In this chapter, we will answer some of the questions raised in the previous chapter. We will do so by looking at the temporal interpretation of relative clauses and participle constructions.

One observation we made regarding the temporal interpretation of relative clauses is that it allows what we call the later-than-matrix interpretation. This is the interpretation where the event time of a relative clause predicate is understood to take place after the event time of the matrix clause. Examples that prefer this kind of reading are ones like *Hillary married a man who became the president of the U.S.* and *Who hired the person who wrote this article?*

We have considered four theories to account for the availability of this interpretation: an absolute theory of tense, a single-index system, a multiple-index system, and a system with explicit quantification over times in the object language. As a version of an absolute theory of tense, we have considered an existential analysis of the past tense that incorporates the speech time into its semantics. This possibility is dismissed since it wrongly predicts the speech time dependency of the past tense in all contexts. It does not predict a past-with-respect-to-a-future-time interpretation. All variants of the absolute theory of tense are subject to this criticism including both versions of Partee's theory and the version of Dowty's we presented.

We have also considered Priorian tense logic as a single-index system. Examples that allow the later-than-matrix interpretation were originally thought to be examples that Priorian tense logic could not handle. We have seen that with an appropriate mechanism such as QR or quantifying in, the later-than-matrix interpretation of these examples can be derived. In § 2.1.4., however, we will see that a solution of this type to derive the later-than-matrix interpretation leads to scope paradoxes, and therefore it is empirically inadequate.
This leaves us two options: a multiple-index system and a system with explicit quantification over times in the object language.\(^1\) These two systems are shown to be equivalent in their expressive power in Cresswell (1990). We are not going to choose between the two systems in this chapter. We will see in Chapter 3, however, that the two systems are not equivalent in some respects, and that a system with explicit quantification over times in the object language is able to explain certain temporal interpretations in a less stipulative way. To anticipate this, we propose a system with explicit quantification over times.

We will also try to answer the question of the relation between tense morphemes and temporal meanings. We have seen in § 1.5.1. that not all occurrences of the past tense morpheme in English correspond to what we think the past tense should mean, namely the meaning of anteriority. The last occurrence of the past tense in sentences like *John decided that he would tell his mother that they were having the last meal together* is vacuous; it does not locate the most embedded event time prior to any evaluation time. We have also seen in § 1.5.2. that not all the past meanings are the result of interpreting past tense morphemes. In English, tenseless elements such as nouns, adjectives, and participles can sometimes have their own temporal interpretations distinct from the one given by tense. We will argue that tense morphemes themselves do not carry any meaning of temporal location, following the line pursued in Stowell (1993, 1995a,b). Specifically, we will argue that tense morphemes are temporal variables that saturate the time argument slot of the predicates they are affixed to. This proposal implies that there is a difference between tensed and tenseless clauses in terms of explicit quantification over event times in the object language; only tensed clauses syntactically represent the event times of the predicates. Evidence for this will be given from the temporal interpretation of participle constructions and relative clauses.

---

\(^1\) We do not consider a system where there is a limit on numbers of indices we can have such as double- or triple-index systems as a multiple-index system. What we mean by a multiple-index system is a system with infinite number of indices and operators that control storing and setting these indices.
In the last section, we will discuss tense interpretations in non-SOT languages. We have seen that not all non-SOT languages behave the same way in relative clauses. Japanese on the one hand allows the simultaneous interpretation in present under past constructions. Polish and Russian on the other hand show the same pattern as English, an SOT language. Only the speech time interpretation is available in English, Polish and Russian, when a present tensed relative clause is embedded under a past tense. We will argue that this is a consequence of (i) the fact that what we have been calling the present tense morpheme is not a real tense morpheme in non-SOT languages, and (ii) relative clauses in Japanese on the one hand and Polish and Russian on the other have different structures which give rise to different temporal interpretations.

2.1. Tense in Relative Clauses in English

2.1.1. Properties of Tense Interpretation in Relative Clauses

We begin with the description of facts about tense interpretation in relative clauses. We have already seen some of them in Chapter 1. We will draw a comparison between tense in relative clauses and tense in clausal complements.

A first fact is that relative clauses are SOT environments. In other words, a vacuous past tense can occur in a relative clause embedded under a past tense such as (1a), as observed in Ogihara (1989, 1996).

(1) a. John said that he would buy a fish that *was* alive
    b. John said that he would tell his mother that they *were* having their last meal together

The sentence (1a) has an interpretation in which the underlined past tense is understood as a vacuous one, i.e., the time of the fish being alive can be understood as simultaneous with a future buying time. This is parallel to the vacuous past tense in clausal complements such as (1b).
A second fact is that tense in relative clauses behaves differently from tense in clausal complements in a number of ways. First, what we call the later-than-matrix interpretation is available to tense in relative clauses. (See Enç 1987, Abusch 1988, 1994, 1997, and Ogihara 1989, 1996 among others.) As we have seen, the event time of the relative clause predicate is understood to follow the event time of the matrix clause predicate in examples like the following:

(2)  
   a. Hillary married a man who became the president  
   b. Who hired the person who wrote this article?

However, such an interpretation is not available to a past tense embedded under clausal complements.

(3) Gordon said that Josephine was pregnant

The sentence has an interpretation in which Gordon locates himself at a time of Josephine's pregnancy or after a time of her pregnancy, but not before a time of her pregnancy. In other words, we cannot report Gordon's utterance "Josephine will be pregnant" by the sentence (3).

It is not the case that the later-than-matrix interpretation should be prohibited in general in clausal complements.² Consider the following examples³:

(4)  
   a. The announcer said that the Red Sox played tomorrow  
   b. The woman told me that the bus left at 3:00

---

² In addition to the fact reported below, there is another case where the later-than-matrix interpretation seems possible. It is when future oriented verbs like predict are used as the matrix verb. See footnote 42 in Chapter 1 for a short discussion.

³ Examples like (4) are discussed in Hornstein (1990).
It is clear from the adverb *tomorrow* that the sentence (4a) only has what we call the later-than-matrix interpretation. Similarly, the sentence (4b) can be truthfully uttered when the woman told me at 2:45 about the bus we were waiting for.

We believe that the difference between examples like (3) and (4) regarding the (un)availability of the later-than-matrix interpretation is related to the following contrast:

(5) * Josephine is pregnant tomorrow/in three months/next year

(6) a. The Red Sox play tomorrow
    b. The bus leaves at 3:00

Present tensed sentences can have a futurate interpretation when the events described are so-called 'scheduled events', such as (6). When such sentences are embedded under a past tense, they can have the later-than-matrix interpretation.

Although it is necessary to explain the clausal complements that seemingly allow the later-than-matrix interpretation, we should note that the availability of the later-than-matrix interpretation is somewhat restricted. On the other hand, there are no restrictions on tense interpretation in relative clauses.

Another difference between tense in clausal complements and relative clauses is found in the present under past construction. When a present tense is embedded in the clausal complement of a past tensed verb as in (7), the sentence obligatorily receives the so-called double access interpretation, which is different from the simultaneous interpretation. Roughly speaking, the truth of the sentences in (7) implies that the embedded event is true at the speech time as well as the matrix event time (hence the name 'double-access').

---

4 The precise semantics of the double-access sentences will be discussed later. See also Abusch (1991, 1994, 1997a,b), Ogihara (1989, 1995a, 1996, 1999), and Gennari (1999a,b).
(7) Eva believed that the boy is crying

When a present tense is embedded in a relative clause under a past tense as in (8), the embedded event is understood as an ongoing event at the speech time and the obligatory double-access effect is not observed.

(8) Eva talked to the boy who is crying

Note that the sentence is compatible with a situation where the boy has been crying since Eva talked to him till the speech time. The difference between this example and examples like (7) is that the double-access interpretation is obligatory in the latter. In other words, the boy does not have to be crying when Eva talked for the sentence (8) to be truthfully uttered, while the boy has to be crying at the speaker's 'now' in the speaker's belief worlds at her believing time for the sentence (7) to be truthfully uttered.

There is also an observation that is made with specific reference to clausal complements. In the clausal complements of verbs like believe and say, the simultaneous interpretation is possible only with stative predicates. This generalization is reported by researchers like Enç (1987), Ogihara (1989), Stowell (1993), and Gennari (1997, 1999a).

Compare the examples in (9) and (10):

(9) a. Gordon said that Josephine was pregnant
    b. Susan said that the baby was crying

(10) a. Gordon said that Josephine got pregnant
    b. Susan said that the baby cried
The sentences in (9) are ambiguous: they can have the simultaneous or earlier-than-matrix interpretation. When eventive predicates are embedded as in (10), the sentences do not generally allow the simultaneous interpretation.

