects, For the latter, I base my explanation on Shirai's two articles on Japanese aspects in 2CAT framework (Chapter 2; Shirai (1999, 2000)).

5.2.1 *-Ta* and *-(R)u* in Matrix and Embedded Positions

As shown in (149) below, Japanese verb-phrase-final particles standardly referred to as tense markers are realized in two major forms.

(149) a. ta: past
b. (r)u: nonpast

(150) exemplify the indicated functions.[42]

(150) a. arui-ta
walk -past
"I walked"
b. aruk-u
walk -nonpast
"I walk"

[42] In phoneticizing Japanese expressions, I omit irrelevant details such as obligatory phonological shifts.

There are debates as to whether these particles denote tenses, or are more connected to (im)perfectivity. [43] I assume that these particles appearing at the end of a sentence actually realize the tensal functions illustrated above. Thus, in terms of the narrative time t and speech time n, I assume (151):

(151) a. *-ta* ('past tense marker') in the matrix position: t < n
b. *-(r)u* ('nonpast tense marker') in the matrix position: t ≥ n

In embedded positions, however, the particles no longer have to do with speech time, but they indicate the temporal location of the embedded clause event relative to the matrix event time. Thus, in (152)a. the walking is a past event, although it bears the 'nonpast' marker *-u*. Likewise (152)b., *-ta* marking on the embedded clause does not make the sentence an event in the past.

(152) a. aruk-u toki-ni korom-da
walk-nonp time-at fall_down-past
"*When I walk, I fell over"
b. arui-ta toki-ni korob-u
walk-past time-at fall_down-nonp
"*When I walked, I fall over"

What is happening here is that the embedded 'tense' particles indicate temporal priority or posteriority of the embedded event time t' relative to the matrix event time t. I assume the following semantic representation (153) for these particles.

(153) a. *-ta* in an embedded position: t' < t
b. *-(r)u* in an embedded position: t' ≥ t

[43] Hasegawa (2000) gives a detailed discussion of the issue.

5.2.2 Situation and Viewpoint Aspects

In his 1999 article, Shirai provides an elaborated classification of Japanese aspect typology, based on Smith's 2CAT. In his 2000 article, Shirai focuses on *te-i-* a Japanese verbal infix which is polysemous, interpretable as either progressive or resultative meanings. Further, according to Shirai (2000:332-333), Japanese predicates are classified into four types, with dividing conditions similar to those for English. The table below illustrates the situation types in Japanese according to Shirai.

Table 5.1 Examples and Feature List of Five-way Aspectual Classification of Japanese Predicates

Category	Example(s)	Smith's binary features
State	ir- "need" "be there"	-dyn, -tel, +dur
Activity	aruk- "walk"	+dyn, -tel, +dur
Accomplishment	Nihon-ni ik- "go to Japan"	+dyn, +tel, +dur
Achievement	tuk- "arrive, attach"	+dyn, +tel, -dur
Semelfactive	kushamis- "sneeze"	+dyn, -tel, -dur

In Japanese, perfective and imperfective viewpoint aspects are morphologically distinctive. Shirai argues that the simple past form represents the perfective viewpoint, while *te-i* is a realization of the imperfective viewpoint.

A complication though is that the *te-i* form can also be used to indicate a result state. The result state meaning evinces when the *-te-i-* is bound to an Achievement predicate. (Shirai (2000:332)) When *te-i* is combined with an Activity, Accomplishment and Semelfactive, the verb complex denotes an ongoing state, namely the progressive. [44]

[44] A State in this environment results in anomaly.

i) *okane-ga itte-iru (Shirai's (22)).

Achievement: Resultative

(154) asoko-ni booru-ga oti-te-i-ru (Shirai's (19))

Dictionary	Perfective	Imperfective		Translation
deki-ru	deki-ta	deki-teiru	Lex.St.	be able
hasir-u	hasit-ta	hasit-teiru	Act	run
hikkosisu-ru	hikkosisi-ta	hikkosisi-teiru	Acc	move (relocate)
kushamisu-ru	kushamisi-ta	kushamisi-teiru	Sem	sneeze
oti-ru	oti-ta	oti-te-iru	Ach	fall

On going

Resultative

To formally express this polysemy, I assume the following semantic descriptions for the verbal infix.

(155) a. -te-i-$_1$: e includes t
b. -te-i-$_2$ e is on ini(t)
-*te-i*-$_1$ and -*te-i*-$_2$ are in complementary distribution, with the former occurring after non-Achievements and the latter after Achievement.

5.2.3 Particle Drop (Morphology)

Another unique characteristics pertaining to *toki-ni* is the optional nature of the postposition *-ni* 'at,' which can be dropped without changing acceptability. (156) represents two different morphological options allowed for the *toki-ni* construction.

Money-NOM need-te-I-nonpast

"*I am needing money"

(156) a. Ruuku-to Reia-hime-wa umareta toki hanarebanare-ni natta. (183)
b. --- --- --- -ni --- --- ---

"As for Luke and Princess Leia, they became separated when they were born"

5.2.4 Excursus: Matrix and Prenominal Forms of Predicates

This subsection is aimed at clarifying a complexity in Japanese conjugational morphology. The focus is on non-past morphemes *-ru/-i/-da* and past morphemes *-ta/-katta//-datta.* Japanese predicates can be divided into four classes, depending on how they conjugate with postverbal predicates.

(157) Classes of Japanese Predicates in their dictionary forms [45]

a. Class V (for 'verb'): *nom-u* "drink", *mi-ru* "see", *su-ru* "do"
b. Class A (for 'adjective'): *ooki-i* "be big"
c. Class AN (for 'adjectival noun'): *siawase-da* "be happy"
d. Class N (for "noun with copula"): *nihonjin-da* "be Japanese"

(158) describes patterns that arise with two grammatical factors, past/non-past and matrix/prenominal. The unshaded area is where I want to bring the reader's attention.

(158)

[45] I give the mnemonic names of the classes for expository purposes of this study. The classes are widely recognized, but they are not necessarily understood by the names I assign here.

	The RU family (nonpast)		The TA family (past)	
PredClass/Position	Matrix	Prenominal	matrix	past
Verb (V)	ru, u *	ru, u*	ta	ta
Adjective (A)	i	i, na**	kat-ta	kat-ta
Adj. Noun (AN)	da	na	dat-ta	dat-ta
N+copula (N)	da	no	dat-ta	dat-ta

* variation sensitive to the final consonant of the root.

**free variation.

The prenominal form is realized in the position right before a noun.[46] In traditional grammatical terms, this form is called 'rentaikee' (*ren-* 'sequence' + -tai-, short for *taigen* 'noun' + *-kee* 'form'). Most often, a predicate contained in a relative clause takes this form, as in (159).

(159) a. Sake-o nomu hito
alcoholic_beverage-ACC drink-pren person
"person who drinks alcoholic beverage".

b. Eega-o mi-ru toki
movie-ACC see-pren time
"the time *when* (I) see a movie"

c. benkyoo_su-ru heya
study-do-pren room
"the room to study in"

The prenominal form has not attracted much attention in Japanese linguistic literature, due to the fact that the form is identical in half of all the classes, namely in V and A. This is indicated by bold framing in the above table. However, the present study categorizes these forms separately. The reason is that it deals with a number of examples containing predicates that belong to AN and N, in which matrix and prenominal forms are distinct

[46] As Japanese is a head final language, this position is usually occupied by a nominal modifier.

and the *toki-ni* construction involves a prenominal form, namely V(pren)+*toki*(noun).. As (158) shows, the class AN and N take *-da* in matrix nonpast clauses, but prenominally take either *-na* or *-no* respectively depending on their morphological category

(160) a. siawase-da
happy-nonpast
"(I am) happy"

b. nihonjin-da
Japanese-nonpast
"(I am) Japanese"

(161) a. siawase-na hito
happy-pren,nonpast person
"a happy person"

b. nihonjin-no ti
Japanese-pren nonpast blood
"Japanese blood"

In the following discussions, especially in the glosses, I will distinguish non-past forms between prenominal and matrix, which can be identical in the surface form. The matrix form occurs in main clauses and is unmarked. When the prenominal form occurs, it is marked as such in the gloss, as in (161) b.. The distinction is only necessary for classes AN and N, but for consistency I adopt the same notational convention to classes V and A.

5.3 Previous Study: Yoshimoto and Mori on Japanese Complex Clauses

To date, there have not been many works about Japanese that discuss *toki-ni* clauses extensively. However, Yoshimoto and Mori's (2000) work (henceforth Y&M) is one such attempt, dealing directly with temporal interpretations of complex clauses in Japanese, including but not limited to *toki-ni* sentences. They first address the temporal position of the event time of simple clauses, stated in relation to the speech time. The interpretations

described in (162) are based on verbal suffixation, represented in rows, as well as lexically marked stativity in columns. [47]

(162)

Stativity → / ↓Verbal Suffix	Dynamic	Stative
(r)u (Nonpast)	Future	Simultaneous
ta (Past)	Past	Past

The *ru* form denotes an immediate future when it is bound to a dynamic predicate. A stative predicate with *ru* attached entails simultaneity of the described eventuality with speech time. (163) through (164) are some examples.

(163)
Eki-made aruk-**u**
station-to walk
"will walk to the station"

(164) Gakusee des-**u**
student be(polite)-nonpast
"am/are/is (a) student(s)"

The *ta* form allegedly indicates the past meaning, regardless of the aspect type of the host predicate, as illustrated in (165) through (166).

(165) Ekimade arui-**ta**
station-to walk

[47] ibid: 303; Y&M attributes the generalization to earlier researchers such as Ogihara (1996).

"walked to the station"

(166) gakusee desi-**ta**
student be(polite)-nonpast
"am/is/are (a) student(s)"

When it comes to complex clauses, however, the picture gets more complicated. Y&M present a partial description of the patterns in matrices.（ibid:314）The affecting factors here, according to them, are stativity of the *toki-ni* clause and combination of the matrix and embedded verbal suffixation.

(167)

toki-ni clause is→ ↓v. suffix combination	dynamic	stative
1: *ta-ta* (Past-Past)	FS	FS
2: *ru-ta* (Nonpast-Past)	BS	OL
3: *ta-ru* (Past-Nonpast)	?	?
4: *ru-ru* (Nonpast-Nonpast)	?	OL

Their claim is twofold: first, the tense marking-- *-ru* or *–ta*-- determines the *toki-ni* clause's event time with respect to that of the main clause. Second, if the *toki-ni* clause is a stative, e_w and e_m overlap; otherwise e_w precedes e_m. The above table is added with the categories they do not discuss in detail, which are marked as ?

toki-ni clause is→ ↓v. suffix combination	dynamic	stative
1: *ta-ta* (Past-Past)	FS	FS /OL
2: *ru-ta* (Nonpast-Past)	BS	OL
3: *ta-ru* (Past-Nonpast)		anomalous
4: *ru-ru* (Nonpast-Nonpast)		OL / anomalous

I will try to fill the gaps in the paradigm using examples from Corpus J. As the gaps and question marks in the original table indicate, Y&M's paradigm as it stands now does not properly fit in to the behavior of *toki-ni* sentences.

5.4 Corpus Observations

The described morphological/syntactic/semantic characteristics of time-related aspects in Japanese give rise to many interesting issues, including ones of direct relevance to the system of *when* developed in the previous chapter. This section juxtaposes four such issues based on observations of constructed and corpus examples. The corpus examples are taken from a newspaper corpus Corpus J (Appendix A). There is some overlap with English observations on Statives (Chapter 4) and those addressed in this section (6.4.1). Some of the issues (6.4.2-4) deal with phenomena characteristic to Japanese.

5.4.1 Observation (1): Two Statives: Discrepancy between Constructed and Corpus Data

The first issue I take up is a recurrent one from English. One of my concerns regarding English *when* sentences concerned how could two different types of stative predicates, progressive and non-progressive, interact with the semantics of *when*. Specifically, I addressed in Chapter 4 that these two Statives are not distinguished in the studies *when* that I reviewed dealing with English. In actuality, I further argued, they

exhibit different possibilities as to whether an Inchoative State is possible in a discourse containing them.

What I want to do in this subsection is to explore the equivalent terrain pertaining to Japanese *toki-ni* sentences, both theoretically and corpus-wise. I start by pointing out that Japanese Lexical State is not familiar with Inchoative State as its English counterpart, given constructed examples. Then, I present data from Corpus J (Appendix A) that suggest otherwise; Lexical State predicates in the corpus are often associated with Inchoative State, surfacing as the forward sequence reading. An account of the observation will be discussed in 6.5.1.

Japanese, like English, morphologically distinguishes progressive and non-progressive Stative predicates (Shirai (2000)). The progressive takes the verbal infix *-te-i-* before tense marking, as in (168)a.. Non-progressive Statives may exhibit various conjugational patterns, such as verbal ((168)b)., adjectival ((168)c., d.) and adjectival nominal ((168)e.).

(168)

	PROGRESSIVE	
a. Sarada-o	tabe-te -i-ru	"(I am) eating salad"
salad-ACC	eat -TE -I-pres	
	NONPROGRESSIVE	
b. Sarada-o	konom-u	"I like salad"
	fond -pres	
c.	tabe-na-i	"I don't eat salad"
	eat -neg -pres	
d.	-ga tabe-ta -i	"I want to eat salad"
	-NOM eat –want-pres	
e.	-wa yasai -da	"Salads are vegetables"
	-TOP vegetable-cop	

In what follows, I will gloss the nonprogressives together as Lexical Stative.

In the domain of constructed examples, English and Japanese show a salient contrast regarding Inchoative State. Let us recall the two options available for a Lexical State in a discourse, non-inchoative (Reading 1) and inchoative (Reading 2) in (169).

(169) The rain stopped. The sky was clear.

Reading 1. The rain stopped. The sky was (already) clear.
Reading 2. The rain stopped. (Then) The sky became clear. (Inchoative State)

The Japanese counterpart of (169) only has the non-inchoative interpretation, as shown in (170).

(170) Ame-ga agar-ta. Sora-ga hare-dat-ta
rain-NOM stop-past sky-NOM clear-be-past

Reading 1.The rain stopped. The sky was (already) clear.
#The rain stopped. (Then) The sky became clear. (NO Inchoative State)

The same contrast can be observed with *when/toki-ni* sentences, as illustrated in (171)a.-b..

(171) a. When the rain stopped, the sky was clear.

Reading 1. When the rain stopped, the sky was (already) clear.
Reading 2. When the rain stopped, (Then) The sky became clear.

b. Ame-ga agar-ta toki(-ni), sora-ga hare-dat-ta
Reading 1. When the rain stopped, the sky was (already) clear.
#When the rain stopped. (Then) The sky became clear.

Unfortunately, examples drawn from Corpus J do not support the above observation. To see this, let us look at Figure 6.1 below, where irrelevant bars are grayed out.

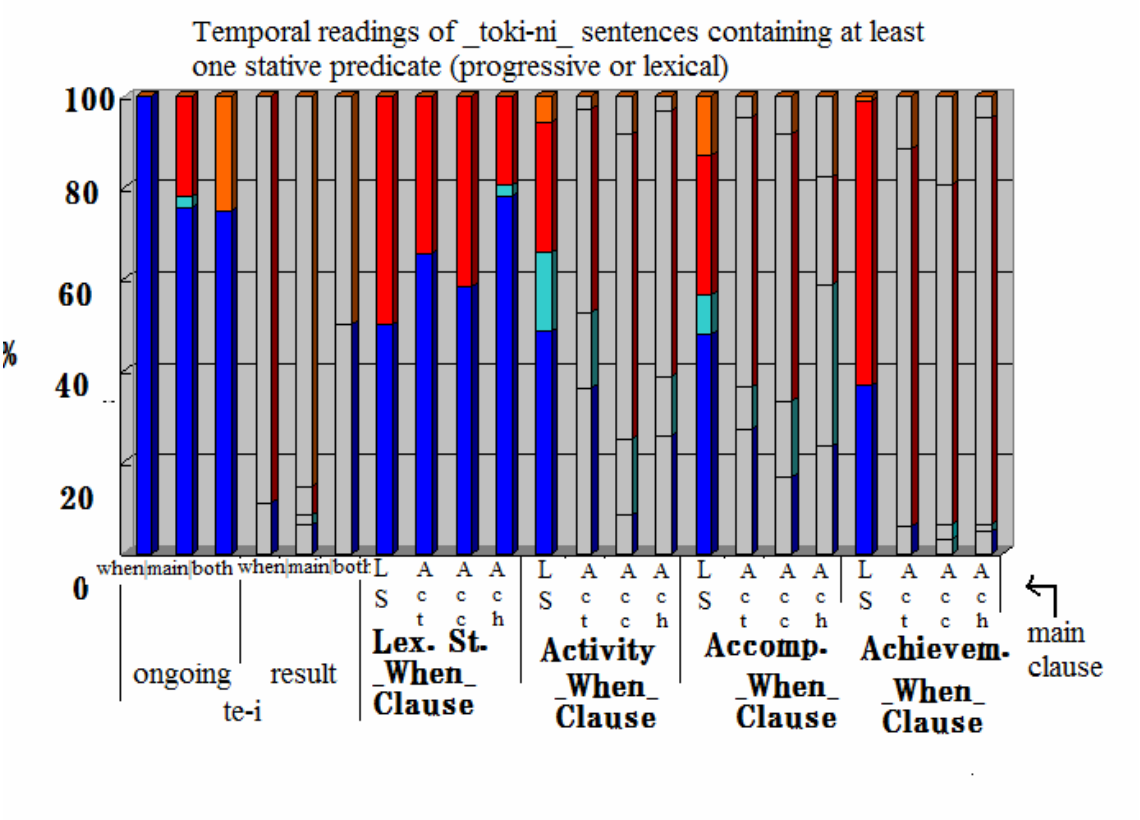


Figure 6.1 Distribution of Temporal Meanings with *Toki-ni* Sentences Containing at least One Stative Predicate

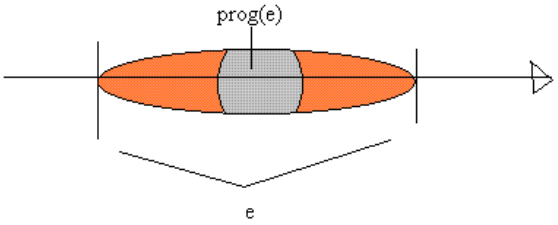
Examples containing a progressive stative occupy the leftmost three bars. Those containing a lexical stative are the other colored bars. Given the observation of constructed examples, the bars for the examples containing a lexical stative (7-11th, 15th and 19th bars from the left) would look more blue, representing the overlap reading, than a combination of blue and red, which suggests both of the two interpretations are available. If *-te-i* is interpreted as ongoing, the overlap reading arises. The alternative interpretation for *-te-i-*, resultative-state, yields two different interpretations according to the position of *-te-i*. In particular, if *-te-i-* is in the *toki-ni* clause, the sentence will have the forward sequence

reading, whereas a *-te-i-* in the main clause results in the backward sequence reading. The data in Corpus J are on par with these arguments.

5.4.2 Observation (2): Polysemous *Te-i*, and Three Readings of *Toki-ni*

As Shirai (2000) addresses, Japanese progressive infix *-te-i-* is two-way ambiguous--ongoing and resultative state--distributed depending on the situation aspect type of the *when* clause.(6.2.2) This polysemy makes interesting predictions on temporal meanings of *toki-ni* sentences. The ongoing interpretation, arising with non-Achievement/Semelfactive *when* clauses, is expected to yield the overlap reading, if embedded in a *toki-ni* sentence. The reason is that the ongoing interpretation corresponds to the progressive in English, pictorially presented in (172).

(172)



This temporal positioning of eventualities entails the overlap reading in the present system, as discussed in Chapter 4. An example from Corpus J is (173).

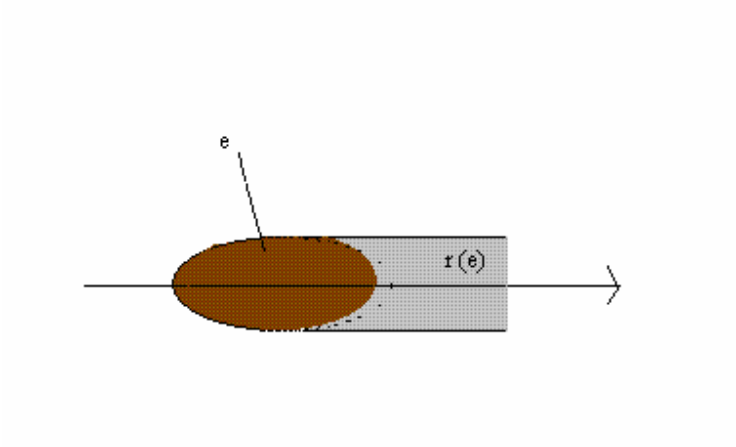
(173)

Ne-te-i-ta	toki-ni	osow-are-ta	(588)
sleep-TE-I-past	time-at	assault-pass-past	

"When I was sleeping, I was assaulted"

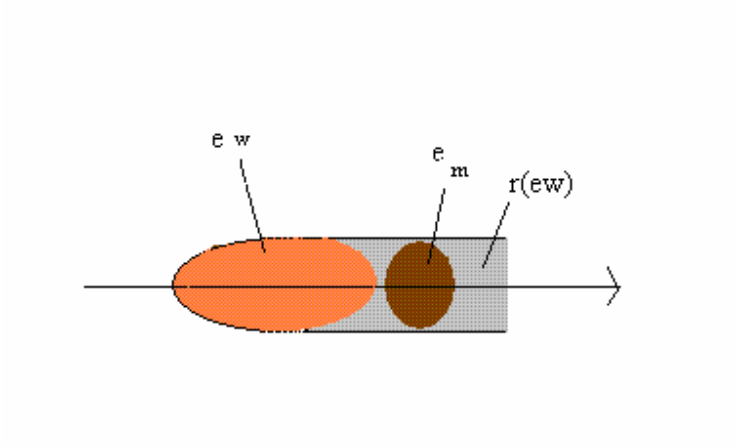
The resultative state interpretation in the *toki-ni* clause is expected to yield the forward sequence reading. To see why, let us consider a defining property of the resultative state: it is a state realized by and ensuing from a certain event. (173) gives a visual presentation of the relevant event structure.

(173)



The *toki-ni* clause, after the *-te-i-* is applied, denotes the state portion (grayed) in (173). By the currently assumed system of *when* demonstrated in Chapters 4 and 5, the main clause eventuality sits somewhere in the grayed area, unless other factors forces it out of the area. This is illustrated in (174).

(174)

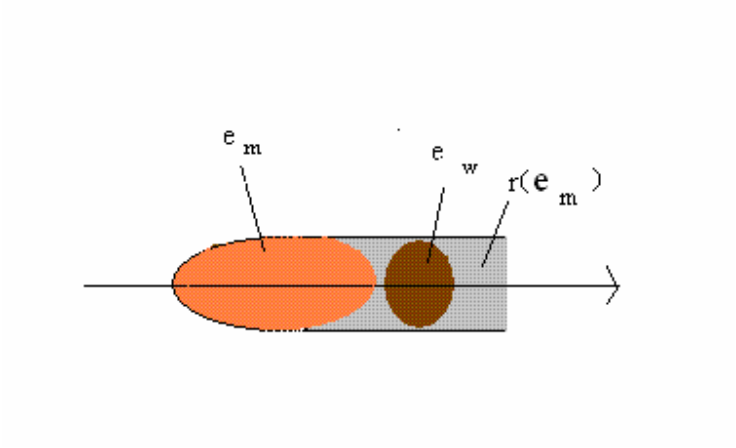


Then, what happens if the main clause bears *-te-i-*? An example is (), obtained by minimally changing (173).

(175) Ne-ta toki-ni osow-are-te-i-ta.
sleep-past time-at assault-pass-TE-I-past

One prediction is that backward sequence arises because the situation can be described by (174) with e_m and e_w reversed, as depicted in (176).

(176)



Note that e_m sits preceding e_w, in order for its result state to be placed as proximate as possible to e_w. In the above example (175) the relevant interpretation is one in which I fell asleep while being assaulted.

These expectations, which depend a lot on the present semantic system of *when*, are supported well in a quantitative analysis of Corpus J. Let us consider Figure 6.2.

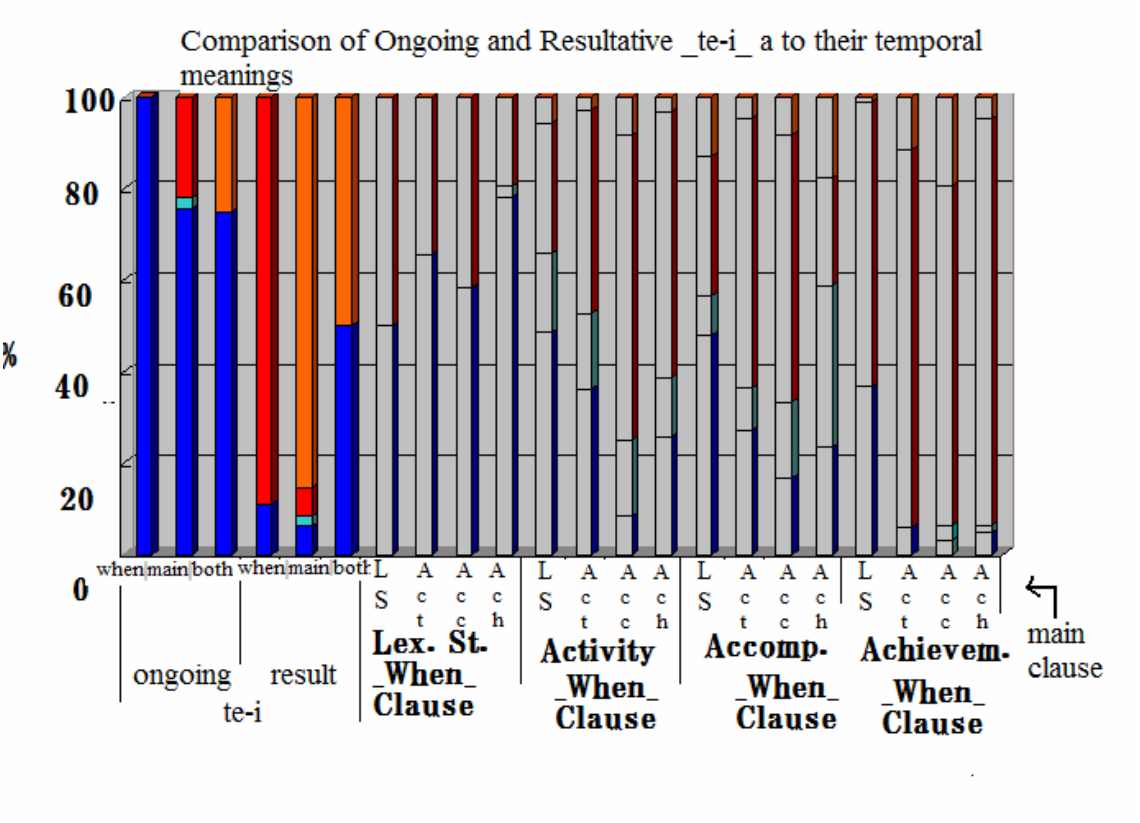


Figure 5.2 Comparing Progressive and Resultative *Te-i*'s as to Their Temporal Meanings

The leftmost three bars are the result of counting *toki-ni* sentences containing the progressive infix with the ongoing interpretation. The fourth and fifth bars represent those with the resultative state interpretation, with the infix in the *when* and main clauses respectively. The overwhelming interpretations shown in these categories are compatible with the above-discussed predictions: 'ongoing' examples are most frequently associated with the overlap reading (blue), examples with a resultative-state *when* clause predominantly yield the forward sequence reading (red) and examples containing a resultative state main clause most often give rise to the backward sequence reading (orange).

In this subsection, I have discussed a unique semantic phenomenon pertaining to Japanese polysemous infix *-te-i-* in relation to *when/toki-ni*, which is the central topic of

the dissertation. I have also shown that corpus data are familiar with theoretical predictions following from the system I presented in Chapter 4. The fact presented here will be used in developing the system for Japanese later in this chapter.

5.4.3 Observation (3): Tense Disharmony and Biased Meaning Distributions

The third observation solely focuses on a morphological variation pertaining to Japanese but not to English. Based on observations concerning four tensal patterns in Japanese complex sentences in general including *toki-ni* sentences, I point out that distribution of temporal meanings is asymmetric among the tensal patterns. Observations to be laid out in this subsection suggest that strengthening processes may be syntactically-motivated, not only semantics/pragmatics driven, as in English

In Japanese, restrictions on embedded clauses are looser than in English in that their tense marking is not dependent on that of the matrix clause. The relevant contrast is shown in (177) through (178).

(177) a. Ruuku-to Reia-hime-wa umare-**ta** toki-ni hanarebanare-ni na-**ru**.
"Luke and Princess Leia will become separated when they get born."

b. Ruuku-to Reia-hime-wa umare-**ru** toki-ni hanarebanare-ni nat-**ta**.
"Luke and Princess Leia would become separated when they were born."

(178) a. *Luke and Princess Leia waere separated when they are born
b. *Luke and Princess Leia are separated when they were born

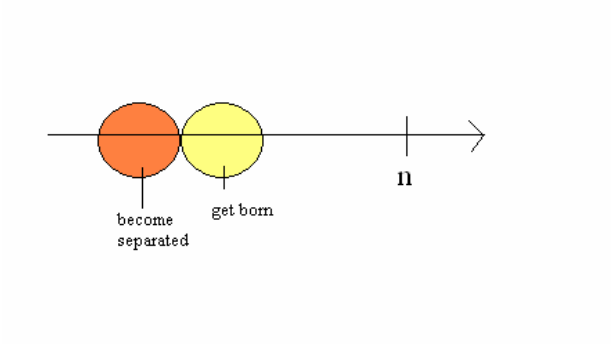
I will call the syntactic options in Japanese where the matrix and embedded clauses do not have a matching tense as Tense Disharmony. [48]

---

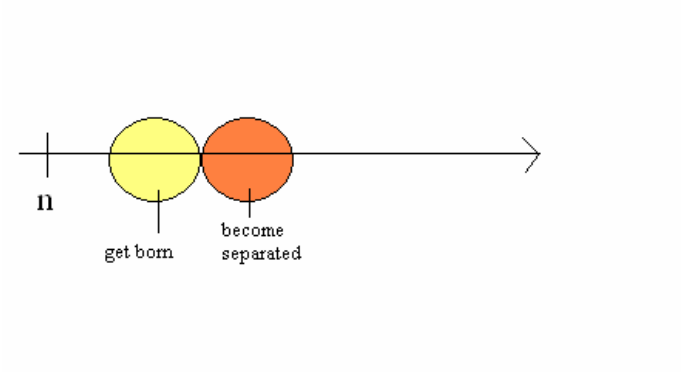
[48] I attribute this name to Carlota Smith (p.c.); Ogihara (1998) and Kusumoto (1999) also discuss this phenomenon in relation to Sequence of Tense (SOT). The term SOT itself refers to the tense-matching constraint in complex clauses.

Turning to semantic aspects of the disharmonic tense patterns, it should be noted that the embedded tense marking is interpreted dependent on the matrix clause event time, rather than on speech time. Hence, the only possible interpretation of (177)a. is that the embedded clause event ('are born') is a past event only relative to the matrix event ('are separated'). Since the matrix clause bears the nonpast tense, the embedded clause is also interpreted as nonpast. (179) through (180) gives pictorial representation of the event order entailed for (177)a, together with that for (177)b, which corresponds to (180).

(179)



(180)



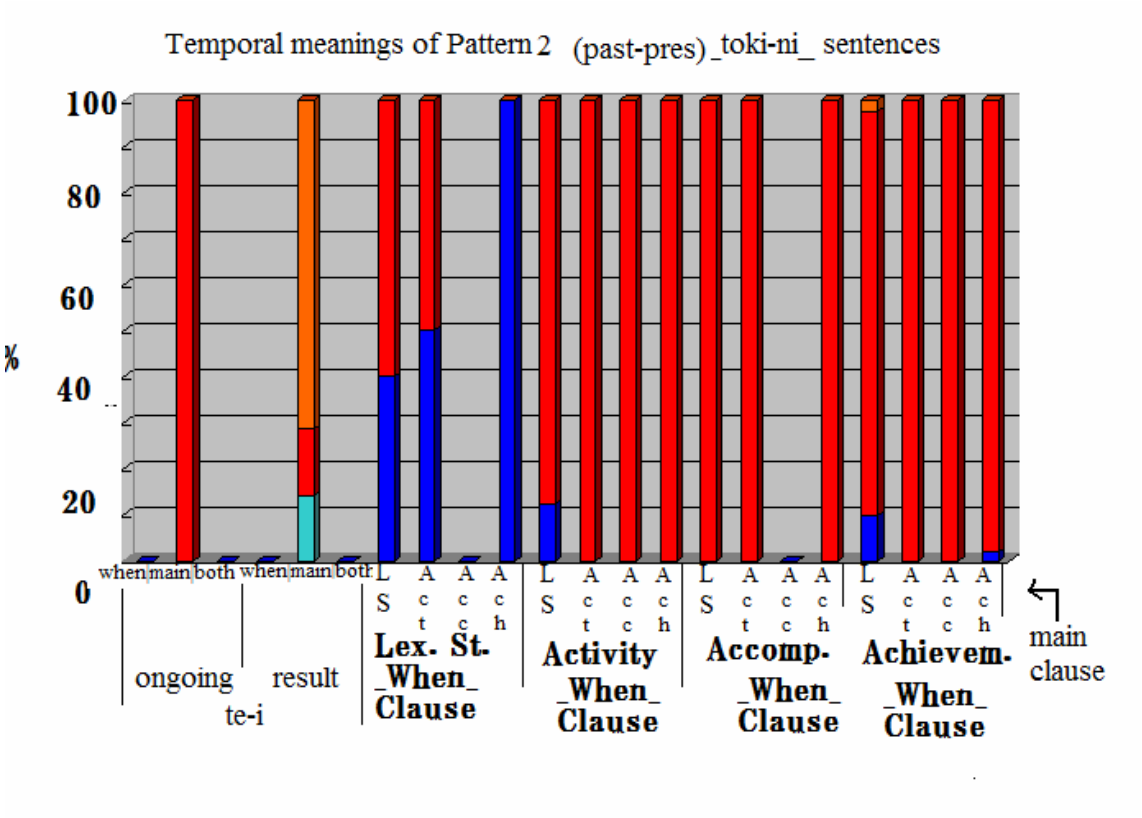
Assuming the same basic system is shared by English and Japanese, the main and toki-ni clause eventualities must be close to each other (The Proximity Constraint 4.3.1). Thus, if the main clause event precedes speech time as in (179), the toki-ni clause can also be assumed to precede speech time.