No such restriction has been reported in the literature regarding relative clauses. For instance, the sentence (11) may be true when Nancy filmed the woman while she parachuted into the campus pond.

(11) Nancy filmed the woman who parachuted into the campus pond

Perhaps almost all, if not all, native speakers agree on the contrast found between (9) and (10). This intuition was the basis for the generalization that the simultaneous interpretation is possible only with stative predicates. We believe that this generalization is too strong.

First, not all verbs that take clausal complements show this restriction, according to Barbara Partee (p.c.). Perception verbs seem to readily allow the simultaneous interpretation:

(12) Elliott observed/noticed/perceived/ that Josephine got hurt

Giorgi (1998) observes that the verb dream also allows the simultaneous interpretation with eventive predicates:

(13) John dreamt that he won a lottery

Second, there are again exceptions to the generalization that eventive predicates do not allow a simultaneous interpretation in clausal complements of verbs of believing and saying. We believe that this case is related to a special use of the present tense in root clauses, too. The example in (14a) is one of the relevant examples. This sentence can have
a simultaneous interpretation in a situation where what the announcer actually said was something like (14b) while watching John strike out.

(14)  
  a. The announcer said that John striked out  
  b. The announcer said, "John strikes out!"

Angelika Kratzer (p.c.) has pointed out to me that the predicate get pregnant can allow the simultaneous interpretation in examples like the following:

(15)  
Josephine said that she got pregnant the minute she got pregnant.

This sentence can truthfully be uttered in a situation where Josephine somehow has the ability to notice exactly when she gets pregnant. This we believe is an exceptional case similar to cases discussed below.

   Barbara Partee (p.c.) has also given me the following examples:

(16)  
  a. I thought the glass fell by itself. I didn't know that you pushed it.  
  b. He didn't realize that his car hit the curb  
  c. The pilot was sure that the plane landed in the correct spot

According to her, these examples report beliefs that may be based on perception, and the formation of the belief may be simultaneous with the perception.  

   The above examples show that whether the simultaneous interpretation is possible with eventive predicates depends partly on the choice of matrix predicates. This suggests that there should not be a general mechanism to exclude the simultaneous interpretation with eventive predicates. The contrast found between eventive and stative predicates in clausal complements of verbs like believe and say should follow from their lexical semantics. We will show in § 2.1.3. that it in fact does. In order to see how attitude verbs differ from other
verbs that typically allow the simultaneous interpretation with eventive predicates, we need to understand the precise semantics of these verbs. This is beyond the scope of this thesis, and therefore we limit our discussion to attitude verbs.

The differences between clausal complements and relative clauses seem to indicate that tense in relative clauses can be independent of tense in higher clauses. This is the view first put forward in Ladusaw (1977), followed by Dowty (1986) and more recently Enç (1987), Ogihara (1989, 1996), and Stowell (1993). We agree with this view. In what follows, we will first present a theory of tense in English which aims to account for the ambiguity of past tenses in this language. Then, we will show how the observed properties of tense interpretation in relative clauses and the differences between relative clauses and clausal complements are derived. Lastly, we will present arguments against a single index system, such as Priorian tense logic.

2.1.2. A Tense Theory for Vacuous Tense

A naïve intuition about the semantics of the past tense is that it carries some meaning of anteriority; the past tense is responsible for locating some event time before another time. The intuition is based on the temporal meaning we get from simple past tensed sentences like *Elliott was in Japan* and *Jen went to Boston*. From these sentences, we understand the events of Elliott's being in Japan and Jen's going to Boston to have taken place prior to the speech time, and we understand that the past tense is responsible for the meaning of 'prior to ...'. Almost all theories of the past tense are built on this intuition. But we have already seen that the past tense does not always carry this meaning. Sometimes it can be vacuous. Theories that are based on the past tense meaning in simple sentences face a difficulty explaining the vacuous past tense. Stowell (1993, 1995a,b) argues that we should build the semantics of tense based on these vacuous interpretations. Thus in this account, no occurrences of tense morphemes, present or past, have any meaning of temporal location.
One way to express this idea is to assume that tense morphemes are temporal variables saturating the time argument positions of predicates.

\[
(17) \quad \begin{align*}
&\text{a. } \llbracket \text{[past]}i \rrbracket^c = g(i) \\
&\text{b. } \llbracket \text{[pres]}i \rrbracket^c = g(i)
\end{align*}
\]

But this cannot be the end of the story. If the present and past tense morphemes are both temporally vacuous, we predict no semantic difference between present and past tensed sentences. For instance, under this semantics, past tensed sentences like (18a) have an LF like (18b).

\[
(18) \quad \begin{align*}
&\text{a. } \text{Jen went to Boston} \\
&\text{b. } \text{pasti Jen go to Boston} \\
&\text{c. } \llbracket (18b) \rrbracket^c = 1 \text{ iff Jen goes to Boston at } g(i)
\end{align*}
\]

These truth conditions do not guarantee that the event of Jen's going to Boston takes place before the speech time. We do not want the past tense to be vacuous in cases like (18). Imposing a restriction on the value of \textit{past} as follows can be a solution to this particular case.

\[
(19) \quad \llbracket \text{[past]}i \rrbracket^c \text{ is only defined when } g(i) < t_c
\]

When defined, \( \llbracket \text{[past]}i \rrbracket^c = g(i) \)

We have seen in Chapter 1, however, that this semantics of the past tense morpheme not only makes a wrong prediction about occurrences of the past tense under the future but also predicts a wrong presupposition when embedded under attitude verbs.

Stowell argues that the inventory of the English lexicon includes phonologically null elements that are semantically similar to \textit{Past} and \textit{Pres} in Priorian tense logic, and that these
elements stand in a certain relation with tense morphemes. In effect, what Stowell does is to claim that what we have been calling 'tenses' should be decomposed into two parts; the tense morphemes that do not carry any temporal information and the phonologically null elements that have information about temporal location.

Under this theory, what we see as the past tense morpheme, for instance, corresponds to either just the past tense morpheme itself or a combination of the morpheme and the past operator. In this sense, this is a theory that treats the past tense as ambiguous. Recall the discussion in Chapter 1: we have concluded that the ambiguity thesis in some form or another is inevitable. Technically speaking, however, what strictly corresponds to the past tense morpheme in Stowell's theory is not ambiguous. Stowell's theory derives the ambiguity from a syntactic condition imposed on it that restricts occurrences of the past tense morpheme without an accompanying past operator.

We follow Stowell and argue for this line of explaining the SOT phenomena. Unlike Stowell, however, we argue that the tense morphemes are time variables along the lines of Partee (1973), Enç (1987), and Abusch (1997a). Here is a summary of the proposal:

(i) Predicates have an extra argument slot for a time. It is an argument more external than individual arguments.

(ii) Tense morphemes are time variables that saturate the time argument slot of predicates. This means that tense morphemes themselves do not contribute to the meanings of anteriority or simultaneity.

(iii) The meanings of anteriority and simultaneity come from phonologically null elements that stand in a certain relation with tense morphemes. These elements give the ordering between event times and evaluation times.

(iv) The evaluation times are also represented in the object language with a phonologically null time variables, which we call the distinguished variable.
Following Stowell, we will use the lower case past and pres for the past and present tense morphemes and the upper case PAST and PRES for the past and present operators.

Specifically, we propose the denotations below for ‘one-place predicates’ like go-to-Boston, the past tense morpheme past, a phonologically null past tense operator PAST, and the variable that serves as evaluation time $t^*$, which we call the distinguished variable.

The system we assume is an intensional one. This means that predicates have another extra argument for a world. We assume that world arguments are not represented in LF syntax, unlike time arguments.

\[(20)\]
\begin{enumerate}
\item \[[\textit{go-to-Boston}]\]_{g,c} = f: D_{e} \rightarrow D_{<i,st>}
For all $x \in D_{e}$, $t \in D_{i}$, and $w \in D_{s}$, $f(x)(t)(w) = 1$ iff $x$ goes to Boston at $t$ in $w$
\item \[[\textit{past}_i]\]_{g,c} = g(i)^5
\item (To be revised)
\[[\textit{PAST}]\]_{g,c} = f: D_{<i,st>} \rightarrow D_{<i,st>}
For all $p \in D_{<i,st>}$, $t \in D_{i}$, and $w \in D_{s}$, $f(p)(t)(w) = 1$ iff there is a time $t'$ such that $t' < t$ and $p(t')(w) = 1$
\item (To be revised)
\[[t^*]\]_{g,c} = \text{the speech time of } c, s^*
\end{enumerate}

Syntactically, tense morphemes and tense operators are elements of T. Simple tensed sentences such as Jen went to Boston have the following LF structure. Here again we assume free insertion of a lambda abstractor whenever compositionally necessary.