Japanese complex sentences are classified into four patterns tabulated in (181), affected by the various tense options. The patterns are numbered, to facilitate reference in the following discussions.

(181) Four Tense Patterns of the *Toki-ni* Sentences

Toki-ni Clause → ↓ Matrix Clause	*ta* (Past)	*ru* (Nonpast)
ta (Past)	**1**[[e_w-ta] toki-ni e_m-ta]	**2**[[e_w-ru] toki-ni e_m-ta]
ru (Nonpast)	**3**[[e_w-ta] toki-ni e_m-ru]	**4**[[e_w-ru] toki-ni e_m-ru]

I would like to pay special attention to the disharmonic patterns, viz. 2 and 3. These patterns show biased temporal meanings, expressed in Figure 6.3.



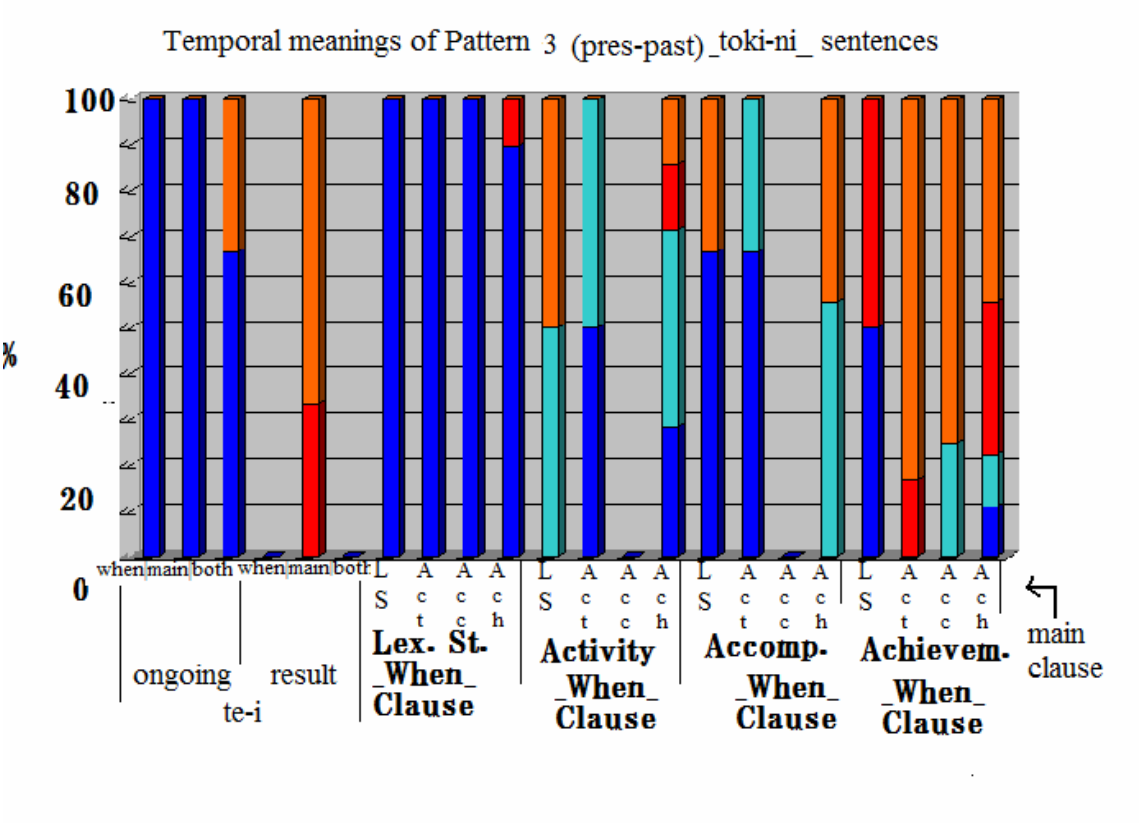


Figure 5.3 Comparing Patterns 2 and 3 in Terms of Temporal Meaning Distribution (continued from previous page)

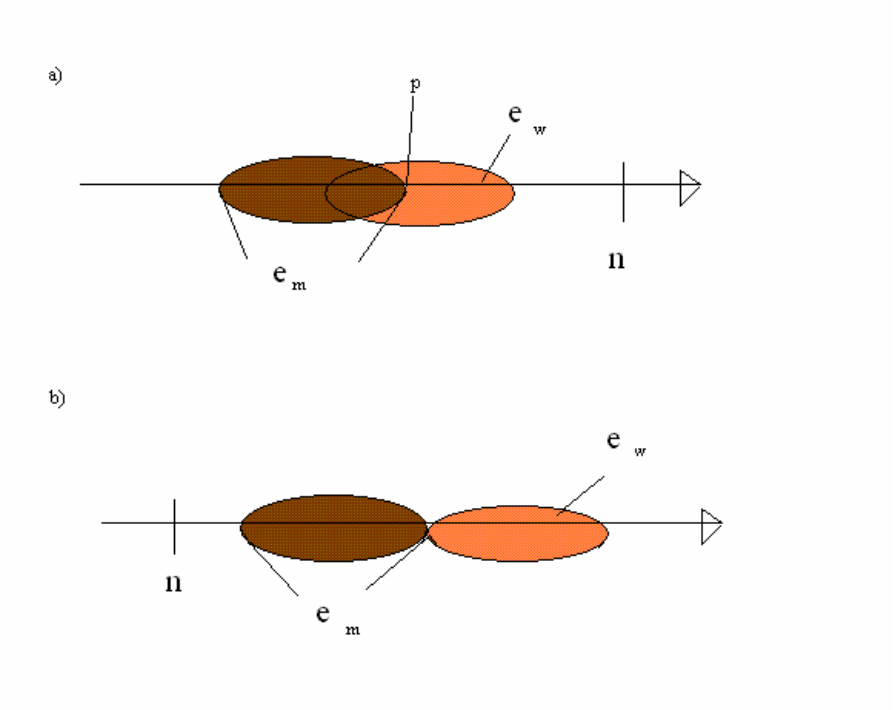
Pattern 2, past-nonpast, is shown on the left. The colors of the bars are predominantly red, indicating that forward sequence is the most preferred in this pattern. Pattern 3, by contrast, is mostly occupied by blue (overlap) and orange (backward sequence) colors, signifying the respective readings which are parenthesized.

This new finding, i.e., the biased distributions depending on tensal patterns, does not really come as surprises given the present assumptions and temporal implications associated with Tense Disharmony. Let us first look at a corpus example of Pattern 3, given in (182) and pictorial descriptions of the possible readings in (183).

(182) Gekijoo-ga torikowas-are-ru toki, jimoto-no hitotati-de shasin-o totta. (89)
Theater-NOM demolish-pass-nonpast time-at neighbor-GEN people-by picture-ACC take-past

"When the theater was to be demolished, some neighborhood residents took its pictures."

(183)



The current assumption on the embedded -ru is that they denote imperfectivity of the host eventuality at the matrix event time. In this case, it amounts to saying that at the time of picture taking, the demolition has begun but not finished (((183) a.) or has not begun at all ((183) b.)). These schema correspond to the overlap and backward readings. Pattern 2 actually contains more overlap and backward sequence examples compared to forward sequence, compatible with the theoretical prediction. By the same token, the fact that the chart for Pattern 3 are mostly in red, the color for forward sequence, is consistent with a Pattern 3, being the reverse of Pattern 2.

The observations from Japanese corpus examples that have been discussed in this subsection show a potential difference between English and Japanese systems: that strengthening processes can be driven by syntax in Japanese but much less so in English, where strengthening factors are mostly rooted in semantics. The finding is notable in

suggesting a natural direction in developing an analysis of *toki-ni* sentences where syntax plays a role in choosing temporal meanings.

5.4.4 Observation (4): Particle Drop and Biased Temporal Meanings

The last issue I want to raise completes the observations pertaining to Corpus J. The phenomenon lies in morphology/syntax area and concerns unconditioned optionality of the postposition *-ni* in *toki-ni*, the temporal adverbial itself. The observation I am giving in this subsection is the subtlest of the four issues in Japanese that I focus on: the contrast I am discussing only comes up when the two options are compared in terms of counting frequencies of actual examples.

The two options in question are given in (184).

(184) a. *Toki-ni* when (lit. at (the) time)
b. *Toki* when (lit. (the) time)

The alternation is a free variation, i.e., not conditioned by any grammatical factor. This point is shown in (185) through (187).

(185) a. Kyuujitsu-o jitaku-de sugositeita toki-ni denwa-ga natta. (1339)
b. ----- ------ -∅ -----
"When (he) was taking his day off at home, the phone rang."

(186) a. Mago-ga umareta toki-ni mago-no namae-o kaita tako-o tukutta (1221)
b. -∅
"When my grandchild was born, I made a kite with his/her name on it."

(187) a. Suasi-de aruita toki-ni rooka-ga kisimu.
b. -∅
"When you walk barefooted, the hallway squeaks."

However, the fact that they are not in a complementary distribution does not mean that the two options are equivalent, semantically and pragmatically. Figure 6.4 is the result of counting temporal meanings for Corpus J examples sorted by presence or absence of the particle *-ni*.

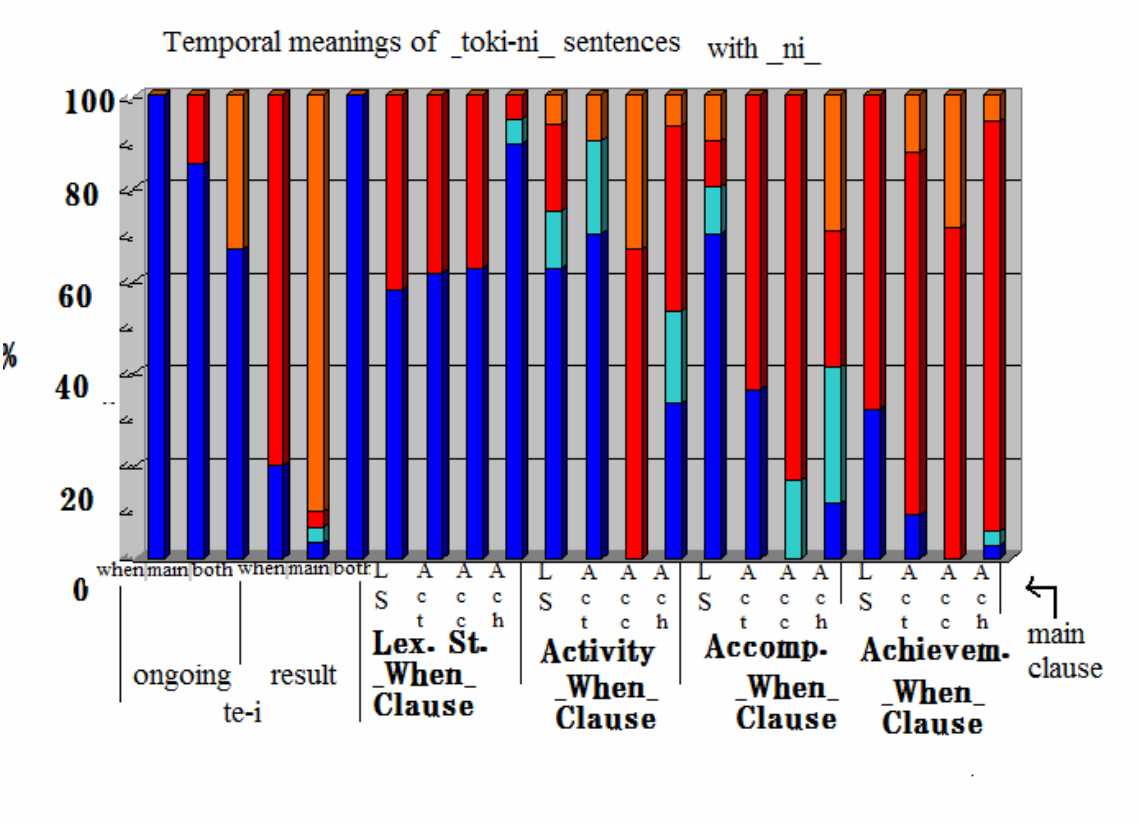


Figure 5.4 Distribution of Temporal Meaning of *Toki-ni* Sentences with the Postposition –*Ni*, which indicates location

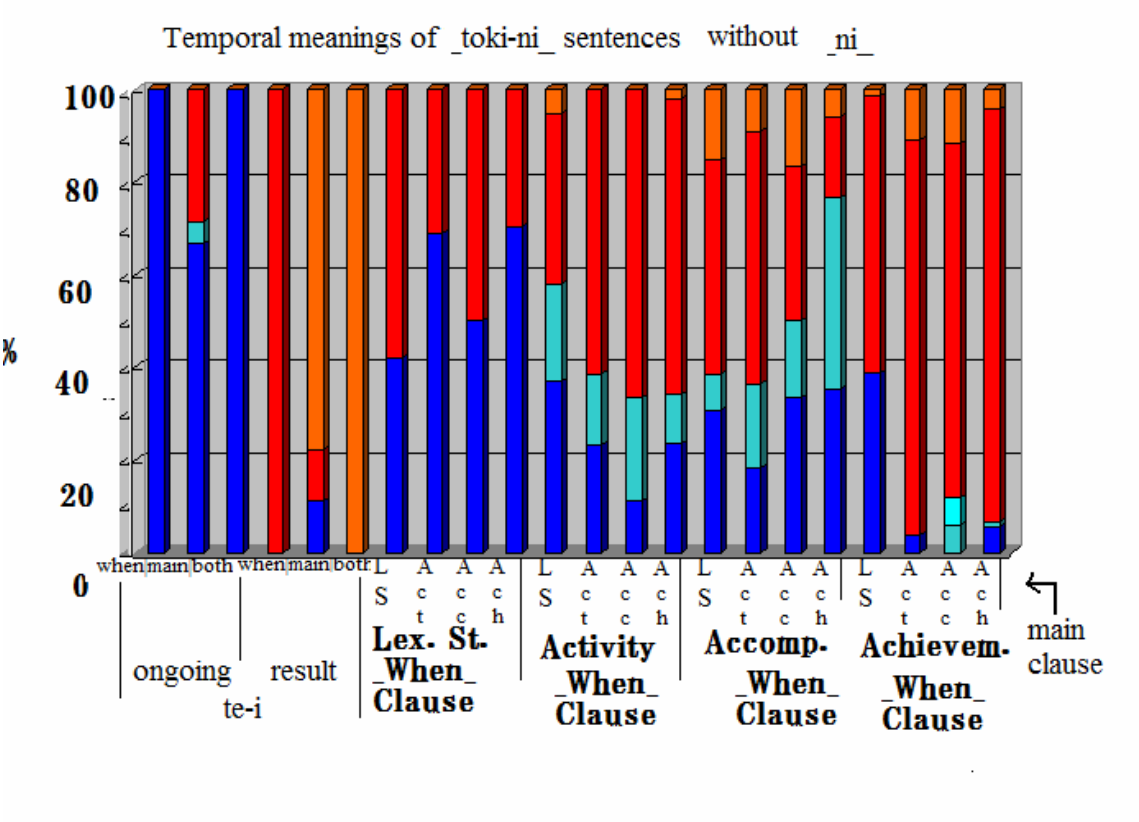


Figure 5.5 Distribution of Temporal Meaning of *Toki-ni* Sentences with the Postposition –*Ni*, which indicates location

The chart on the left represents how temporal meanings are distributed in *when* sentences WITH the postposition, while the one on the right displays the result of those WITHOUT the postposition. Although the difference is not very salient, a tendency can be observed that the *-ni* option prefers the overlap reading, and the -∅ option, the forward sequence reading.

A possible reason for this asymmetry lies in the nature of the postposition *-ni*. *-Ni* is a multi-purpose particle, being used as the Dative case marker, a locative or a goal marker. (188) through (190) illustrate some examples.

As Dative case marker:

(188) Sensee-ga seeto-ni seesekihyoo-o ageta.
teacher-NOM student-DAT grade_report-ACC give-past
"The teacher gave the student his/her grade report"

As Locative marker

(189) Tokyo-ni i-ru.
Tokyo-LOC exist-nonpast
"(I am) in Tokyo"

Marking a goal[49]

(190) Tokyo-ni it-ta.
-to go-past
"(I) went to Tokyo"

Assuming that the optional *-ni* in question falls in one of these types, the most plausible candidate is the locative. The reasoning uses the strategy of elimination, viz., getting rid of unavailable options. First, it is not the Dative case marker, because the clause it attaches to is not an argument, as Dative marked phrases usually are. The fact that (191) is grammatical without the *toki-ni* clause shows this point.

(191) a. Ruuku-to Reia-hime-wa hanarebanare-ni nat-**ta**.
Luke-and Leia-princess-TOP separate-DAT become-past
"Luke and Princess Leia were separated when they were born."