\footnote{Recall that \[[\textit{past}_i]\]_{g,c} = g(i) is an abbreviation of \[[\textit{past}_{i,c}]\]_{g,c} = g(i,$\tau$). The value assigned for the past tense morpheme is thus restricted to intervals of times.}
We assume the VP internal subject hypothesis. A subject generated inside the VP moves out of the VP for case reasons before LF. We will put it back in its original position for simplicity of compositional semantics whenever the undoing operation does not result in a semantic difference. As defined in the lexical semantics, the predicate \textit{go-to-Boston} is a function from individuals to properties of times. At the VP level, the subject saturates the individual argument position of the predicate, making it denote the property of times at which Jen goes to Boston. The past tense morpheme then saturates the time argument position of the predicate. It is bound by the past tense operator. We assume that the semantic value of a sentence is a proposition, a function from worlds to truth values, but that world variables are not syntactically realized.

The computation of the truth value of the LF in (21b) goes as follows:

\begin{equation}
[[t* [\text{PAST } \lambda i \text{ past}_i [\text{Jen go-to-Boston}]]]]_{\text{\Sigma C}}(w) = 1
\end{equation}

iff (by Functional Application, FA and lexical entry of $t^*$)
\[\text{[[\text{PAST } \lambda i \text{ pasti Jen go-to-Boston}]]}^{\mathcal{G},c}(s^*)(w) = 1\]

iff (by lexical entry of \([\text{[PAST]}]\))

\[\exists t' \text{ such that } t' < s^* \text{ and } \text{[[\lambda i \text{ pasti Jen go-to-Boston}]]}^{\mathcal{G},c}(t')(w) = 1\]

iff (by Predicate Abstraction)

\[\exists t' \text{ such that } t' < s^* \text{ and } \text{[[pasti Jen go-to-Boston]]}^{\mathcal{G}[i/t'],c}(w) = 1\]

iff (by FA)

\[\exists t' \text{ such that } t' < s^* \text{ and } \text{[[go-to-Boston]]}([[\text{Jen}}])([[\text{pasti}]])(t')(w) = 1\]

iff (by Pronoun Rule)

\[\exists t' \text{ such that } t' < s^* \text{ and } \text{[[go-to-Boston]]}([[\text{Jen}}])(t')(w) = 1\]

iff (by lexical entries of \([\text{[go-to-Boston]}]\) and \([\text{[Jen]}]\)

\[\exists t' \text{ such that } t' < s^* \text{ and Jen goes to Boston at } t' \text{ in } w.\]

The last line says that there is a time before the speech time at which Jen went to Boston. This correctly captures the intuitive meaning of the sentence.

According to this semantics of the past tense, it merely asserts the existence of a past time at which Jen goes to Boston. What about the context dependency effect that Partee's stove example shows? As we have seen in Chapter 1, context dependency does not necessarily contradict an existential treatment of tense. Let us assume, based on von Fintel's treatment of restriction on quantifier domains (von Fintel 1994), that the past tense operator, i.e., \text{PAST}, takes another argument, represented as \(C\) in syntax, whose value is determined by the context of utterance.
(23)  
\[
\begin{align*}
\text{a. } & \text{Jen went to Boston} \\
\text{b. } & \text{TP} \\
& \quad \text{t*} \\
& \quad \text{PASTC} \\
& \quad \text{\lambda i} \\
& \quad \text{pasti} \quad \text{VP} \\
& \quad \text{Jen go-to-Boston}
\end{align*}
\]

(24)  
\[
\begin{align*}
\text{a. } & [[\text{PAST}]] = f: D_{i,\text{st}} \rightarrow D_{i,\text{st} \times i,\text{st}} \\
& \text{For all } p, q \in D_{i,\text{st}}, t \in D_i, \text{ and } w \in D_s, f(p)(q)(t)(w) = 1 \text{ iff there is a time } t' \text{ such that } t' < t, p(t')(w) = 1, \text{ and } q(t')(w) = 1 \\
\text{b. } & [[\text{C}]]_{g,c} = f: D_i \rightarrow D_{s,t} \\
& \text{For all } t \in D_i, f(t)(w) = 1 \text{ iff } t \in tR, \text{ the salient set of times in } w \text{ given in } c
\end{align*}
\]

Suppose that the sentence is uttered while discussing who did what in the winter break. The LF in (23b), together with the semantics of the past tense and the free variable \(C\) above, yields the interpretation in (25).

(25)  
\[
[[\text{(23b)}]]_{g,c} = 1 \text{ iff there is a time } t \text{ such that } t < s^*, t \in \text{the set of times that are in the winter break, and Jen goes to Boston at } t \text{ in } w.
\]

This is the desired result.

Recall that this was not the only option we considered in Chapter 1 to account for the context dependency of tense interpretation. Context dependency can also be accounted
for by introducing the notion of 'reference time' as argued in Bäurele (1979), Hinrichs (1981), and Partee (1984). We have presented an implementation of this idea as follows: the tense operator takes an overt time variable as reference time whose value is given by an assignment function determined by a context c, and locates the event time of the predicate it 'modifies' within the reference time.

(26) a.     TP

       VP

       Past  tR

          Jen go-to-Boston

b. \[[\text{Past}]\]_{g,c} = f: D_i \rightarrow D_{<t,t>}

   For all t \in D_i and p \in D_{<t,t>}, f(t)(p) = 1 iff there is a time t' such that t' \subseteq t and p(t') = 1.

We will see in the following section that the former system has wider empirical coverage. Although this itself does not deny that natural language tense systems do not employ a system like the latter (in addition to the former), we will assume that all context dependency is derived by implicit restrictions on quantifier domains.

Now let us see how this theory explains SOT phenomena. We will first give an informal sketch of the analysis. The compositional semantics of the analysis will be presented in the sections that follow. Roughly speaking, the ambiguity of sentences like the following is attributed to whether the embedded clauses contain the past tense operator (i.e., \textit{PAST}) or not.

(27) Gordon said that Josephine was pregnant

   a. that past Josephine be pregnant
b. that PAST past Josephine be pregnant

(28) Eva talked to the boy who was crying
   a. who past be crying
   b. who PAST past be crying

When the embedded clauses do not contain the operator PAST as in the (a) representations, the sentence should have the simultaneous interpretation. When they do, as in the (b) representations, it should have the earlier-than-matrix interpretation. One question immediately arises. When can the past tense morpheme past occur without being bound by the PAST operator? Obviously, we want it to happen only when we find a vacuous past tense, such as embedded contexts like (27) and (28), but not in other cases. For instance, we do not want the matrix tense in these examples to be vacuous.

We assume with Ogihara (1989, 1996) and Stowell (1993) that there is a structural condition on occurrences of vacuous past tenses. We formulate it as follows:

(29) a. past has to be locally c-commanded by PAST
   b. a tense morpheme $\alpha$ is locally c-commanded by a tense operator $\beta$ iff there is no tense operator $\gamma$ such that $\gamma$ c-commands $\alpha$ and $\gamma$ is c-commanded by $\beta$.
   c. (i) Tense morphemes in English are past, pres, and nothing else
       (ii) Tense operators in English are PAST, PRES, and nothing else.

---

6 This condition and the condition on the present tense morpheme pres defined below are similar to what Stowell (1993) proposes. Kratzer (1998b) criticizes the stipulative nature of these conditions, and presents a more elegant analysis of tense semantics, drawing analogies between referential usage of tenses and 1st and 2nd person pronouns. Although I agree with Kratzer to a large extent, I was unable to incorporate her insights into our system without losing some core proposals concerning the relation between the tensed/tenseless distinction and explicit quantification over times. We will leave this issue for future research.
This condition makes all matrix past tenses true past tenses since all matrix clauses must contain a \textit{PAST} operator. And in embedded contexts, such as (27) and (28), the condition predicts that a vacuous past tense will be licensed since it is c-commanded by the matrix \textit{PAST} operator.