---

[49] I have marked the c. as marginal. The reason is that there is another particle -e which is only used to mark a goal and is prescriptively considered as a standard way to indicate the meaning.

i) Tokyo-e it-ta
-to go-past
"(I) went to Tokyo."

Next, a goal marker is not the right type, either. Goal markers are only compatible with directional predicates, as can be seen in (192).

(192) *kyoositu-ni* (to the classroom)--
it-ta (went), *ki-ta* (came) , **suwar-ta* (sat), **aruk-ta* (walked)

The postposition in *toki-ni* can go with all of these predicates, as illustrated in (193). In fact, *toki-ni* does not seem to have any selectional restrictions as to the main clause predicate type.

(193) *yob-ta toki-ni* (when called,)--
it-ta (went), *ki-ta* (came), *suwar-ta* (sat), *aruk-ta* (walked)

The only possibility that is left, the locative, actually has features favorable to the corpus result in 6.4.

Locative expressions are known to go with Stative sentences than non-Stative ones. By combining our current conjecture that the optional postposition in *toki-ni* is a locative marker and the known familiarity of locative expressions with Stative predicates, the corpus result in Fig. 6.4 falls out naturally with one additional assumption: Statives generally prefer the overlap reading, and so do Locative markers including the optional postposition in *toki-ni*. If we suppose, either grammatically or cognitively, the presence of a locative marker is a positive factor in choosing the overlap reading over the sequential reading, then we can conclude that the asymmetric result in Figure 6.4 comes from the locativity of the postposition. [50]

---

[50] Of the issues I have addressed, the discussion in this subsection has been most benefited from the data-driven strategy I have taken in this dissertation: by studying only constructed examples, I would not have been able to present the preceding argument. By raising an issue about a subtle contrast only coming up when actual examples are counted for frequency, the topic of this dissertation was seen from a wide and practical perspective.

5.5 An Analysis for *Toki-ni*

In this section I spell out my proposal of *toki-ni* sentences. My approach is inspired by the observation that temporal meanings of *toki-ni* sentences are more affected by surface level factors such as syntax and morphology, compared to English *when* sentences, where non-surface level phenomena mainly had effects on temporal meanings.

5.5.1 *Toki-ni* in a Nutshell

5.5.1.1 The Semantics of *Toki-ni*

Based on the above observations, I propose a semantic description for Japanese *toki-ni as follows*.

(194) Toki-ni: the *toki-ni* clause eventuality is determined its temporal location depending on that of the main clause. Specifically, e_w is placed maximally close to e_m, unless other constraints are not violated.

5.5.1.2 The Proximity Constraint

As far as observations on Corpus J are concerned, the Proximity Constraint seems to need little modification: the ongoing reading of *-te-i-* requires the constraint. The other phenomena do not directly call for, but are compatible with, the constraint. As discussed above, the Japanese phenomena I have focused on present no evidence against the Proximity Constraint. By invoking Occam's razor, therefore, I assume that the constraint is at work in Japanese as well as in English.

5.5.2 Specific Cases

5.5.2.1 Two Statives

My explanation of the first observation, which involves progressive and Lexical statives is similar to that of English *when*, save that the resultative reading of the progressive infix *-te-i-* is a little different from English *-ing*, as independently discussed in 6.5.2.2. In one interpretation of *-te-i-,* the infix is semantically analogous to *-ing*. In this particular interpretation, *te-i-* behaves just as the English progressive.

5.5.2.2 The Resultative State Reading of *Te-i*

In the other interpretation of *-te-i-*, which attaches to Achievements and give rise to te resultative-state reading, the expected interpretation is a sequence reading, either forward sequence or backeard sequence depending on the position of *-te-i-* in the sentence. If the main clause contains *-te-i-*, the *-te-i-* eventuality denotes a resultative state the main clause eventuality. This amounts to saying that the eventuality itself is placed earlier on the timeline, because the cause and an ensuing result state must be ordered, with the former preceding the latter.

5.5.2.3 Tense Disharmony

The third observation concerns two different associations of a morphological pattern with a temporal reading. Pattern 2, where the *toki-ni* clause bears *-ru* (nonpast) and the main clause *-ta* (past), strongly prefers the backward sequence reading. Pattern 3 involves the reversed morphological forms, namely the *-ta* marked *toki-ni* clause and the *-ru* marked main clause, leading to forward sequence reading. In my system, these particular patterns are grammatical correlates of the described temporal readings.

5.5.2.4 Optional Locative Particle

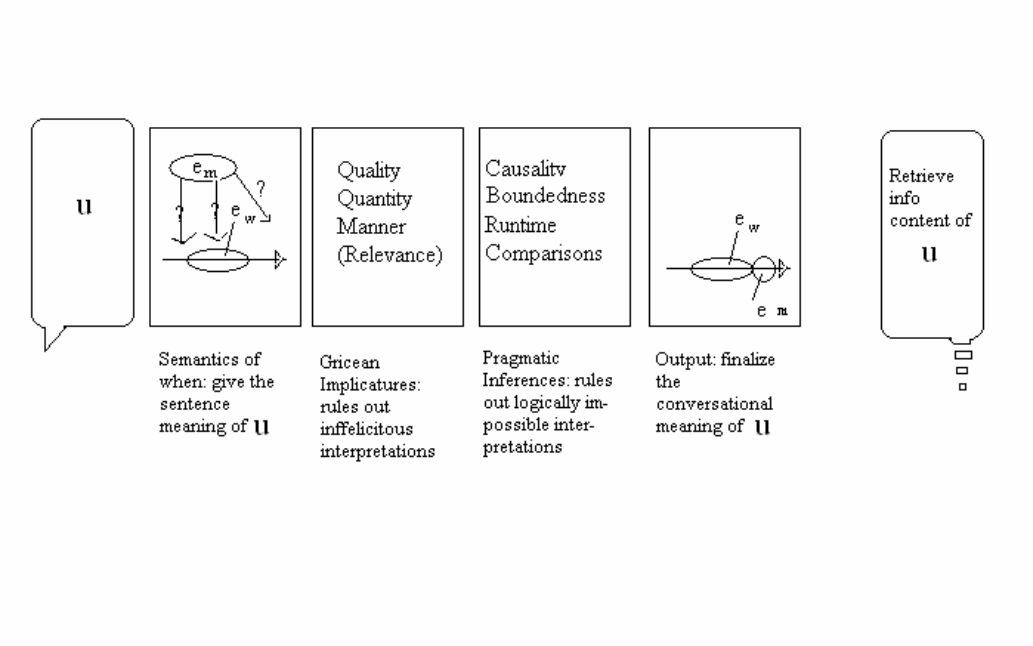
The last observation receives the essentially same account as Tense Disharmony. The reason is that the phenomenon regarding the optional locative particle *-ni* draws motivation from association of a grammatical form and a certain meaning, analogous to the picture I have drawn for Tense Disharmony.

5.6 Formal Descriptions and Demonstrations

5.6.1 System Description

In chapter 4, I have developed a system that accounts for the temporal semantic behavior of *when* sentences. Under this system, the clause presented first in the sentence defines the approximate temporal location of the clause following it. Gricean maxims of conversation, as well as semantics/pragmatic inferences then contribute to fix the finalized temporal meaning. The overall flow, repeated below as (195), describes the processes.

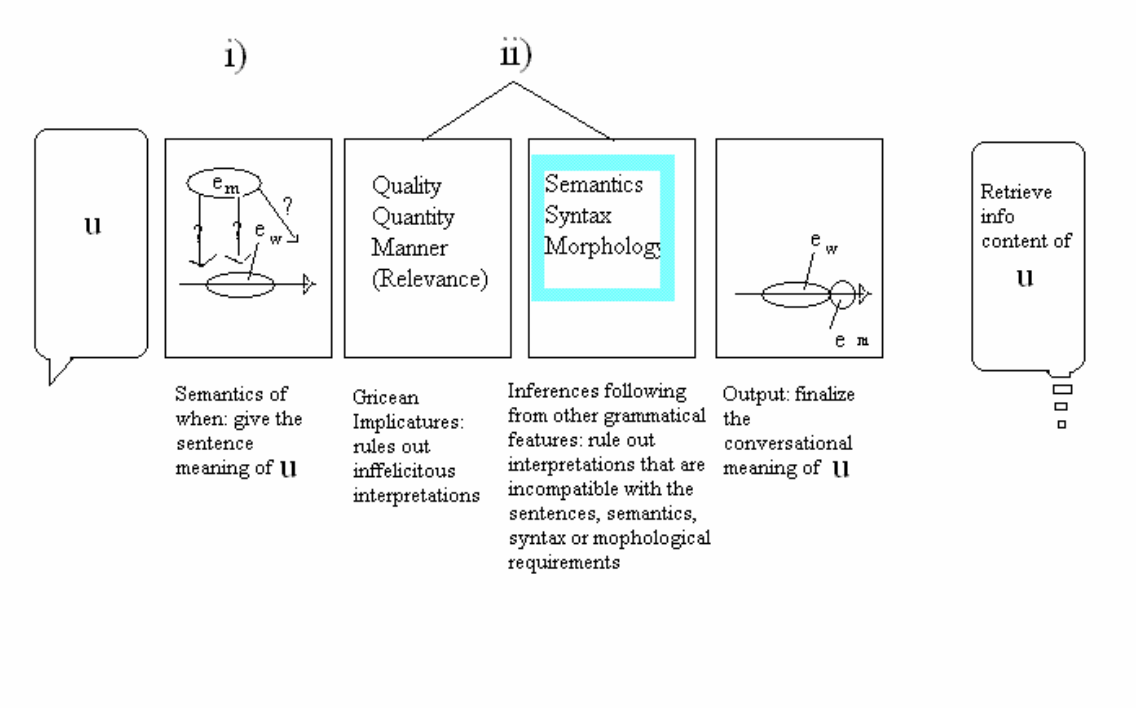
(195)



I assume, in this and next chapters, that roughly the same conceptual architecture holds true for a language other than English. The two systems are distinct in several technical

parts, to be discussed below. Below, I elaborate the Japanese system using data from Corpus J. It involves more grammatically-triggered strengthening processes than its English counterpart, where semantic and pragmatic information play a central role in strengthening processes. (196) is the system image for Japanese.

(196)



5.6.2 What *Toki-ni* does

The basic building blocks of CR.*toki-ni* are the same as English CR.*when*.

(197) Introduce to U_k: e_w e_m, t, t′, e_1, e_2

(198) Introduce to Con_k:

a. e_w ® e_m, where ® ∈ R = {o, <,>}

b. *choice of ® to be strengthened by various *grammatical* factors as separately specified

c. Proximity Constraint: e_w and e_m are close to each other as possible, insofar as other constraints are not violated.

5.6.3 What *Toki-ni* does not do: Strengthening Factors

Compared to English, where most salient strengthening processes concern pragmatics, strengthening factors in Japanese are more connected to low-level grammatical information, such as tense marking and presence/absence of postpositions. A caveat though is that by saying this I am not going to argue against pragmatics being relevant in the strengthening process in Japanese.

5.6.4 Specific Cases

5.6.4.1 Two Statives in Japanese

Case (1) **Phenomenon**: Progressive and Lexical Statives do not show a strong contrast of meaning distribution, unlike English. **Mechanism**: Strengthening Description: IF the when sentence contains a stative (Progressive or Lexical), THEN ® = o.

5.6.4.2 The Resultative-State Reading of –*Te-i*

The backward sequence reading associated with the resultative interpretation of -*te-i*- is a straightforward reflection of lexical semantic information to a temporal reading. The phenomenon is incorporated into the semantic description as follows.

Case (2): **Phenomenon**: Achievement Main clause in -*te-i*- form gives rise to the backward sequence reading. **Mechanism**: The *te-i*- form attached to an Achievement clause denotes a resultative state of the Achievement eventuality. By Proximity Constraint, the *toki-ni* clause is placed as close to the resultative state, which comes after the Achievement eventuality itself. Collectively, it is entailed that the *toki-ni* clause eventuality temporally follows the main clause eventuality. **Strengthening Description**:

IF the main clause contains an Achievement AND the main clause verb form is *-te-i-*, THEN ® = >.

5.6.4.3 Tense Disharmony

Strengthening Based on Tense Disharmony is deeply concerned with the viewpoint aspectual meanings of postverbal suffixes *-ru* and *-ta*. I have assumed that *-ru* embedded in a complex sentence denotes imperfectivity at the time of the main clause event, and *-ta* perfectivity under the same conditions. Using this assumption, the biased interpretations of Patterns 2 (the *toki-ni* clause is *-ru* and the main clause is *-ta*) and Pattern 3 (the *toki-ni* clause is *-ta* and the main clause is *-ru*) fall naturally, as described below.

Case (3): **Phenomenon**: Pattern 2 is likely to be interpreted as forward sequence; Pattern 3 is likely to be interpreted as backward sequence. **Mechanism**: Embedded *-ru/-ta* marking indicates anteriority or posteriority, respectively, of the embedded clause eventuality relative to the main clause eventuality. Given that, Pattern 2 involves the embedded (*toki-ni*) clause occurring anterior to the main clause. In the current terms, this is a situation familiar to the forward sequence reading. Pattern 3 is the reverse of Pattern 2, with which the backward sequence reading is inferred. **Strengthening Description**: IF tense of the main clause is past AND the tense of the *toki-ni* clause is nonpast, THEN ® = <; IF tense of the main clause is past AND the tense of the *toki-ni* clause is nonpast, THEN ® = >.

5.6.4.4 Particle Drop

Biased interpretations driven by the –ni/∅ alternation, under the present proposal, comes from inferences regarding the particle's familiarity with stativity and associating lack of Narrative Progression. Case (4): **Phenomenon**: *Toki-ni* sentences with *-ni* are likely to be interpreted as overlap than those without the particle are. **Mechanism**: The particle *-ni*, used predominantly in stative, locative and existential sentences, lets the hearer infer that the discourse containing it is also one of the above-stated sentential

categories. None of these categories associates Narrative Progression, the hearer's inference extends to concluding that the *toki-ni* sentence she is interpreting also lack it, and therefore having the overlap reading. The reverse inference process is at work in sentences WITH the particle. **Strengthening Description**: IF the sentence contains the locative particle *–ni*, THEN DEFEASIBLY ® = o; IF the sentence does not contains the locative particle *–ni*, THEN DEFEASIBLY ® = <

5.7 Construction Rule

(next page)

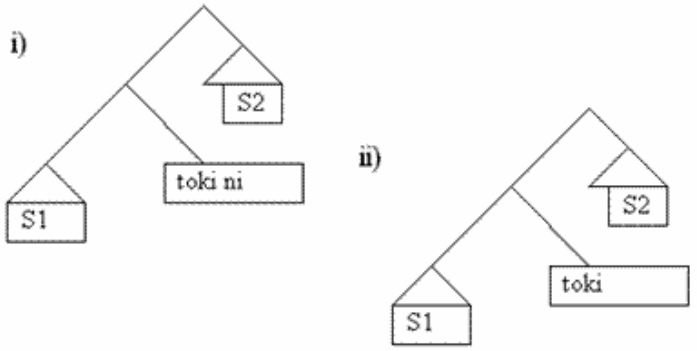
CR.Toki-ni	
Triggering Configurations	
Introduce to U,	e_w, e_m, n, t, t , e_1 , e_2
Introduce to Con	IF tense (S_1) = past THEN t′ < t ELSE t′ > t; IF tense (S_2) = past THEN t < n IF e_m is a nonstative event, THEN $e_m \subset t$ ELSE $e_m \supset t$; IF e_w is a nonstative event, THEN $e_m \subset t'$ ELSE $e_m \supset t'$; e_w ® e_m, where ® ∈ **R** = {o, <, >}; IF S_0 contains a state (lexical or progressive) THEN ® = o (deals with case (1)) IF S_2 is Achievement AND *-te-i-*, THEN ® = > (deals with case (2)) IF tense (S_1) = past AND tense (S_2) = nonpast, THEN ® = <; IF tense (S_1) = nonpast AND tense (S_2) = past, THEN ® = <; (deal with case (3)) IF i) , THEN DEFEASIBLY ® = o; IF ii) , THEN DEFEASIBLY ® = <. (deal with case (4))
	ew = e_1, where e_1 is the eventuality introduced immediately before *toki-ni*
	em = e_2, where e_2 is the eventuality introduced immediately after e_1

Table 5.2 <CR. *Toki(-ni)*>
(previous page)

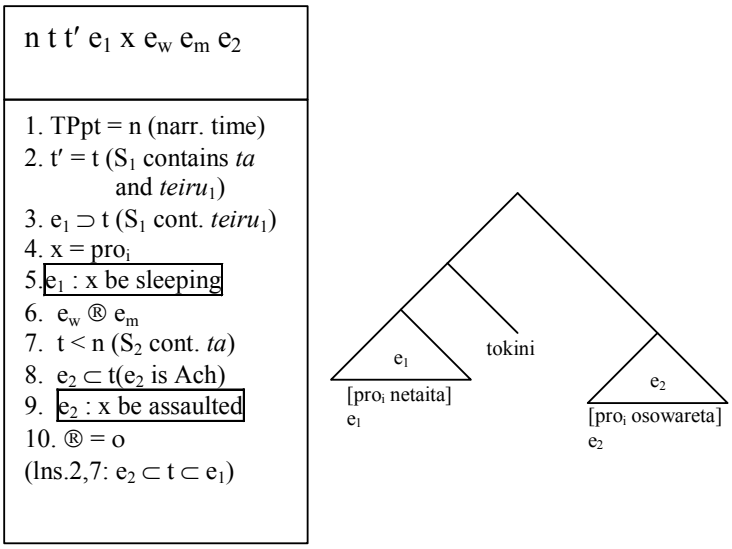
5.8 Demonstrations

I give demonstrations for the points made in this and the previous chapters. I address four Corpus J excerpts, applying CR.*toki-ni* to them to yield DRSs that depict the intended reading. The fragments to be discussed are chosen to illustrate my analysis on i) polysemy of -*te-i*- (excerpts 1 and 2), ii) Strengthening based on Disharmonic Tenses (excerpts 3 and 4) and iii) Particle Drop (excerpts 5 and 6).

Excerpt #1

(199) Ne-te-i-ta toki-ni osow-are-ta (588)
sleep-TE-I-past time-at assault-pass-past
"When I was sleeping, I was assaulted"

This excerpt contains *te-i*$_1$, which gives rise to the ongoing reading. The first DRS describes what is happening at the point e1 has been introduced. As the discourse proceeds, the second DRS captures the interpretation of the whole sentence. At line 10., the final interpretation is determined by picking the overlap relation as the temporal relation between e_m and e_w. This conclusion is inferred from lines 3. and 7.: the *toki-ni* clause eventuality includes the embedded event time t', which is equal to the matrix time t, which in turn includes the main clause eventuality. In other words, the *toki-ni* and main clause eventualities surround the same event time.

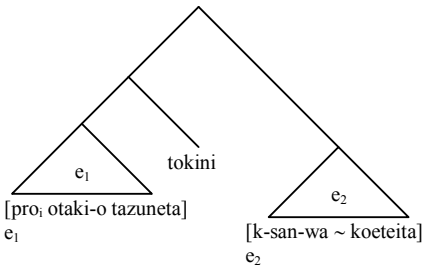


Excerpt #2

(200) O-taku-o tazune-ta toki, K-san-wa 80-sai-o koe-te ita
hon-house-ACC visit-past time K-hon-TOP 80-years_of_age exceed-TE-I-past
"When I visited his house, Mr. K was over 80 years Old"

This excerpt shares the basic structure with excerpt 1. The *te-i* form contained in the sentence receives the resultative state interpretation, which affects the final interpretation. From line 10., it is inferred that the main clause eventuality sits at the initial point of t, which overlaps t'. t' in turn includes the *toki-ni* clause eventuality, which is an activity (line 3.). By common sense reasoning concerning linear order, the initial point of an interval precedes all other points of that interval (line 14.) The *toki-ni* clause eventuality is included in some of those 'other points of that interval,' so it is preceded by the main clause eventuality, in other words, the temporal interpretation is backward sequence (line 16.).

$n\ t\ t'e_1\ x_y\ e_w\ e_m\ e_2\ z$
1. TPpt = n 2. t′ = t (disc. cont. *teiru*) 3. $e_1 \subset t'$ (e_1 is Act) 4. $x = pro_i$ 5. y = a house 6. e_1 : x visit y 7. $e_w = e_1$ 8. e_w ® e_m 9. t < n (e_2 cont. *ta*) 10. e_2 o ini(t) (s_2 cont. $teiru_2$) 11. z = Mr. K 12. e_2 : z exceeds 80 yrs old 13. $e_m = e_2$ 14. ini(t) < t (common sense) 15. e_2 o ini(t) < t = t′ ⊃ e_1 (lns. 2,3,10, 14) 16. ® = > (ln.15)

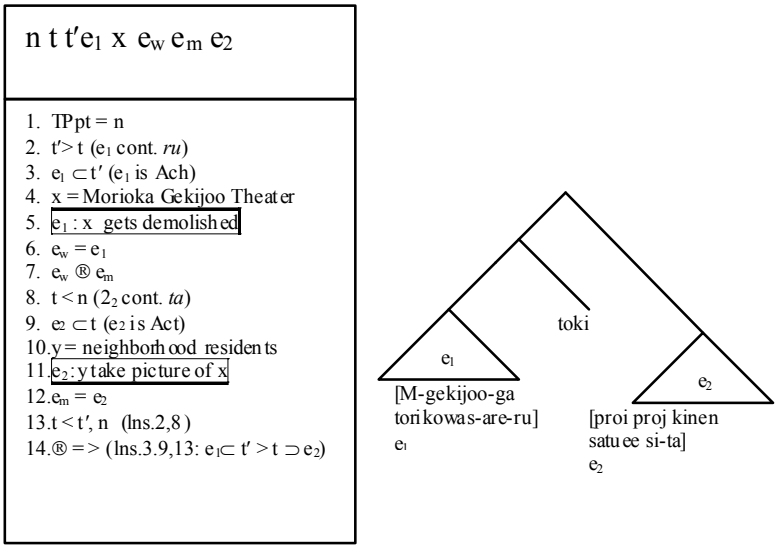


Excerpt #3

(201) Morioka Gekijoo-ga torikowas-are-ru toki, jimoto-no hitotati-de shasin-o totta. (89)
M.G. Theater-NOM demolish-pass-nonpast time-at neighbor-GEN people-by picture-ACC take-past

"When the Morioka Gekijoo Theater was to be demolished, some neighborhood residents took its pictures."

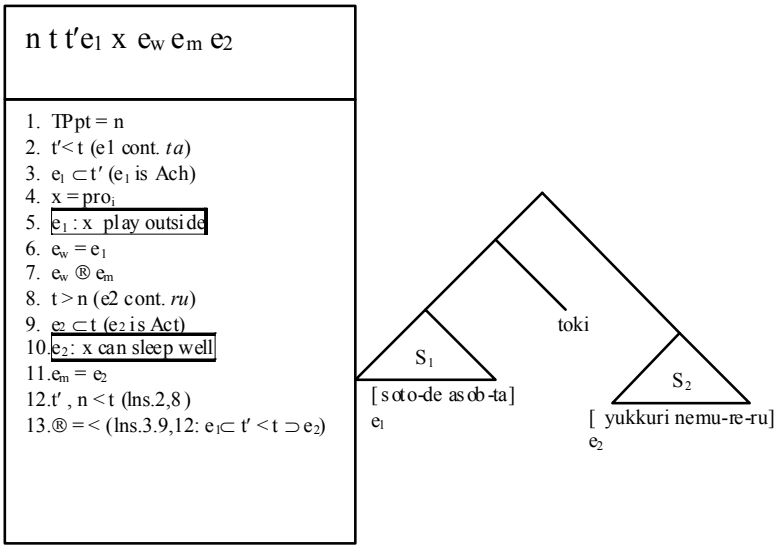
This excerpt involves Tense Disharmony, specifically Pattern 3, where the *toki-ni* clause is a nonpast and the main clause is a past. The *toki-ni* clause contains *-ru*, the nonpast. By the semantics of embedded tense particles, it is inferred that the *toki-ni* clause event time is placed posterior to the main clause event time (line 2.). This inference goes through the rest of the interpretation, yielding the temporal interpretation backward sequence in line 14.



Excerpt #4

(202) Soto-de asob-ta toki-wa yukkuri nemu-re-ru.(1068)
Outside-at play-past time-TOP well sleep-able-nonpast
"When one has played outside, one can sleep well."

This excerpt contains a Pattern 3 *toki-ni* sentence, the reverse of Pattern 2 just discussed. *Ta-* marked *toki-ni* clause entails that the eventuality described there is a past event relative to the main clause event time (line 2.). This is reflected in the final interpretation in line 13. As the main clause eventuality is a situation that has not yet occurred (line 8.), the *toki-ni* clause event is also interpreted as a future occurrence. This particular DRS, however, does not successfully describe the fact that the *toki-ni* clause eventuality is a future event. All it says is that the toki-ni clause event time and speech time both precedes the matrix event time (line 12.). This entailment follows from the Proximity Constraint. The *toki-ni* clause eventuality is placed as close to the main clause eventuality as possible. The overlap option is not available because there is a consequentiality entailment, which requires that the two eventualities are apart. The next available temporal location for the *toki-ni* clause eventuality is where it immediately precedes the main clause eventuality.

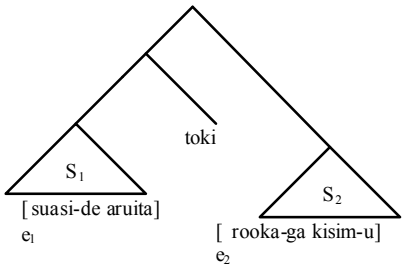


Excerpt 5

This excerpt involves the optional locative particle *–ni* associated strongly with the overlap reading and weakly with the forward sequence reading.

(186) a. Suasi-de aruita toki-ni rooka-ga kisimu.
b. -∅
"When you walk barefooted, the hallway squeaks."

n t t′e_1 x e_w e_m e_2
1. TPpt > n 2. t′> t (e1 cont. *ru*) 3. $e_1 \subset t'$ (e_1 is ACT) 4. x = pro_i 5. y = hallway 6. e_1 : x walk on y barefooted 7. $e_w = e_1$ 8. e_w ® e_m 9. t > n (e2 cont. *ru*) 10. $e_2 \subset t$ (e_2 is Semelfactive) 11. e_2: y squeak 12. $e_m = e_2$ 13. t′ , n < t (lns.2,8) 14. ® = < (lns.4.10,13: $e_1 \subset t' < t \supset e_2$) A. FWSEQ (a.) B. OLAP (b.)



5.9 Chapter Summary

Observations have suggested that forms and interpretations are strongly related in Japanese *toki-ni* sentences. This feature contrasts with English *when* sentences, where effects from the pragmatic domain are overwhelming. The contrast between the two languages, which is built upon similarly-designed systems, is suggestive of the following research thesis for future research: English and Japanese *when* sentences are given their default temporal interpretations on the bases of similar semantic systems. Differences between the temporal adverbials in these languages may be the degree to which pragmatic information come in to affect the temporal meaning of the sentence including the adverbials.

:

Chapter 6 :

Conclusion and Future Directions

6.1 Conclusion

My approach to the semantics of *when/toki(-ni)* sentences has concentrated on describing two aspects regarding their constructions, one along the paths laid by previous authors and the other I have started anew. The present analysis takes over insights from former studies in that it has incorporated and developed factors previously addressed. Such factors include "approximate coincidence" (Ritchie), "Sensitivity of Interpretation to Aspectual Types" (Heinëmäki, Hinrichs) and "consequentiality" (Sandström, Moens and Steedman).

However, at least three aspects distinguish this study from these previous works. First, it does not leave it up to Pragmatics alone to decide how a given *when* sentence receives its interpretation. As in the previous studies, the present system heavily depends on contextual information. However, I regard sucn information as supplementing the grammatically induced meaning(s) which inferences from the contextual information cannot override. I also make clear what kind of information the system needs to know, and given sufficient information, what kind of interpretation it yields. Secondly, the analysis is constructed based on actual discourse samples. This data-oriented nature of this approach has been helpful in better capitulating what is happening outside of constructed examples. Lastly, I have brought in a cross-linguistic viewpoint into the discussion of *when*. I have dealt with two languages based on one system, with their differences represented as variations in their system configurations, rather than fundamental disparities in their grammars. Through doing this job, I believe that the present study successfully captures language-independent semantic properties pertaining to *when*.

6.2 Future Directions

6.2.1 How Discourse Relations Would Come in

Some of the discussions above are deeply connected to the topic of Discourse Relations (Hobbs (1985), Asher (2003), inter alia). Aside from the temporal meanings which I have extensively discussed, a few non-temporal entailments have been acknowledged that are concomitant with certain *when* sentences. The two 'atemporal meanings' listed in (203) are most directly connected to *when* sentences as explored in the present study.

(203) a. Consequentiality
b. Subevent

Segmented Discourse Representation Theory (Asher ibid), or SDRT is a direct offspring of the classical DRT. SDRT has built in a way to directly address pragmatic relations that characterize two consecutive discourse states. Such relations are often referred to as Discourse Relations (DRs). DRs do not usually correspond to derive from particular syntactic forms, but regarded as objects of an abstract level. If we identify the atemporal meanings with DRs, independent of the semantics of *when*, we can design a thought experiment to figure out whether the whole range of DRs discussed in the literature will be available for *when* sentences.

This expectation does not hold true. I give just one example of DRs which can be found with sequences of simple sentences but not with *when* sentences. Simple sentences can be connected by way of the Cause relation, while this option, i.e. the main clause event causing the when clause event, is not possible with *when* sentences, as illustrated in (204).[51]

[51] I thank Carlota Smith (p.c., 2006) for the judgement.

(204) a. John had nothing to wear. He cleared the closet (the other day).
b. !When John had nothing to wear, he cleared the closet (the other day).

Asher ibid) calls this DR Explanation. To recognize the fact that Explanation is available in consecutive simple sentences but not in when sentences is a good starting point of a comparative study.

6.2.1.1 The Behavior of Inchoative States in *When* Sentences Dubs Narrative Progression: Possibility of Cross-Constructional Extension

The varying behavior of Lexical State I discussed in this dissertation is not a phenomenon unique to the *when* sentence. A similar kind of State-Nonstate distinction is observable in main clause sequences, commonly referred to as Narrative Progression (NP). (Kamp and Reyle (1983), Kamp and Rohrer (1979)) Let us side-track a little bit and discuss the similarity of NP to the overlap/forward sequence distinction in *when* sentences. Consider (205).

(205) a. John woke up. Birds were singing.
b. John woke up. Birds sang.

The progressive gives rise to two overlapping situations, while the simple past form of non-state predicate introduces a sequence of events. Lexical States can go either way. The actual interpretation depends on the surrounding context. To see this point, let us compare the following two sentences.

(206) a. John opened the door. The sky was clear.
b. The goddess moved the rock. The sky was clear.

Understood neutrally, both sentences can be interpreted as overlapping situations, where the sky was already clear when the opening of the door or moving of the rock occurs.

However, if we add a specific context taken from an old Japanese myth, (206)b. can only be interpreted in a certain way.

Context: The Sun behind the Rock

Amateras-Ohmikami, which means "the goddess who shines in the heavens," is the greatest Japanese god. She represents the sun, shining her daylight on the earth. Her brother, the god Susanoh, was always terribly mean to her. One day he threw horse's hide into her temple. The temple maidens were sewing and a sharp sewing tool accidentally stabbed…one of the maidens [dead]. Angry, Amateras hid herself behind the big rock and the entire world…went dark. So the other gods made a plan to get her out from the rock. They had a big party in front of the rock, and Amateras was so curious that she asked them what was going on. One of the gods answered, "Another great goddess appeared and we're having a party for her." When Amateras moved the rock slightly to see outside, one of the gods pulled her out from behind it and the daylight shone on the world again.
(Reference 1.)

In the last scene of this myth, Amateras' moving the rock and the change of climate are consequentially related. Understood with this situation in mind, (206)b. is coerced to have only the forward sequence reading.

To my knowledge, it has not received much attention what grammatical and pragmatic factors contribute to the availability of an Inchoative State. I point out that a VRS is easier to construe as an Inchoative State than an FRS is, and that consequentiality might be a factor to choose a preferred meaning. This is instantiated (206) in the previous page. The first sentence describes an event and the second a state, either surrounds the time of the event ((207)a.) or starts to hold after the event ((207)b.) The same point can be made in another set of example, (207).

(207) a. Mary learned about the terror attack. She was on a day-off.
b. Mary learned about the terror attack. She was shaken.

Note that a. involves an FRS, whereas b. a VRS.

6.3 Closing Remarks

This dissertation has explored the semantic attributes of *when* and *toki-ni* sentences. On the basis of corpus examples, it has been argued that the temporal meaning of *when*, by default, involves overlapping two eventualities, represented as the *when* and main clauses. There is an alternative reading involving two eventualities ordered in sequence, which arises if the default reading is inconsistent with other information provided in the context. *Toki-ni*, on the other hand, may have one of the two temporal meanings discussed for English, namely overlap and sequence. In the case of *toki-ni* sentences, it has been claimed that distribution of these readings largely depends on morphological factors, such as tense marking and postpositions. The present investigation did not reveal whether either of the two readings is the default in *toki-ni* sentences or whether pragmatic factors play major roles in determining temporal interpretations of *toki-ni* sentences.

While there are are many issues to consider for future research, the present project has added the following knowledge to the achievements of previous scholars who have dealt with *when*: The available readings for *when* and *toki-ni* sentences addressed above derive from the general semantics of the temporal adverbials such that i) *when* requires that the two eventualities it connects are maximally close to each other unless otherwise indicated in the context, and ii) *toki-ni* requires that the two eventualities are close to each other, and whether they are maximally close (overlap) or proximate (sequence) is determined by other factors, primarily morphological. In both cases, specific pragmatic information, such as consequential inference, functions to choose one reading over the other.

Appendix A: The Corpora

A.1 Introduction

This appendix describes the two newstext corpora utilized in this study. One is culled from LDC's English Gigaword (ref) and has been referred to as Corpus E. The other is for Japanese, constructed from a commercial newspaper archive. The latter has been referred to as Corpus J.

A.2 Why Employ Corpus Data in a Theoretical Linguistic Study?