What about the present tense? One notable fact about the present tense in SOT languages like English is its indexical-like behavior when it is embedded under a past tense. In order to capture this, we propose the following semantics.

\begin{equation}
\text{(30) a. } [[\text{PRES}]]_{g,c} = f: D_{<i,st>} \rightarrow D_{<s,t>}
\end{equation}

For all \( p \in D_{<i,st>} \) and \( w \in D_{S} \), \( f(p) = 1 \) iff \( \exists t' \) such that \( t' \) overlaps \( t_c \) and \( p(t')(w) = 1 \)

\begin{equation}
\text{(30) b. } [[\text{presi}]]_{g,c} = g(i)
\end{equation}

\begin{equation}
\text{(31) } \text{pres has to be locally c-commanded by PRES}
\end{equation}

At this point, the proposed theory does not seem to be different from Ogihara's (1989, 1996) or Stowell's (1993, 1995a,b) theories especially as far as the SOT phenomena are concerned. The LFs we propose for sentences with the simultaneous interpretation, such as \textit{Gordon said that Josephine was pregnant}, are the same as what Abusch (1994, 1997a) proposes. The theory is nothing more than a hybrid of the contributions made by these three authors. This is because we believe the line taken by these authors concerning the SOT phenomena is basically correct, and we have little to contribute to this issue.

There are, however, two points in which we differ from these authors and these points make a crucial difference when we look at tense in relative clauses and temporal adjunct clauses, and temporal interpretations of tenseless expressions: first, both evaluation times and event times of predicates are explicitly represented in the LF syntax in this system. As we have seen in Chapter 1, this is one way in which we are enabled to account for the speech time dependency of tense in relative clauses. In the following section, we will
see a compositional semantic analysis based on the proposed tense system. But we have also seen a competing analysis of this effect proposed by Stowell (1993), Ogihara (1989, 1996) and others, namely a movement analysis within a single-index system. In § 2.1.4., we will discuss this issue and present arguments against a movement analysis.

Second, the analysis addresses the issue of explicit quantification over times in a limited way. It implies that there is a close connection between types of clauses and explicit quantification over event times. Specifically, the analysis says that tenseless expressions, such as bare VPs, denote properties of times with the time argument slot of the predicates unsaturated. Event times are only represented in the object language by tense morphemes. We will see in section 2.2. that this accounts for a semantic difference concerning the temporal interpretations between relative clauses and participle construction we saw in Chapter 1.

In the following section, we will see how the proposed system accounts for the observed properties of tense in relative clauses.

2.1.3. Tense in Relative Clauses: How is it Different from Tense in Clausal Complements?
We have observed four properties of tense in relative clauses in §2.1.1: (i) relative clauses can contain a vacuous past tense, (ii) the later-than-matrix interpretation is available for past tensed sentences containing a past tensed relative clause, (iii) past tensed sentences containing a present tensed relative clause yield the speech time interpretation, and (iv) the simultaneous interpretation is available with eventive predicates as well as stative predicates. The first property is shared by clausal complements and the latter three properties distinguish tense in relative clauses from tense in clausal complements of attitude verbs.

Let us start with the first property. We assume the standard analysis of relative clause modification. In such an analysis, a noun and the relative clause that modifies it form a constituent, and a determiner takes this constituent as its sister as shown in (32).
When an NP of this from is embedded as an object NP as in (33a), the tense in a relative clause is syntactically in the scope of the tense in the matrix clause, and therefore the condition on vacuous occurrences of the past tense is met. This means the sentence can have an LF where there is no past tense operator in the relative clause such as the following.
When the embedded past tense morpheme is bound by the matrix past tense operator (or more precisely the binder index on the operator), the sentence yields the simultaneous interpretation.
A vacuous past tense may be licensed when embedded more deeply as long as there is no intervening present tense operator. In examples like *Eva said that she would talk to a boy who was comforting a girl who was crying*, all three embedded past tenses can be vacuous; the past tense operator in the matrix clause licenses all three underlined past tenses since there is no other tense operator in between. (Note that the auxiliary *woll* is not a tense operator, hence does not count as an intervener.) When we replace *would* in the above example with *will*, then we lose an interpretation in which the girl's comforting time and the boy's crying time coincide with the time of future talking. This is due to the fact that *will* is present tensed; the present tense morpheme on *will* needs the present tense operator to be licensed. Therefore, the past tenses on both occurrences of *was* are no longer locally c-commanded by the matrix past tense operator. At least the past tense on *was comforting* needs its own past tense operator. Then this past tense morpheme is no longer vacuous. This explains why a certain interpretation is missing.

When a vacuous past tense is embedded in a clausal complement, things are a little different. If we assume that the past tense morpheme *past* in the embedded sentence of (34) is bound by the *PAST* operator in the matrix clause in the same way as in relative clauses such as (33), the resulting structure is uninterpretable.

(34) Gordon said that Josephine was pregnant

This is because of the semantics of verbs like *say*. As we have seen in § 1.5.1., verbs like *say* require an element of type \(<i,st>\) as their complement. We repeat the semantics of the verb *say* below:

(35) \([\text{[say]}] = f: D_<i<_s,t>> \rightarrow D_{<e<_i<_s,t>>>}

For all \(p \in D_{<_i<_s,t>>}\), \(t \in D_i\), \(x \in D_e\), and \(w \in D_s\), \(f(p)(x)(t)(w) = 1\) iff for all worlds \(w'\) and times \(t'\) that are compatible with what \(x\) says in \(w\) at \(t\), \(p(t')(w') = 1\)
Since the past tense morpheme *past* in the embedded clause saturates the time argument of the predicate *be-pregnant*, the resulting constituent denotes a proposition under our analysis. In order to resolve the type mismatch, we follow Abusch (1994, 1997a), Heim (1994) and others and assume that the past tense morpheme is bound by an operator in Comp as follows:

(36) a. 
\[ \begin{array}{c}
\text{TP} \\
\text{t*} \\
\text{PASTC} \\
\lambda i \\
past_i \\
\text{Gordon} \quad \text{V'} \\
\text{V} \\
\text{say} \\
past_j \\
\text{Josephine} \quad \text{V'} \\
\text{be pregnant}
\end{array} \]

This yields the right truth conditions:

\[ \text{7 They follow Chierchia (1989), who proposes a similar treatment for personal } \textit{de se} \text{ pronouns.} \]
b. \[ ((36a))^{g,c}(w) = 1 \] iff there is a time \( t \) such that \( t < s^*, t \in t_R \), and for all worlds \( w' \) and times \( t' \) that are compatible with what Gordon says in \( w \) at \( t \), Josephine is pregnant in \( w' \) at \( t' \)

Although a vacuous past tense is licensed in the same manner both in relative clauses and clausal complements, the analysis implies that its interpretation differs in the two types of clauses. In relative clauses, a vacuous tense is directly bound by a higher tense operator while in clausal complements, it is bound by a lambda operator.

What happens when embedded past tenses are not vacuous? We have seen that tense in relative clauses can behave as if it is not embedded. It has access to the original evaluation time just like the tense in matrix clauses. The speech time dependency of embedded past tenses follows from the proposed tense system with explicit quantification over times. In such a system, each occurrence of the past tense operator, whether embedded or not, can have its own evaluation time syntactically realized as a time variable, which can be interpreted as denoting the speech time. For instance, the sentence in (37a) has the LF in (37b).
(37)  a.  Hillary married a man who became the president

b.  

   TP

      t*  

     \hline

    PASTC₁

       \hline

      \lambda_i

      past_i  VP

         \hline

     Hillary  V'  

            V  NP

               l  

      marry  a  N'

          \hline

     man  CP

        \hline

     whok  TP

        \hline

      t*  

     \hline

    PASTC₂

       \hline

      \lambda_j

      past_j  VP

         \hline

     tk  V'

        \hline

     V  NP
become the president

Even though the second occurrence of the past tense in the above structure is syntactically in the scope of the matrix past tense, it is semantically independent of the interpretation of the matrix tense. This is because the distinguished variable \( t^* \) is indexical and it gets the same value irrespective of where it appears. As a result, the event time of the matrix predicate and that of the embedded predicate are ordered only with respect to the speech time (namely, they have to precede the speech time) but not with respect to each other. Thus, any order between the two is allowed, predicting that the earlier-than-matrix, simultaneous, and later-than-matrix interpretations are all available.

Sentences like (33a) can receive a different structure, a structure like (37) with a true past tense in the relative clause. This would yield a distinct interpretation. Unlike the sentence in (37), however, the later- or earlier-than-matrix interpretations are difficult to get for the sentence in (33) when it is uttered out of the blue. This is because (i) past progressive in general strongly need a past reference time, and (ii) there is no past reference time that the speaker can assume that the hearer shares. The point in (i) is responsible for the following contrast.

\[
\text{(38) } \begin{align*}
\text{a. } & \# \text{ Bill was crying} \\
\text{b. } & \text{A: I saw Bill this morning.} \\
& \text{B: What was he doing?} \\
& \text{A: He was crying}
\end{align*}
\]

A's response to B in (38b) is understood to mean that Bill was crying when A saw him this morning. The context dependency of this sort is derived by the variable \( C \).

\[
\text{(39) } \begin{align*}
& t^* [\text{PAST}_C \lambda i [\text{past}_i [\text{he be crying}]]]
\end{align*}
\]
Since our proposal is that tense in relative clauses can be interpreted in the same way as tense in unembedded clauses, the context dependency of sentences like the following is derived in the same way, too.