My reasons for employing actually-produced texts as the primary source of investigation are twofold. The first purpose is to obtain as many examples as possible, not only those which are favorable for my analysis. One criticism which Hinrichs raised regarding using only constructed examples was that arguments tend to be 'one-sided,' allowing the researcher to pick up data that would support her claims. A fairly large corpus would contain examples that can occur, working in favor of or against the researcher's arguments.

The second motivation concerns the bilingual nature of the present study. I have investigated two languages extensively, including one of which I am not a native speaker. As such, it is important to secure a method to collect a sufficient amount of natural data.

A.3 Corpus E: English Gigaword

The English corpus has been culled from English Gigaword 2004 distributed by Linguistic Data Consortium. English Gigaword series contain newswire texts of New York Times in the .txt format. I have obtained a licensed copy of the corpus and extracted one month's (July 2004) worth of newstexts.

A.4 Corpus J: Yomidas Bunshokan Archive

The other corpus is also a newstext corpus, which contains Japanese newspaper articles. I have chosen this corpus, Corpus J, in order to ensure comparability with Corpus E. Not many newstexts have been distributed in Japanese for research purposes, especially outside of Japan. For this reason, I have culled Corpus J from a web-based article database for the general audience, rather than for researchers and language engineers. The database I have used is called Yomidas Bunshokan Archive, which I shall call mnemonically as Corpus J henceforth. [52] The archive is only available in the .html format, one article per page. To align with Corpus E, I have taken one month's worth of article data and converted them into the .txt format.

A.5 String Processing

Since both of the corpora are very large chunks of raw texts, it is not easy to recognize relevant examples. String processing extracts interesting examples and their surrounding contexts from the corpora. The process consists of three parts, extraction, level assignment and markup.

A.5.1 Extraction

The first part, extraction, excerpts relevant when sentences from unsorted raw texts. Both corpus E and J consist of multiple text files. Specifically, I have utilized a grep tool that is pre-loaded into WZ, a Japanese text editor. Using regular expressions, sentences containing when and surrounding contexts have been extracted. The regular expressions

[52] Yomidas Bunshokan Archive is the online database of the Yomiuri Shimbun, one of the best-selling newspapers in Japan.

used was simply “when” for English. For Japanese, the expression was more complicated in order to take out sentences containing irrelevant idioms, and looks like the following.

(208)

“[^一二三四五六七八九十の同当臨害]時[^間期刻代々]|とき[^ど]”

1 2 3 4

1.Words that can immediately precede *toki* to form a compound

2.Words that can immediately follow *toki* to form a compound

3.Alternative Chinese character representation of *toki*

4.Using ^ to exclude the letter that can immediately follow 3. to form an irrelevant compound

A.5.2 Level Assignment

The set of text strings excerpted from the corpora by the extraction procedure above contain a fairly large amount of irrelevant examples, such as when used as an interrogative, or idiomatic expressions like *when it comes to*, …. Level assignment is a manual process done for the purpose of refining the corpora to get them more focused on examples that are interesting for the present investigation. I have assumed five levels for each when sentence appearing in the corpora.

(209) a. Level 1: Examples with the least noise; non-fragmented and ready to use as key examples for discussion. Sentences assigned this level are included in the numerical analysis.

b. Level 2: Examples with a little noise; marked sentence forms[53], modal auxiliaries. Sentences assigned this level are included in the numerical analysis.

[53] Examples are negations (E/J) passive mood (E/J), the polite form (J), Interrogative (E/J), Exclamative (E/J) and benefactive (J).

c. Level 3: Incomplete but Interesting Examples; Clefts, Ellipses, Fragmented sentences, Focal and other adverbs (only when, since when etc..). Sentences assigned this level are excluded from the numerical analysis but may be considered to be used in discussions depending on their content.

d. Level 4: Incomplete and Uninteresting Examples; same as Level 3 but are not considered for discussion.

e. Level 5: Irrelevant Examples; Interrogative when, idiom chunks, expressions with little content. Sentences assigned this level are excluded from the numerical analysis.

These levels are intended to assure objectivity to some degree. However, since I have used a holistic method when assigning levels, the assigned levels heavily reflects my subjective judgments. This is especially so in Levels 3 and 4, where interestingness is one of the crucial criteria. I believe that this is fine, because the purpose of Level assignments is not to give absolute scales but rather is to focus on more interesting examples (Levels 1,2 and 3) without losing attention to less interesting ones (Levels 4 and 5).

Before proceeding to the next step, I have converted the excerpt files (*.txt) into comma separated values (*.csv) and then to Microsoft Excel files (*.xls), to facilitate sorting.

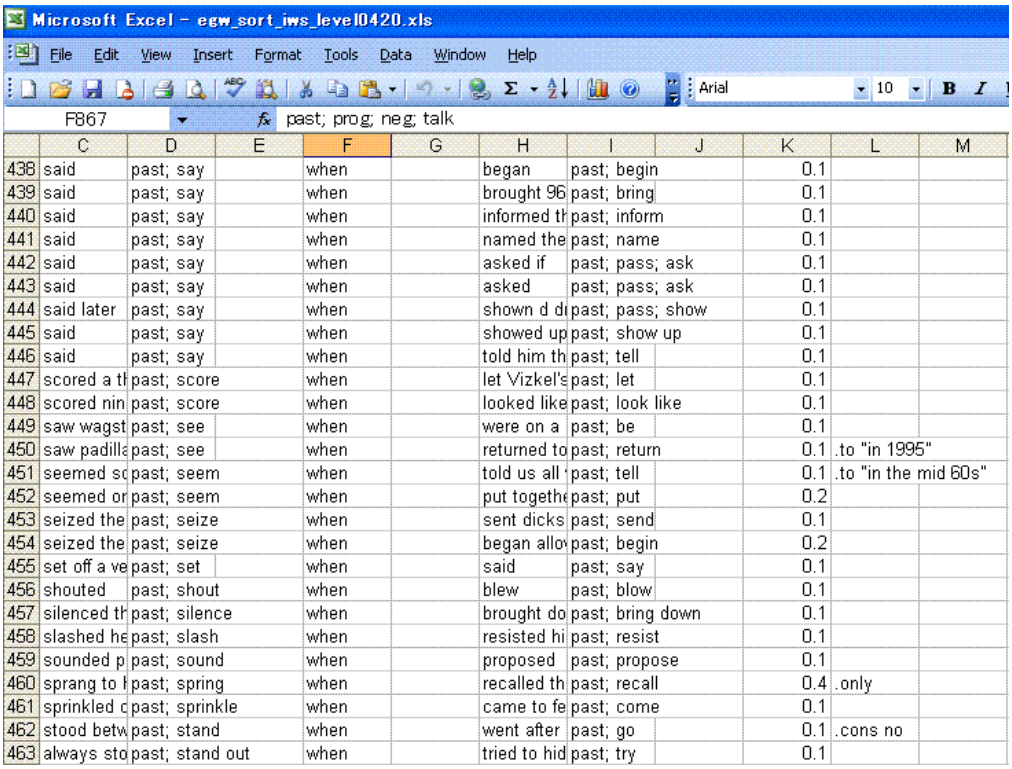
A.5.3 Markup

The next step, Markup, adds morpho-syntactic, semantic and pragmatic information to each example that has been assigned Level 3 or higher. The following features were annotated at the end of each record. [54]

---

[54] I referred to the features appearing in Timex2 discussed in Hobbs (1995) and added ones particular to the present study.

(210) a. Serial #
b. Tense Pattern
c. Presentational Order (English)
d. Particle alternation (Japanese)
e. Aspect-*when* clause
f. Aspect-main clause
g. Predicate-*when* clause
h. Predicate-main clause
i. Temporal Meaning
j. Level
k. Remarks


Microsoft Excel - egw_sort_iws_level0420.xls

File Edit View Insert Format Tools Data Window Help

F867 past; prog; neg; talk

	C	D	E	F	G	H	I	J	K	L	M
438	said	past; say		when		began	past; begin		0.1		
439	said	past; say		when		brought 96	past; bring		0.1		
440	said	past; say		when		informed th	past; inform		0.1		
441	said	past; say		when		named the	past; name		0.1		
442	said	past; say		when		asked if	past; pass; ask		0.1		
443	said	past; say		when		asked	past; pass; ask		0.1		
444	said later	past; say		when		shown d di	past; pass; show		0.1		
445	said	past; say		when		showed up	past; show up		0.1		
446	said	past; say		when		told him th	past; tell		0.1		
447	scored a th	past; score		when		let Vizkel's	past; let		0.1		
448	scored nin	past; score		when		looked like	past; look like		0.1		
449	saw wagst	past; see		when		were on a	past; be		0.1		
450	saw padilla	past; see		when		returned to	past; return		0.1	.to "in 1995"	
451	seemed so	past; seem		when		told us all	past; tell		0.1	.to "in the mid 60s"	
452	seemed or	past; seem		when		put togethe	past; put		0.2		
453	seized the	past; seize		when		sent dicks	past; send		0.1		
454	seized the	past; seize		when		began allov	past; begin		0.2		
455	set off a ve	past; set		when		said	past; say		0.1		
456	shouted	past; shout		when		blew	past; blow		0.1		
457	silenced th	past; silence		when		brought do	past; bring down		0.1		
458	slashed he	past; slash		when		resisted hi	past; resist		0.1		
459	sounded p	past; sound		when		proposed	past; propose		0.1		
460	sprang to h	past; spring		when		recalled th	past; recall		0.4	.only	
461	sprinkled c	past; sprinkle		when		came to fe	past; come		0.1		
462	stood betw	past; stand		when		went after	past; go		0.1	.cons no	
463	always sto	past; stand out		when		tried to hid	past; try		0.1		

Figure A.1 Part of the original annotation file

Once the examples are sorted in the Excel file, classification was conducted manually by sorting out the examples by grammatical factors and their temporal interpretation.

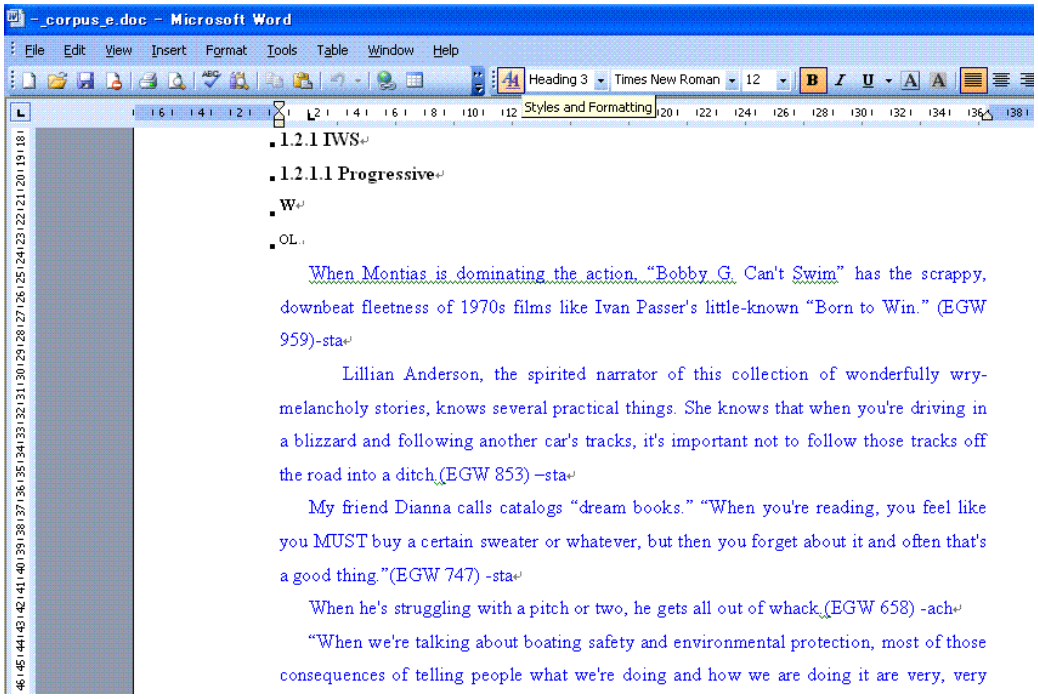
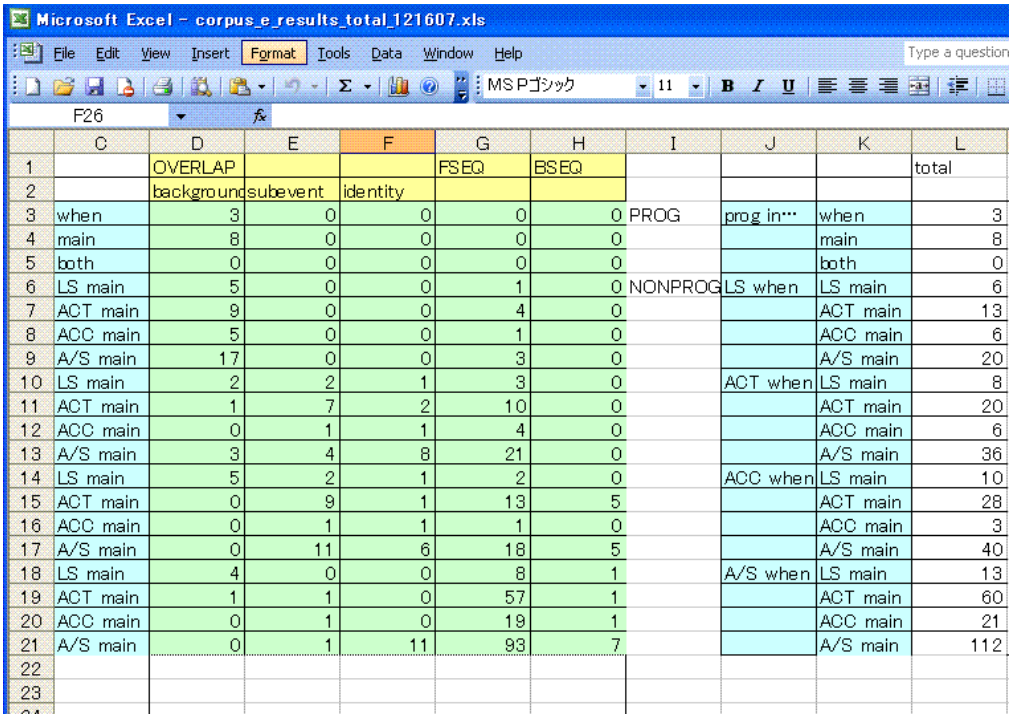


Figure A.2 Part of the qualitative analysis file

Then, a quantitative analysis was conducted in a separate file to count the results and express them visually.



Microsoft Excel - corpus_e_results_total_121607.xls

File Edit View Insert Format Tools Data Window Help

F26

	C	D	E	F	G	H	I	J	K	L
1		OVERLAP			FSEQ	BSEQ				total
2		background	subevent	identity						
3	when	3	0	0	0	0	PROG	prog in…	when	3
4	main	8	0	0	0	0			main	8
5	both	0	0	0	0	0			both	0
6	LS main	5	0	0	1	0	NONPROG	LS when	LS main	6
7	ACT main	9	0	0	4	0			ACT main	13
8	ACC main	5	0	0	1	0			ACC main	6
9	A/S main	17	0	0	3	0			A/S main	20
10	LS main	2	2	1	3	0		ACT when	LS main	8
11	ACT main	1	7	2	10	0			ACT main	20
12	ACC main	0	1	1	4	0			ACC main	6
13	A/S main	3	4	8	21	0			A/S main	36
14	LS main	5	2	1	2	0		ACC when	LS main	10
15	ACT main	0	9	1	13	5			ACT main	28
16	ACC main	0	1	1	1	0			ACC main	3
17	A/S main	0	11	6	18	5			A/S main	40
18	LS main	4	0	0	8	1		A/S when	LS main	13
19	ACT main	1	1	0	57	1			ACT main	60
20	ACC main	0	1	0	19	1			ACC main	21
21	A/S main	0	1	11	93	7			A/S main	112
22										
23										

Figure A.3 Part of quantitative analysis file

A.6 Peripheral Forms and Idioms

The corpora for the present study contain a large number of examples which I have regarded 'marginal' due to one of the following reasons: fragmented; noisy with discourse particles and auxiliaries; and overly idiomatic. Those peripheral examples are included in the quantitative analysis except for the idiomatic ones, but are excluded from the qualitative analysis.

Participle Constructions

When ---ing...

Nominal Modification

The year when…

Grammaticalized Expressions and Idioms

When it comes to...