(40)  
   a. Eva talked to the boy who was crying  
   b. \( t^* [\text{PAST}C_1 \lambda i \text{[past}_i \text{[Eva talk to the boy [whoj [t* [\text{PAST}C_2 \lambda k \text{[past}_k t_j be crying]]]]]]}] \)

The embedded past tense in (40b) is anchored to a contextually salient interval. It could be after, before, or at the same time as the matrix event time.

The following examples show that when the speaker and hearer share relevant background, it is not too hard to anchor past progressives to a time that is different from the matrix event time.\(^8\)

(41)  
   a. Who hired that young reporter who was filing false reports?  
   b. The student who was sitting in my class arrived by bus and left by car with a friend

When describing temporal interpretations of relative clauses, we have used the terms simultaneous, earlier-than-matrix, and later-than-matrix interpretations. According to the proposed analysis, however, past tensed sentences with a past tensed relative clause are only two-ways ambiguous as far as temporal interpretations are concerned. Embedded past tenses can be true past tenses or vacuous ones. When they are vacuous, the sentences yield the simultaneous interpretation. When they are not, their interpretations are independent of matrix tenses. This yields the earlier-than-matrix, later-than-matrix, and even simultaneous interpretations depending on the contexts. This means that the earlier-than-matrix and later-

\(^8\) The examples are due to Barbara Partee (p.c.).
than-matrix (and some of the simultaneous) interpretations are not distinct interpretations resulting from structural ambiguity. When embedded past tenses are true past tenses and anchored to the speech time, the semantics of the past tense does not specify when with respect to the matrix event time the embedded event time is located. So the terms may be misleading. We will continue to use these terms, though. They should be understood as theory neutral, descriptive terms that describe different situations compatible with the truth conditions of the relevant sentences.

We have seen that the proposed system naturally accounts for the fact that tense in relative clauses behaves like it is not embedded. In our system, each tense operator, whether embedded or not, is evaluated with respect to an overtly realized time variable. Therefore, as far as the semantic interpretation goes, embedding one tense in the scope of another does not alter the interpretation of the embedded tense.

When a true past tense is embedded under clausal complements, we face the same problem that we did with a vacuous past tense. If the embedded clause in the following sentence has the same structure as root clauses, i.e., structures like (43), it cannot be embedded under verbs like *say*. That would result in uninterpretability because of type mismatch: the TP below denotes a proposition, i.e., of type <s,t> while the verb *say* wants a property of times, i.e., an element of type <i,st>.
(42) Gordon said that Josephine was pregnant

(43) \[
\begin{array}{c}
\text{TP} \\
\text{t* TP} \\
\text{PASTC} \\
\lambda i \\
past_i \text{ VP} \\
\text{Josephine V'} \\
\text{be pregnant}
\end{array}
\]

This means that we have to allow the variable \(t^*\) to be bound by a lambda operator in certain environments. When it is, the entire clause denotes the property of times after which

\[\text{Another possibility is to embed a lower TP in (43), which is of the right type for embedding. This solution does not work when we consider more complex structures such as (ib):}\]

(i) a. Hillary married a man who became the president
   b. Susan said that Hillary married a man who became the president

We argued that the two past tenses in sentences like (ia) may be evaluated with respect to the speech time by means of explicit quantification over times. When such sentences are embedded in a clausal complement as in (ib), we can obtain an interpretation in which both evaluation times are the subject's 'now' rather than the speech time. Under the system proposed above, i.e., a system in which the evaluation time of each tense operator is represented in the syntax as the distinguished variable, and get bound by the lambda operator, we can easily account for this interpretation by binding both occurrences of the distinguished variable. The other option, i.e., a system where structures like the lower TP in (43) are embedded under a propositional attitude verb, runs into a problem. This is because of the tense interpretation of the relative clause. If the evaluation time slot of the past tense operator in the relative clause is saturated by the distinguished variable, it denotes the speech time since there is nothing to bind it in the Comp of the attitude verb. If we leave it unsaturated, the most embedded past tense is evaluated relative to the next higher tense, i.e., the past tense on the verb marry. This yields the earlier-than-marrying-time interpretation. Thus, there is no way to derive the interpretation we are after in the latter system, except by moving (some constituent that contains) the most embedded past tense over the intermediate past tense. We will see arguments against a movement analysis like this in § 2.1.4.
Josephine is pregnant. And this will yield the earlier-than-matrix interpretation when embedded as in (42). This means that we can no longer stick to the denotation of the distinguished variable \( t^* \) as defined.

(44) \[ [[t^*]]_{g,c} = \text{the speech time of } c, s^* \]

If \( t^* \) is indexical in nature as above, it cannot be bound. We follow Heim (1994) and von Stechow (1995a) and revise the denotation as follows:

(45) The variable \( t^* \) may be bound in an intensional context.

When it is bound, \[ [[t^*]]_{g,c} = g(i) \]

When it is free, \[ [[t^*]]_{g,c} = \text{the speech time of } c, s^* \]

Under this analysis, the unavailability of the later-than-matrix interpretation is predicted. In order to derive the later-than-matrix interpretation, the evaluation time of the embedded clause cannot be bound, resulting in ungrammaticality. This difference between relative clauses and clausal complements follows from the semantics of verbs like *say* and *believe*, and compositionality.

The issue of compositionality in clausal complements may give us a clue as to how the natural language tense system encodes context dependency. Recall the two systems of context dependency we considered. One relies on the domain restriction variable \( C \) as in (46a), and the other relies on the reference time variable as in (46b).
Neither structure can be embedded in a clausal complement of an attitude verb such as *believe* and *say* as it stands. The denotation of the TP is of the wrong type. We suggested the possibility of binding the distinguished variable $t^*$ in (46a) above. What should we do if we are to adopt strategy (b) for context dependency? We may change the status of the reference time variable, and make it possible in certain environments to bind it. But this does not give us a past-relative-to-future interpretation. In the (b) system, the operator *Past* is not a shifting operator.

Another problem of the (b) system concerns the derivation of context dependency in future contexts. Consider the following example in the following situation: I am going to call David tomorrow. Maybe he is home, maybe not. If he is not, I am going to ask him, the next time I see him, where he was when I called. My guess is that he will say something like "I was out of town." The clausal complement of the sentence *David will say that he*...
was out of town receives the following LFs under the two different theories of context dependency.

(47) David will say that he was out of town
   a. \( t^* \text{ PAST}_C \) he be-out-of-town
   b. [\( t_R \text{ Past} \)] he be-out-of-town

In the (b) system, context dependency of the past tense is due to the value assigned to \( t_R \). However, since the calling event has not happened yet at the speech time, there is no assignment function determined by the speech context that can assign an appropriate value to the free variable \( t_R \). In the (a) representation, on the other hand, this problem does not arise. The denotation of \( C \) given by the speech context is the set of time at which I call. Under the situation described above, this set is made salient, which correctly predicts the context dependent reading of the sentence.

This argument shows that in future contexts such as the example above, we need a system in which context dependency is derived through an implicit restriction on quantifier domains. The system is able to account for context dependency in all contexts in a uniform manner. Therefore, we assume this system for context dependency, although we are unable to show that the other system is not employed.

Let us now come back to differences between relative clauses and clausal complements. A second difference we observed was the effect of the eventive vs. stative distinction. Why don't sentences like the following have the simultaneous interpretation?

(48) a. Ana believed that Deanna baked a cake for her
   b. Gordon said that Josephine got pregnant
In order to receive the simultaneous interpretation, the embedded clause has to have a vacuous past tense. For instance, the sentence (48a) should have the LF in (49a) with the truth conditions in (49b).