Appendix B Miscellaneous Numerical Results

English

Presentational Order Variation

IWS

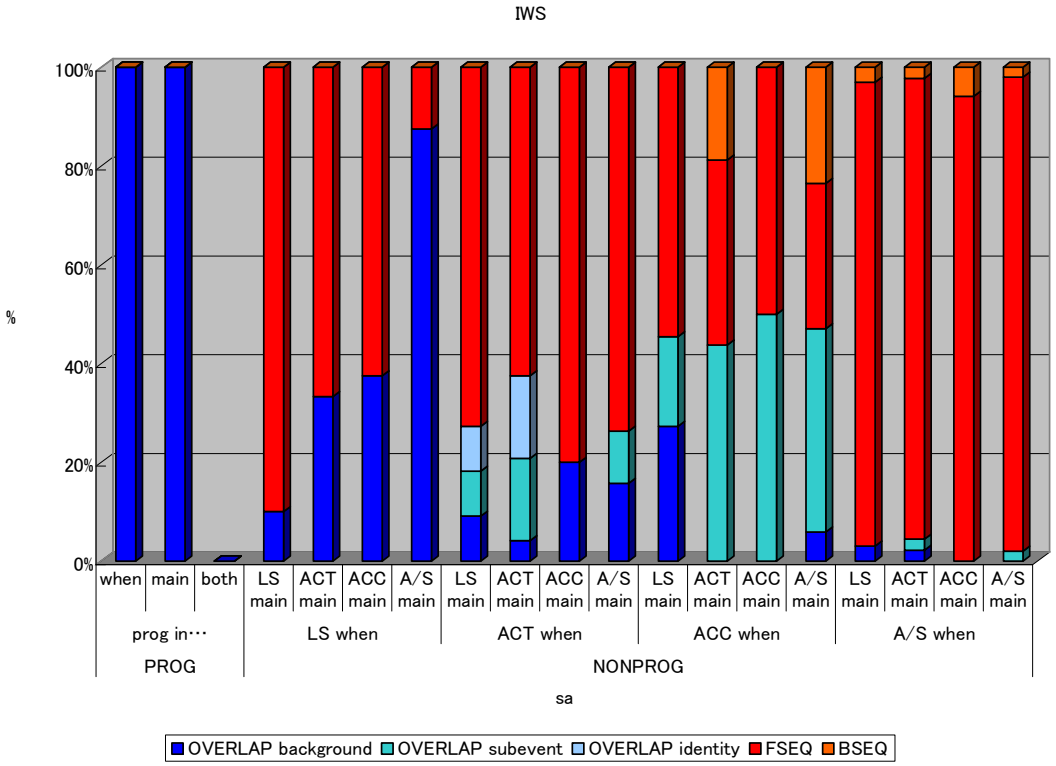


Figure B.3 Distribution of Meaning(E)-IWS

FWS

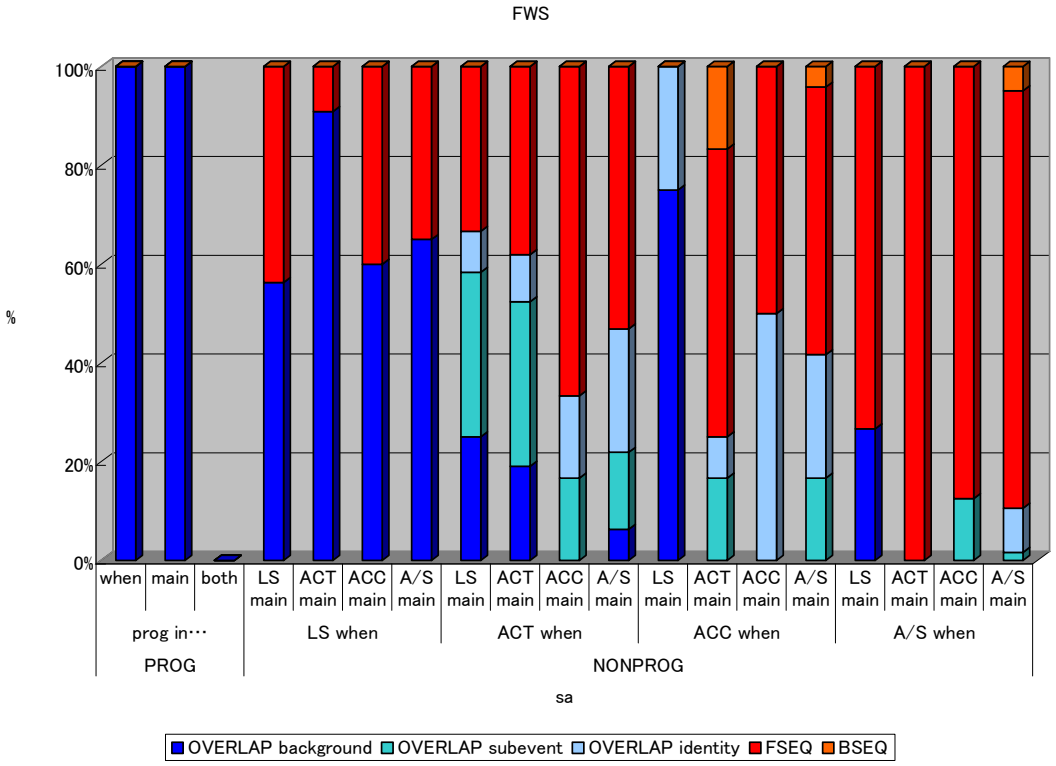


Figure B.6 Distribution of Meaning(E)-FWS

Tense marking

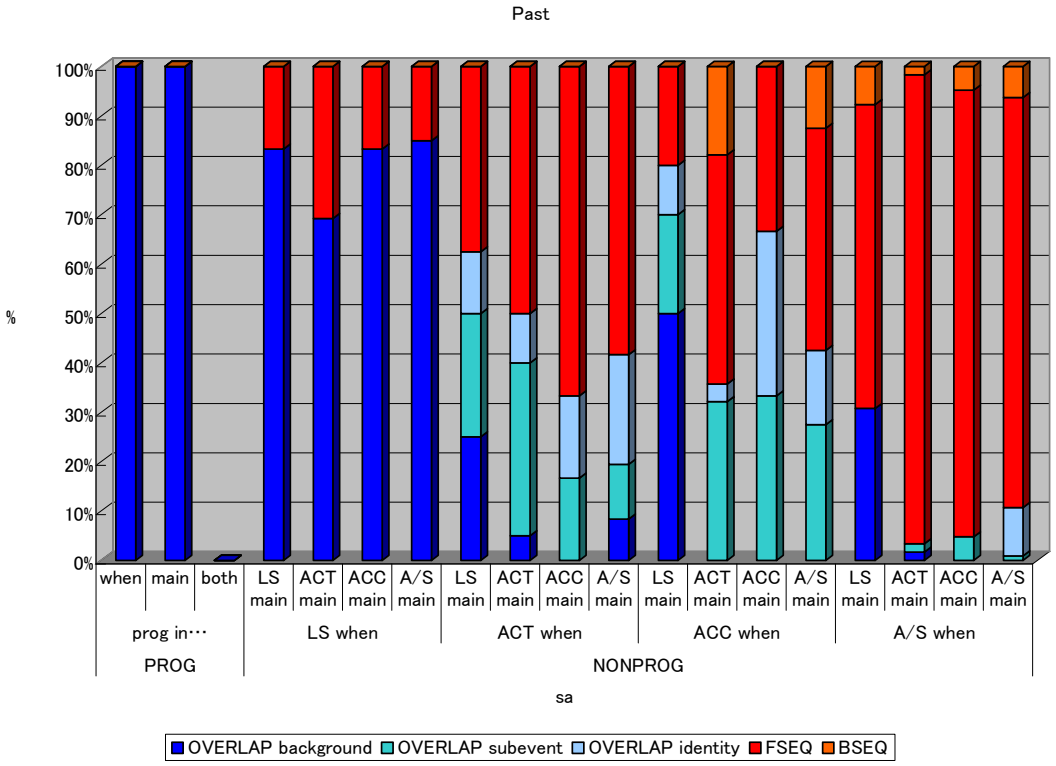


Figure B. 9 Distribution of Meaning (E)-Past

Nonpast

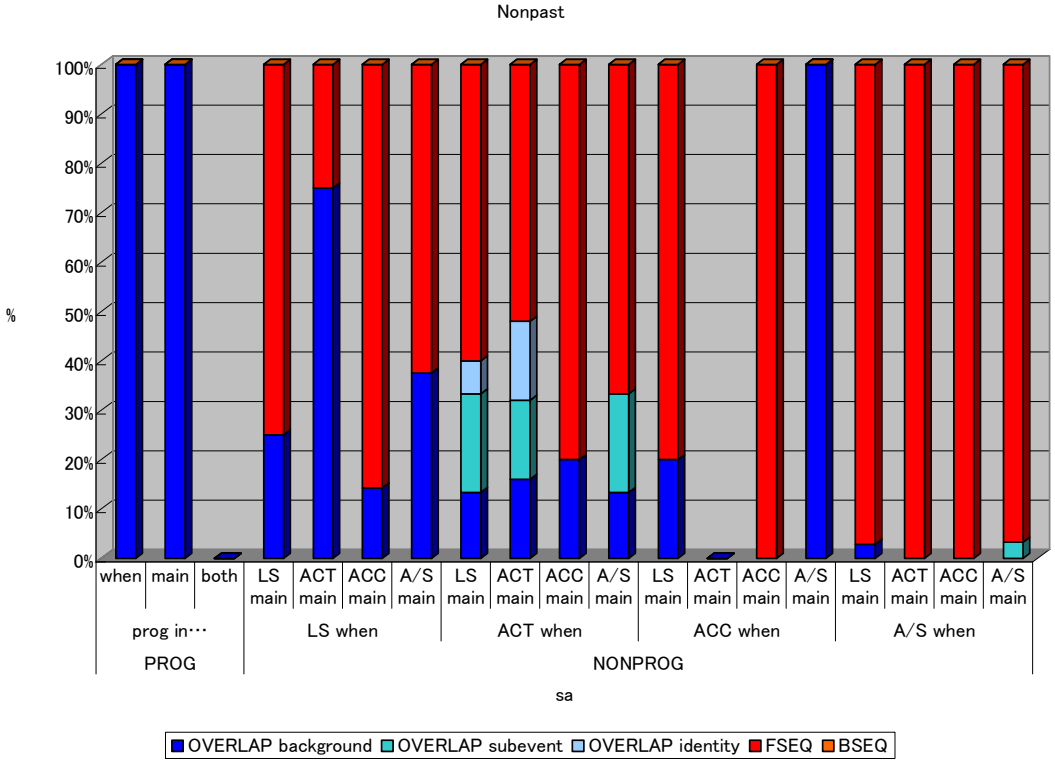


Figure B.11 Distribution of Meaning (E)-Nonpast

Japanese

Pattern 1: ta-ta (embedded-past and matrix-past)

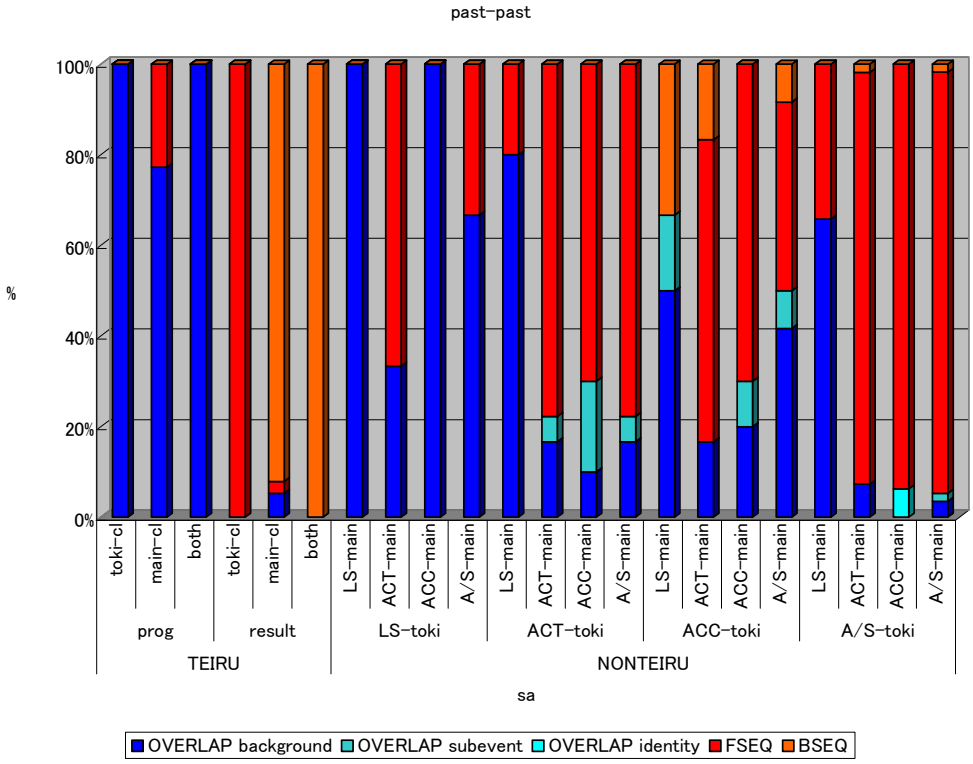


Figure B.17 Distribution of Meaning (J)-Pattern 1

Pattern 2: ru-ta (embedded-nonpast and matrix-past)

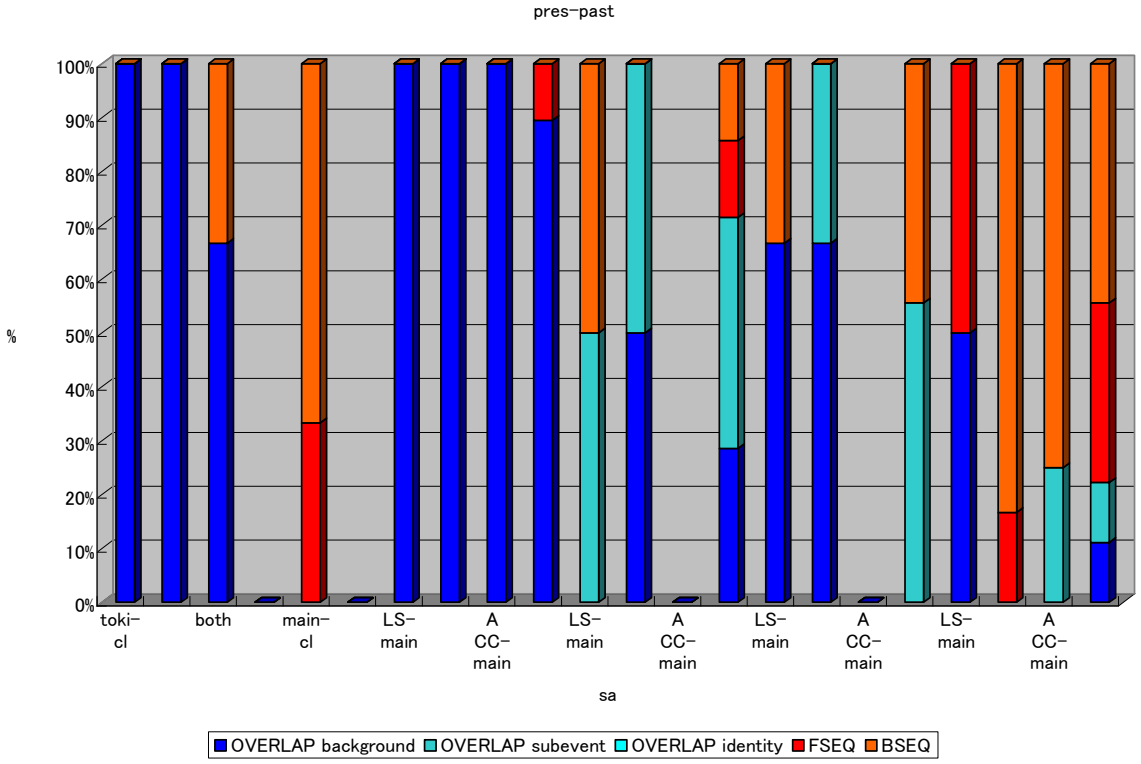


Figure B.20 Distribution of Meaning (J)-Pattern 2

Pattern 3: ta-ru (embedded-past and matrix-nonpast)

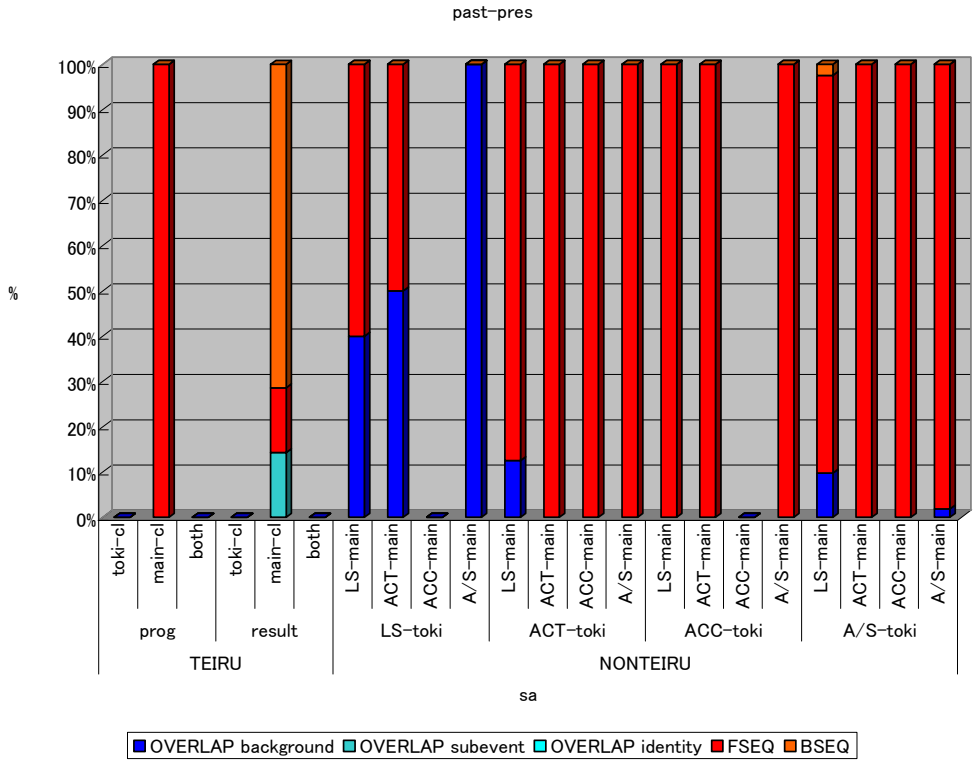


Figure B.23 Distribution of Meaning (J)-Pattern 3

Pattern 4: ru-ru (embedded-nonpast and matrix-nonpast)