(49) a. \( t^* \) PAST \( \lambda i \) past_\( i \) Ana believe \( \lambda j \) past_\( j \) Deanna baked a cake for her

b. \([[(49a)]]^{\lambda i \lambda j}\) = 1 iff there is a time \( t \) such that \( t < s^* \) and for all worlds \( w' \) and times \( t' \) that are compatible with what Ana believes at \( t \) in \( w \), Deanna bakes a cake for her at \( t' \) in \( w' \)

According to these truth conditions, in order for this sentence to be true, it has to be the case that Deanna bakes a cake at every moment compatible with what Ana believes. Since baking a cake cannot be accomplished in a moment, the sentence cannot be true. This line of explanation is not new: it has been given to account for why simple present tensed sentences like the following cannot have an interpretation where the event of cake-baking is understood to be an on-going event at the speech time. (See Bennett and Partee 1972, Rothstein 1997.)

(50) Deanna bakes a cake

If this explanation as to why eventive predicates are often not compatible with the simultaneous interpretation is on the right track, we do not need an independent principle to prohibit a vacuous tense in these contexts. And perhaps we should not have such a principle. Recall that there are at least two kinds of exceptions, cases where perception verbs embed clausal complements and cases where the so-called reporter's present is embedded. (See the discussion in § 2.1.1.) Gennari's (1997, 1999a) position can be taken as a proponent of such a principle. She argues that there are no vacuous past tenses in English, based on the generalization that the simultaneous interpretation is not available with eventive predicates. According to Gennari, past under past constructions like the following
are not ambiguous. Truth-conditionally, they only have the earlier-than-matrix interpretation.

(51)  a. John believed that Mary was pregnant
     b. John believed that Mary baked the cake

But this goes against our intuition; we judge the sentence (51a) to be true when what John believes is something like "Mary is pregnant". Gennari argues that this is derived from what she calls the super-interval property of stative predicates and predicates with a progressive marker. When a stative predicate is true at an interval i, it may be true at a proper super interval i’ of i. This is not true of eventive predicates. Therefore we have the following contrast:

(52)  a. Mary was pregnant (when I saw her last week). She is still pregnant now
     b. Mary baked a cake. #She is still baking the cake now.

Gennari argues that this difference regarding a super-interval property is what is responsible for our intuition about sentences like (51a).

Under our analysis, the general unavailability of the simultaneous interpretation with eventive predicates follows from the semantics of verbs like believe and say. Our analysis also predicts that the simultaneous interpretation with eventive predicates is not banned semantically. Thus, our analysis correctly leaves room for explaining the availability of the simultaneous interpretation in perception constructions and 'exceptional' cases with attitude verbs.

This kind of restriction on eventive predicates is not found in relative clauses. When both tenses are anchored to the speech time in sentences like the following, the order between the two event times is not given by the semantics. This means that they could accidentally coincide.
(53) Nancy filmed a woman who parachuted into the campus pond

Lastly, the speech time interpretation of a past tensed sentence containing a present tensed relative clause is derived in the following way. In the sentence (54a), the present tense morpheme on the verb *is* has to be licensed. Since the matrix clause is past tensed, the licensing has to be done clause internally. This means that there is a present tense operator *PRES* in the relative clause. We have proposed that *PRES* is inherently indexical. This automatically gives the speech time interpretation irrespective of syntactic scope.
(54) a. Eva talked to the boy who is crying

b. 

```
TP

\( t^* \)

PASTC

\( \lambda_i \)

\( \text{past}_i \quad \text{VP} \)

\( \text{Eva} \quad \text{V}' \)

\( \text{V} \quad \text{NP} \)

\( \text{talk-to the} \quad \text{N}' \)

\( \text{boy} \quad \text{CP} \)

\( \text{whok} \quad \text{TP} \)

\( \text{PRES} \)

\( \lambda_j \)

\( \text{pres}_j \quad \text{VP} \)

\( \text{tk} \quad \text{V}' \)

be crying
```
This analysis has an important implication for the present under past constructions such as the following. We predict that the sentence should have an LF like (55b) and that this LF is not interpretable.

(55) a. John believed that Mary is pregnant
b. t* PAST λi pasti John believe [PRES λj presj Mary be pregnant]

This is because the embedded clause is of the wrong type. The verb believe takes a constituent of type <i,st> but the embedded clause is of type <s,t>. The fact is that some native speakers find sentences like this unacceptable as reported in Kratzer (1998). But not everybody dislikes sentences like this. And those who accept them agree that these sentences have a special interpretation called the double-access interpretation. It has often be assumed that the sentence should mean something like the following: John believed that Mary was pregnant (at the time of his belief) and Mary is still pregnant now. Ogihara (1989, 1995a, 1996) and Abusch (1991, 1994, 1997a) claim that this is not correct. The sentence can be true when John was wrong about Mary's pregnancy and Mary is not pregnant in this world at any time. Here is Abusch's scenario to show it. Suppose that Mary had been overeating and had gained a lot of weight. As a consequence, when John looks at her he comes to believe that she is pregnant. If Mary keeps her weight up to the present moment, we could truthfully utter the sentence (55a) to report John's belief. Ogihara and Abusch propose a way to derive such an interpretation: tenses can sometimes be understood de re. In what follows, we will present a de re analysis of the present tense along these lines. The LF for a de re interpretation of the present tense we assume is something like the following.\(^{11}\)

\(^{11}\) Kyle Johnson (p.c.) correctly pointed out that this structure violates the licensing condition on pres: PRES does not locally c-command pres due to the presence of PAST between the two. We assume that the trace of tense operators can serve as a licensor.
We assume, following Heim (1994), that verbs like \textit{believe} take an extra argument that is the \textit{res} of the appropriate attitudes. The present tense operator is moved out of the complement.
clause to the *res* position of the matrix verb and then moved again to the sentence initial position. The denotation of such verbs is something like this:

\[(56)\]

\[\begin{align*}
&\text{a.} \quad [\text{[believe-of]}] = f: D_i \rightarrow D_{<i,\text{st}><e<i<s,t>\text{>>>}} \\
&\quad \text{For all } p \in D_{<i<s,t>\text{>>, } t \text{ and } t' \in D_i, x \in D_e, \text{ and } w \in D_s, f(t')(p)(x)(t)(w) \text{ is} \\
&\quad \text{only defined when there is an acquaintance relation } R \in D_{<i,e,<i,s,t>>} \text{ such} \\
&\quad \text{that } R(t')(x)(t)(w) = 1. \\
&\quad \text{When defined, } f(t')(p)(x)(t)(w) = 1 \text{ iff for all worlds } w' \text{ that are compatible} \\
&\quad \text{with what } x \text{ believes in } w \text{ at } t, p(t'[R(t')(x)(t)(w)])(w') = 1 \\
&\text{b.} \quad R = f: D_i \rightarrow D_{e<i,s,t>\text{>>>}} \\
&\quad \text{For all } t \text{ and } t' \in D_i, x \in D_e, \text{ and } w \in D_s, f(t')(x)(t)(w) = 1 \text{ iff } x \text{ is} \\
&\quad \text{acquainted with } t' \text{ via an appropriate description at } t \text{ in } w.
\end{align*}\]

The semantics of *de re* attitude is based on Lewis (1979) and Cresswell and von Stechow (1982). In order to have a *de re* belief, the subject has to have a certain relationship with the *res*. In the above scenario, John was acquainted with the time of Mary's being fat by looking at her and forming a belief that she was pregnant at that time. This time is the *res* of John's belief, and the semantics requires that it overlap the speech time, resulting in the double-access effect.

\[(57)\]

\[g_{\text{c}}(w) \text{ is defined iff } x \text{ is acquainted with } g(t_k) \text{ at } g(t_i) \text{ in } w.\]

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12 We choose to derive a *de re* interpretation in this way since it best respects compositionality. Constructing an appropriate LF for a *de re* interpretation in this way, however, creates a few syntactic problems. First, we have to assume movement into an argument position. Second, this movement has to be immune to island constraints since a *de re* interpretation is possible out of *wh*-complements. Kratzer (1998b) presents a solution to these problems based on her analysis of attitude verbs in Kratzer (1998a). She argues that verbs like *believe* take an event or situation variable, and that this event or situation variable is understood as the *res*. See Kratzer (1998b) for details.
When defined, \( \lbrack (55c) \rbrack^c_\mathcal{E}(w) = 1 \) iff there is a time \( t \) such that \( t \) overlaps \( s^* \) and there is a time \( t' \) such that \( t' < s^* \) and for all \( w' \) that are compatible with what John believes in \( w \) at \( t' \), Mary is pregnant at the unique time that John is acquainted with through the acquaintance relation \( R \) at \( t' \) in \( w \) in \( w' \).

If this is the correct analysis of the present under past constructions such as (55a), we expect this operation to be available for the past tense, too. If it were, the embedded past tense could be evaluated with respect to the speech time, which would make the later-than-matrix interpretation possible. So are \textit{de re} interpretations of the past tense prohibited in the grammar?