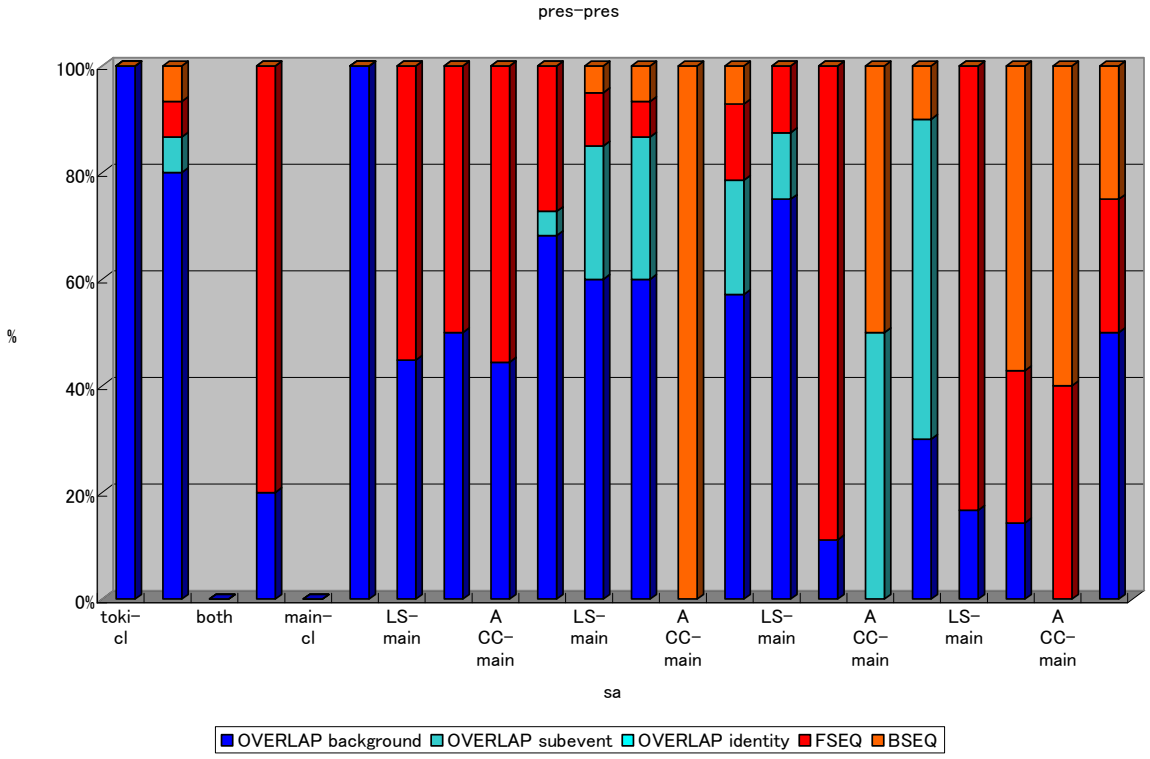


Figure B. 26 Distribution of Meaning (J)-Pattern 4

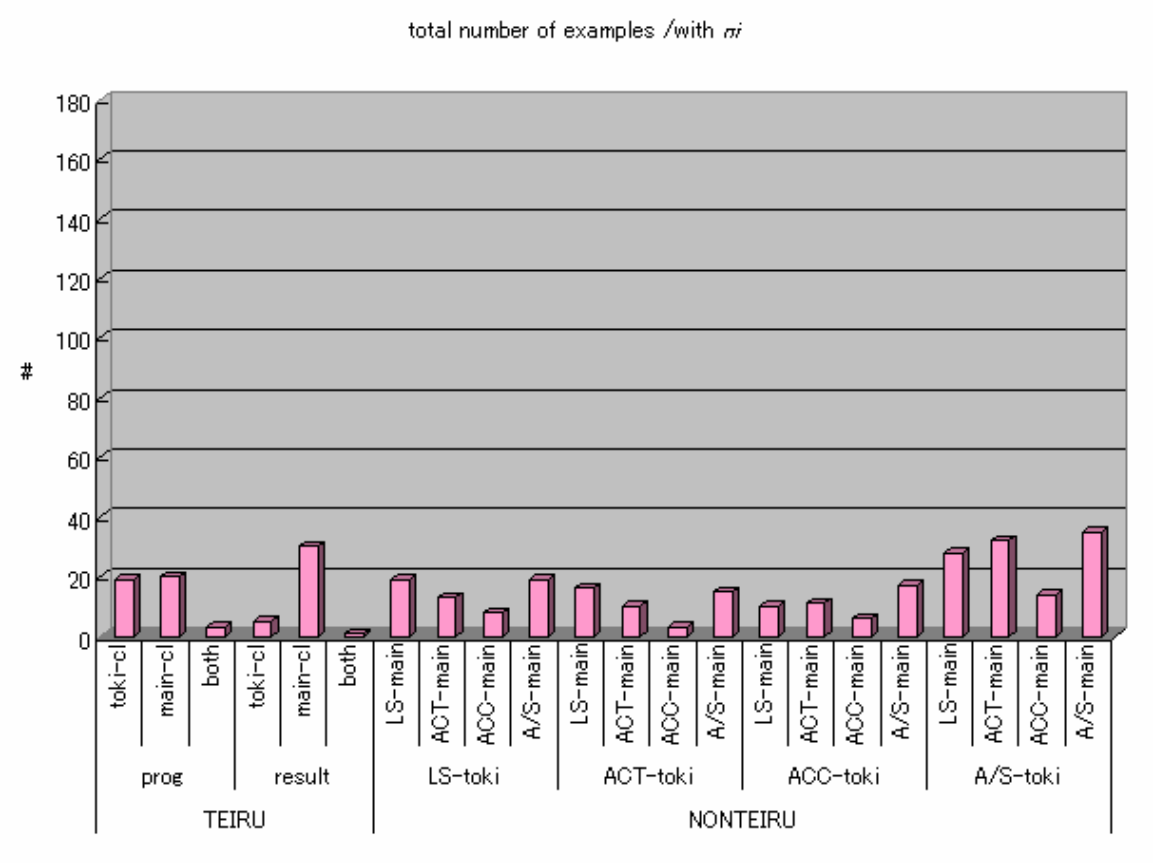


Figure B.27 Number of Examples for Fig. 6.4 Found in Corpus J (with *ni*)

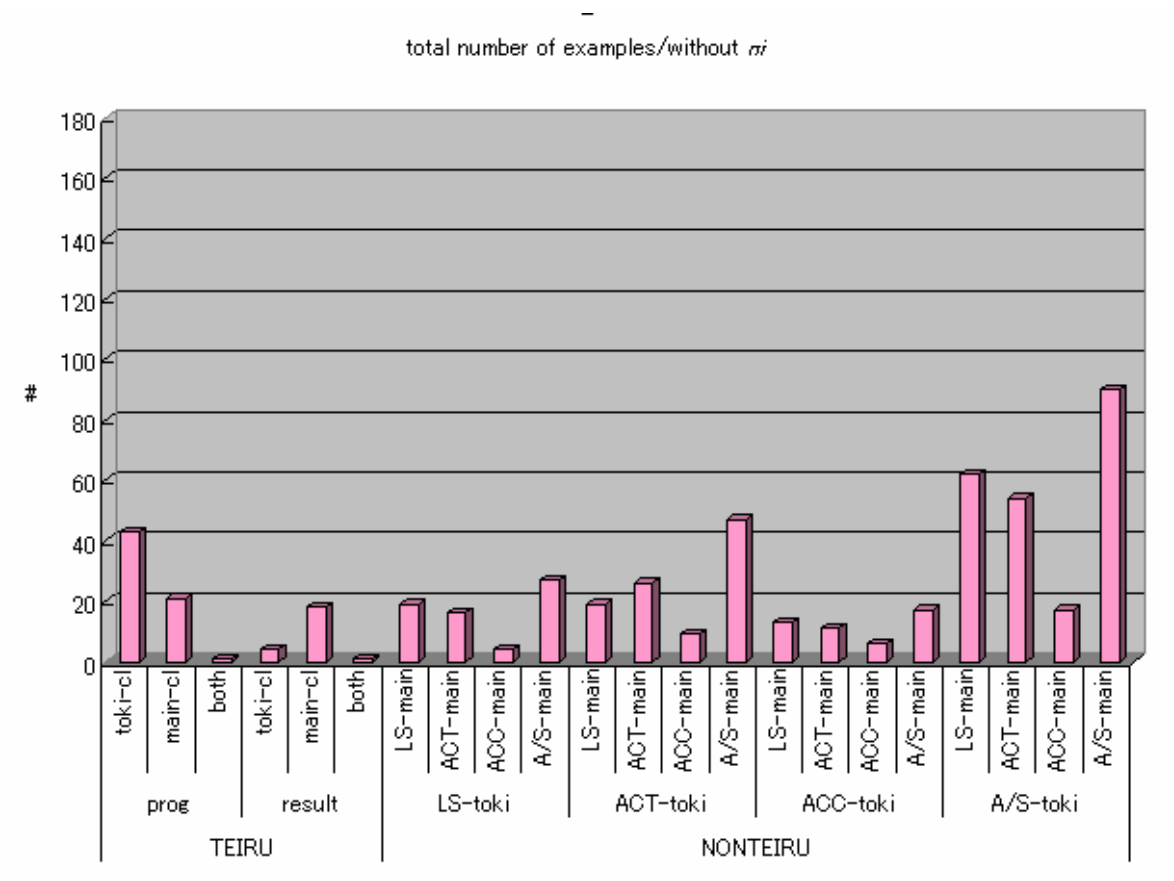


Figure B.28 Number of Examples for Fig. 6.4 Found in Corpus J

References

Bach, Emmon. 1986. The Algebra of Events, in *Linguistics and Philosophy 9*, 5-16.

Caenepeel, Mimo. 1989. *Aspect, Temporal Ordering and Perspective in Narrative Fiction*. Doctoral Dissertation, University of Edinburgh.

Dowty, David. R.. 1979. *Word Meaning and Montague Grammar*. Dordrecht, Reidel.

Galiatou, Eleni and Gérard Ligozat. 2002. A Formal Model for the Representation of Processes having an Internal Structure. Ms., University of Athens and Paris-Sud University.

Grice, Paul. 1989. *Studies in the Way of Words*. Cambridge, Harvard University Press.

Halldorson, Micheal and Singer, Murray. 2002. Inference Processes: Integrating relevant Knowledge and Text Information, in Discourse Processes 34, 145-161.

Hasegawa, Yoko. 1998. *Tense-Aspect Controversy Revisited: The -TA and -RU forms in Japanese*. Ms. University of California at Barkley.

Heinämäki, Orvokki. 1978. *Semantics of English Temporal Connectives*. Doctoral Dissertation, The University of Texas at Austin.

Hinrichs, Erhard. 1986. Temporal Anaphora in Discourses of English, *Linguistics and Philosophy 9*, 63-82.

Hespelmath, Martin. 1997. From Space to Time: Temporal Adverbials in the World's Languages. Newcastle, Lincom Europa.

Hobbs, Jerry. 1995. *On the coherence and structure of discourse.* Technical Report CSLI-85-37, Center for the Study of Language and Infor mation, Stanford University.

Irie, Makiko. 2003. "Temporal Interpretations of *When* in English," Paper Presented at High Desert Linguistic Society 4, Albuqueque, NM.

Irie, Makiko. 2006. "Temporal Order of *Toki-ni* in Japanese," Proceedings of JK 15, CSLI Publications.

Kamp, Hans and Uwe, Reyle. 1993. *From Discourse to Logic*. Dordrecht, Kluwer.

Kamp, Hans and Rohrer, Christian. 1983. Tense in Texts, in Bäuerle, Schwarze and von Stechow (1983).

Keil, Frank C.. 2003. Categorisation, Causation and the Limits of Understanding, in *Language and Cognitive Processes 18*, 663-692.

Kusumoto, Kiyomi. 1999. *Tense in Embedded Clauses*. Doctoral Dissertation, University of Massachusetts at Amherst.

Landman, Fred. 1993. The Progressive, *Natural Language Semantics* 1, 1-32.

Lascarides, Alex and Asher, Nicholas. 1991. *Discourse Relations and Commonsense Entailment*. DYANA deliverable 2.5B. Center for Cognitive Science, University of Edinburgh.

Levinson, Stephen. . *Pragmatics*. Cambridge University Press.

McReady, Eric. 2005. *The Dynamics of Particles*. Doctoral Dissertation, The University of Texas at Austin.

Mizuta, Yoko. 2002. *Discourse-semantic Analysis of Tense and Aspect in English and Japanese*. Doctoral Dissertation, University of Chicago.

Moens, Marc. 1987. *Tense, Aspect and Temporal Reference*. Doctoral Dissertation, University of Edinburgh.

Moens, Marc and Mark, Steedman. 1988. Temporal Ontology and Temporal Reference, *Computational Linguistics 14*, 15-28.

Nelken, Rani and Francez, Nissim. 2001. Splitting the Reference Time: Temporal Anaphora and Quantification in DRT. Ms., Tel-Aviv University and The Technion.

Ogata, Norihiro. *2002?. Dynamic Predicate Logic of Pronouns oFWSeqtages and Individual Concepts: $DPL^{S\otimes}$. Ms., Osaka University.

Ogihara, Toshiyuki (1996). *Tense, Attitude and Scope*. Dordrecht, Kluwer.

Parsons, Terence. Events in the Semantics of English. Cambridge, MIT Press.

Partee, Barbara Hall. 1984. Nominal and Temporal Anaphora. *Linguistics and Philosophy 7, 243-286*.

Ritchie, Graeme, D. 1979. Temporal Clauses in English, in Theoretical Linguistics 6, 89-115.

Reichenbach, Hans. 1947. Elements of Symbolic Logic. New York, Macmillan.

Sandström, Görel. (1993). *When-Clauses and The Temporal Interpretation of Narrative Discourse*. Doctoral Dissertation, University of Umeå.

Shirai, Yasuhiro. 2000. The Semantics of the Japanese Imperfective *–teiru*: An Integrative Approach. *Journal of Pragmatics 32*, 327-361.

Smith, Carlota S.. 1997. *The Parameter of Aspect (Second Edition)*. Dordrecht, Kluwer.

Smith Carlota S.. 2003. *The Modes of Discourse*. Cambridge University Press.

van Staden, Miriam and Bhuvana Narasimhan. *????. Granularity in the Cross-linguistic Encoding of Motion and Location. Ms., University of Amsterdam and MPI.

Trabasso, T., van den Broek, P.W., and Suh, S.Y.. 1989. Logical Necessity and Transitivity of Causal Relations in Stories. *Discourse Processes* 12, 1-25.

Tapiero, I., van den Broek, P.W., and Quintana, M.-P.. 2002. The Mental Representation of Narrative Texts as Networks: the Role of Necessity and Sufficiency in the Detection of Different Types of Causal Relations. *Discourse Processes* 34, 237-258.

Tohsaku, Yasu-Hiko. 1999. *Yookoso!: An Invitation to Contemporary Japanese*. Boston, McGraw Hill.

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

Yoshimoto, Kei and Y., Mori. 2001. A Compositional Semantics for Complex Tenses in Japanese, in van Eynde, F. and D. Beermann (eds.) *Proceedings of the Eighth International HPSG Conference*.

Zucchi, Sandro. 1997. "Incomplete Events, Intensionality and Imperfective Aspect." *Natural Language Semantics* 7.179-215.

Web Pages

URL1. http://www.st.rim.or.jp/~cycle/AMATEE.HTML

URL2. http://www.cogsci.ed.ac.uk/~jbos/comsem/book2.html

Vita

Makiko Nakayama, the second daughter of the late Masahiro Sakugawa and Machiko Nakayama, was born at Japan Red Cross Medical Center in Shibuya, Tokyo, Japan on November 22, 1972. After attending Machida City Tadao 7th Elementary School, Machida City Yamasaki Junior High School and Tokyo Municipal Matsugaya High School, she was enrolled in International Christian University in Mitaka, Tokyo, where she graduated with a bachelor's degree in Liberal Arts. She was then enrolled in the graduate school of Yokohama National University, Kanagawa, Japan, to pursue her interest in theoretical linguistics. After receiving a master's degree from YNU in March 1997, she worked as a technical assistant for the Language Laboratory for the Faculty of Education and Human Sciences at YNU. In August 1998, she was enrolled in the University of Texas at Austin as a full time graduate student in the department of Linguistics.During her graduate study at UT, she worked as a teaching assisitant of the Japanese language in the department of Asian Studies, as well as being involved in a number of translation projects.

Permanent Address:
3-57-3-307, Wakamiya, Nakano, Tokyo 165-0033 Japan

The dissertation was typed by the author.