We argue that the later-than-matrix interpretation is in principle possible in clausal complements of attitude verbs, and therefore, introducing a \textit{de re} mechanism like the one above does not create a problem. We have already seen examples where the later-than-matrix interpretation in clausal complements of attitude verbs is possible, examples like the announcer said that the Red Sox play tomorrow and the woman said that the bus left at 3:00. We suggested that this fact is related to the fact that present tensed sentences can sometimes have a futurate interpretation, as in the Red Sox play tomorrow and the bus leaves at 3:00. Suppose that the later-than-matrix interpretation is only possible when embedded sentences have a futurate interpretation in isolation. This explains why sentences like Gordon said that Josephine was pregnant do not have the later-than-matrix interpretation: the sentence Josephine is pregnant does not have a futurate interpretation. If an explanation along these lines is on the right track, we predict that in situations where the sentence Josephine is pregnant has a futurate interpretation, it is possible to get a later-than-matrix interpretation for sentences like \( X \) said that Josephine was pregnant. Suppose that Josephine went to see a fortune teller to see if she can get a pregnant soon, and if so when. Looking into the crystal ball, the fortune teller says, "you are pregnant next month." In this situation, we can truthfully report what the fortune teller said by the sentence The fortune teller said that Josephine was pregnant next month.
This is only half of the story: there is another question to be answered. Suppose Gordon said, "Josephine will be pregnant." Why can't we truthfully report his utterance by the sentence Gordon said that Josephine was pregnant? We argue that the absence of the later-than-matrix interpretation in this case should be derived by the semantics of the future. The line of reasoning we want to pursue is hinted at in the discussions in Dowty (1979) and Abusch (1994, 1997a) and by the claim often made in the literature that the future will and would are not tense but modal elements. Abusch argues that there is a fundamental difference between how we view past events and future events. At a certain point in the history of the actual world, say 4:23 PM, March 15, 1999, the past is determinate, but the future is not. It is a fact that I was drinking coffee in front of my computer a minute ago. Nothing is a fact yet as to what I will be doing a minute later. I might still be sitting in front of my computer, or I might be talking to Mako on the phone, or I might be out in the garden. The tense semantics given in Priorian tense logic or any variant of it captures neither that the past is determinate but the future is not nor that the future is a modal operator. In the following semantics of the past and the future, they are treated differently only with respect to the temporal ordering.

\[(58)\] Where \(\varphi\) is a tenseless sentence,

\begin{enumerate}
\item[[\text{Past } \varphi]]^t = 1 \text{ iff there is a time } t' \text{ such that } t' < t \text{ and } [[\varphi]]^{t'} = 1
\item[[\text{Fut } \varphi]]^t = 1 \text{ iff there is a time } t' \text{ such that } t' > t \text{ and } [[\varphi]]^{t'} = 1
\end{enumerate}

Instead, we propose the following semantics of the future auxiliary based on Dowty (1979). We will call the future auxiliary \textit{woll} following Abusch (1988). The English future auxiliaries \textit{will} and \textit{would} are present tensed and past tensed realizations of this auxiliary.

\footnote{The notion of 'normal' continuation worlds is introduced in Dowty (1979) for the semantics of progressives.}
(59) \[
\text{[[will]]}^\text{Gl} = f: \text{D}_{\text{<s,t>}} \rightarrow \text{D}_{\text{<s,t>}}
\]

For all \( p \in \text{D}_{\text{<s,t>}} \), \( t \in \text{D}_{\text{s}} \), and \( w \in \text{D}_{\text{s}} \), \( f(p)(t)(w) = 1 \) iff for all 'normal' continuation worlds \( w' \) of \( w \) from \( t \), there is a time \( t' \) such that \( p(t')(w') = 1 \)

This semantics treats \textit{will} as a universal quantifier over worlds. It quantifies over all the worlds that are possible future worlds given what is going on in the evaluation world at the evaluation time. Given that I am sitting in front of my computer in my room (and other principles that this world is based on), it is possible that I am still sitting in from of my computer, talking to Mako on the phone, or out in my garden a minute later. But it is not possible that I am on campus, or I have my thesis done a minute later.

Let us say a few words about 'normal' continuation worlds. We do not want to quantify over all possible continuation worlds: we want to restrict these worlds to just expected ones. If we quantify over all continuation worlds in saying something like \textit{this plane will arrive in Osaka at 4:25 PM}, the sentence will never be true. In perhaps more than a few continuation worlds, the arrival is delayed. Or worse, in some of the continuation worlds it does not arrive in Osaka at all given the frequency of air accidents. So in uttering a sentence with a future auxiliary, we only make a commitment, assuming that nothing unexpected happens.

With this semantics of \textit{will}, the truth conditions of the sentence (60a) will be (60b)

(60) a. I will be exhausted
b. \( t^* \) \[ will \lambda_\text{i} [\text{pres}_\text{i} \text{ be exhausted}] \]
c. \[ \text{[[(60b)]]}^\text{Gl}(w) = 1 \text{ iff for all continuation worlds } w' \text{ of } w \text{ from } s^*, \text{ there is a time } t' \text{ such } t^* < t' \text{ and that I am exhausted at } t' \text{ in } w' \]

Now consider how we derive a \textit{de re} interpretation of the embedded past tense in the following example. The sentence has the LF (61b) before movement. In order to get a \textit{de
interpretation for the embedded past tense, it has to move together with its evaluation time. Under the particular tense system we are assuming, the past tense operator and its evaluation time $t^*$ are not a constituent, and therefore cannot undergo a res movement.

(61) a. I said that I was exhausted
    b. $t^* \text{ PAST} \lambda i \text{ past}_i \text{ I say } [t^* \text{ [PAST } \lambda j \text{ past}_j \text{ I be exhausted}]]$

Perhaps this is why the embedded past tense cannot receive a de re interpretation and this is why the later-than-matrix interpretation is not available in clausal complements. But what if they are a constituent? If we could have a de re interpretation for the embedded past tense, we would get truth conditions like those in (62). We would predict the availability of the later-than-matrix interpretation.

(62) There are times time $t$ and $t'$ such that $t < s^*$ and $t' < s^*$, and for all worlds $w'$ that are compatible with what I say in $w$ at $t$, I am exhausted at $t'$ in $w'$

We would like to argue that interpretations like (62) do not have to be excluded. There is an independent reason why we cannot use the sentence (61a) to report my utterance "I will be exhausted": the original utterance contains universal quantification over worlds, and that information is missing from the report. It is simply not a true report. This is analogous to the fact that (64) cannot be used to report Tom's beliefs if what he believes is (63a) or (63b).

(63) a. Karen may be a good dancer
    b. Karen must be a good dancer

(64) Tom believes that Karen is a good dancer
The sentence (64) is perfectly grammatical and it has an interpretation in which Tom locates himself at a time at which Karen is a good dancer. But it cannot truthfully report a belief like (63). For the same reason, we cannot report utterances like *I will be exhausted* by sentences like *I said I was exhausted*.

We have seen how the proposed tense system accounts for the properties exhibited by tense in relative clauses. The analysis of tense interpretation in relative clauses presented here has a lot in common with the analysis offered in Enç (1987) in that the independence of the tense in relative clauses does not rely on syntactic scope. In the following section, we present arguments for this view. That is, the tense interpretation mechanism should be such that the tense in relative clauses may be evaluated independently even when it is syntactically in the scope of higher tenses.

2.1.4. Against a Single-Index System

Ladusaw (1977) and Dowty (1982) notice that the semantics of tense in traditional tense logic such as (65) does not give all the possible interpretations of tense in relative clauses.14

\[(65) \text{ Where } \varphi \text{ is a tenseless sentence,} \]

\[\begin{align*}
[[\text{Past } \varphi ]]^t = 1 & \text{ iff there is a time } t' \text{ such that } t' < t \text{ and } [[\varphi ]]^{t'} = 1
\end{align*}\]

This semantics of the past tense predicts that when a past tense is embedded under another tense, the second past tense places the event time of the embedded predicate prior to the event time of the matrix predicate, predicting that only the past-shifted interpretation is possible. The simultaneous reading may be obtained as the result of applying a sequence of tense rule since English is an SOT languages. What the theory does not predict is the availability of the later-than-matrix interpretation.

14 The same criticism applies not only to traditional tense logic but also any variant of it such as Ogihara (1996) and Stowell (1993).
Ladusaw (1977) argues that Montague grammar offers an appropriate device to
generate the later-than-matrix interpretation, namely quantifying in. Instead of discussing
how it works in Montague grammar, however, we will discuss an equivalent proposal made
in Ogihara (1989, 1996) and Stowell (1993) within recent Chomskian syntactic theory.
Ogihara and Stowell propose that the later-than-matrix interpretation is rendered by moving
the object noun phrase together with the relative clause out of the scope of the matrix past
tense by means of movement such as quantifier raising (QR) of May (1977). Thus the
sentence in (66a) receives an LF representation like (66b) after QR.

(66)  

   a. Eva talked to a boy who was crying
   b. [a boy who was crying] [Ev]a talked to ti

The past tense in the relative clause is no longer in the scope of the matrix past tense, and
thereby it is interpreted relative to the original evaluation time, the speech time. The event
time of the relative clause is only ordered with respect to the speech time, but not with
respect to the matrix event time, predicting the possibility that it may be after the time of the
matrix event.

There are a number of objections against a movement analysis. First, the
movement analysis of the later-than-matrix interpretation predicts a correlation between the
interpretation of tense in relative clauses and the scope of the NPs heading those relative
clauses. Given that NPIs must be in the scope of negative elements, the later-than-matrix
interpretation should be unavailable in the examples below. The prediction is not borne out.

(67)  

   a. None of our sales people sold insurance to anybody who was on that plane
   b. I didn't hire anybody who put on a terrible performance. (Therefore I'm not
      responsible for the failure of that play.)

---

15 See also Matsuo (1996).
Suppose that the (a) sentence is uttered by the president of an insurance company after a plane crash and that the (b) sentence is uttered by a director of a TV drama. The sentences must have the later-than-matrix interpretation in these contexts. If the later-than-matrix interpretation is derived by moving an NP that contains the relevant past tense outside the scope of the matrix past tense, the NPIs in these sentences are not in the scope of a negative element, and therefore these sentences should be ungrammatical. One might argue that in (67a) the indirect object NP anybody ... is moved somewhere above the TP but still below the subject or that the object NP is moved above the subject but the subject itself is subsequently moved above it. In (67b), one might argue that the hierarchical structure of the inflectional phrases is such that NegP dominates TP, contrary to the standard assumption about the phrase structure of English. If so, the object NPs could sit somewhere between NegP and TP so that the NPI and the later-than-matrix interpretation are licensed at the same time.

Consider the following example, however.16,17

(68)  a. I tried not to hire anybody who put on a terrible performance  
     b. She failed to talk to any prospective student who (later) decided to come to UMass

In these examples, if the object NPs are moved above the matrix TP to get the later-than-matrix interpretation, the movement will necessarily take them out of the scope of the negative element.

16 I thank Danny Fox for suggesting use of the phrase *try not to*.

17 Some native speakers do not like example (a). To get the relevant interpretation, they require a partitive like *any of those who put on a terrible performance*. Since this change will give proponents of a movement analysis a possible explanation to get the later-than-matrix interpretation, namely, to raise the phrase *those who put on a terrible performance*, we did not make the suggested change. Those who do not like the (a) example do accept the (b) example, which establishes the same point.
Another case of scope interaction is between two quantified NPs. Consider the following examples with the later-than-matrix interpretation of the most embedded predicate with respect to the highest verbs. (The later-than-matrix reading is forced due to the presence of just and later.)\textsuperscript{18,19}

(69)  
\begin{align*}
\text{a.} & \quad \text{Bob believed that both (of the) unicorns liked most students who just left} \\
\text{b.} & \quad \text{Katy said that every Kennedy brother at the party kissed most female astronauts who later landed on the moon}
\end{align*}

Under a movement analysis, the later-than-matrix reading is rendered by moving the object NPs, most students... and most women... out of the complement clauses, higher than the matrix past tense. First of all, QR is supposed to be clause-bound. So in order for this story to work, we need to make these cases exceptions. But suppose we do so. A movement analysis predicts that both cannot take scope over most under the following scenario: Bob was under the misconception that unicorns exist and that his neighbor kept two unicorns, Johnny and Billy. There are three students Pius, Steve and Paul, who just left. Moreover, Bob believed that unicorn Johnny liked Pius and Steve, and unicorn Billy liked Steve and Pius. Of course, I, the speaker of the sentence, know that unicorns do not exist and think that Bob is crazy having a belief like that. So the situation is as sketched in (70).

(70) \quad \begin{array}{c}
\text{Johnny} \\
\text{Billy} \\
\text{Pius} \\
\text{Steve} \quad \text{Paul}
\end{array} \quad \leftarrow \text{like-relation}

\text{just left}

\textsuperscript{18} The examples are suggested by Ana Arregui (p.c.).

\textsuperscript{19} Again, some native speakers do not like the sentences and suggested to change the most embedded NPs into partitives.
To obtain the later-than-matrix reading, QR must move the object NP, *most students*... outside the complement clause (i.e., outside the domain of the matrix tense). In order for the embedded subject NP to take scope over the object NP, it has to move to a place higher than the object NP. This is impossible since the reading we are trying to get is an opaque reading for *both (of the) unicorns*. Yet, the sentence is judged true in the above situation. This shows that the quantifier *most* takes narrower scope than *both*: each of the two unicorns liked most students who just left, but only one student out of three was liked by both unicorns. Similarly for (69b).

The following examples also demonstrate the same point.20

(71) a. Every faculty member failed to talk to a prospective student

The (a) sentence is three-ways ambiguous. It may mean (i) that there is a prospective student that no faculty member talked to, or (ii) that for each faculty member there is a (possibly different) prospective student s/he didn't talk to or (iii) that no faculty member talked to any prospective student. These three readings correspond to the widest, intermediate, or the narrowest scope of the indefinite *a prospective student*. Now consider the (b) sentence below under the following situation21: every spring, the UMass linguistics department holds an open house for prospective students. Faculty members talk to them and try to convince them to come to UMass. The faculty member who recruits the most students gets a prize.

b. Every faculty member failed to talk to a prospective student who (later) decided to come to UMass. So nobody got a prize this year.

---

20 Inspired by a similar example discussed in Heim (1991).

21 I thank Mike Terry for suggesting this situation.
The movement analysis predicts that the third interpretation is not available for this sentence. This is because to get the later-than-matrix interpretation, the object NP *a prospective student* ... has to move to a position higher than the matrix tense. This movement necessarily takes the object outside the scope of the verb *fail*. The prediction again is not borne out.

Second, the movement analysis predicts island effects.

(72)   a. John tried not to hire anybody who hired the writers who wrote the article in yesterday's paper
       b. Lisa was looking for an exterminator who could get rid of the bugs that were in the attic just now

Since the intermediate NP *anybody* in (72a) has to stay in the scope of the negation, the most embedded subject NP, *the writer* ..., has to move out of the higher relative clause to get the later-than-matrix interpretation over the matrix clause event. The movement analysis predicts that the later-than-matrix reading is impossible. Similarly, in (72b), the most embedded subject NP, *the bugs*..., has to move out of the relative clauses when the NP *exterminator* is understood referentially opaque. Thus the later-than-matrix reading should be incompatible with the opaque interpretation. Neither is the case, however. The later-than-matrix interpretation is readily available in both sentences.

Next, here are some examples with *wh-*islands.

(73)   a. Bob wondered if both (of the) unicorns liked most students that just left
       b. Katy asked whether every Kennedy brother at the party kissed most female astronauts who later landed on the moon

In these examples, too, the later-than-matrix interpretation is available with opaque interpretations of the embedded subject NPs. Therefore, a movement analysis has to
assume that the kind of movement involved in temporal interpretation is immune to island constraints in order to derive empirically adequate interpretations.

These examples also show that another possible movement analysis of the later-than-matrix reading is untenable. That analysis relies on movement of the relative clauses alone so that the tense in relative clauses is outside the scope of the matrix tense.\(^\text{22}\) The scope problem discussed above would not arise in this case. However, it is predicted that the later-than-matrix interpretation is impossible when relative clauses are contained in an island, which is not the case.

More crucially, the issue of semantic reconstruction ruins this enterprise.\(^\text{23}\) Unlike movement of NPs such as QR, movement of relative clauses cannot leave a trace of type \(<e>\). If it does, a type mismatch arises when we interpret the structure \([N' \ N \ tCP]\).

Normally, when a relative clause stays in the sister position to a noun, we intersect the denotation of the noun and the relative clause. Leaving a trace of type \(<e>\) makes this impossible. Taking the trace as an argument of the noun (by functional application) makes the next higher structure uninterpretable. This leaves us interpreting the trace as a higher type trace of the same type as the moved relative clause, i.e., of type \(<e,t>\). When this happens, semantic reconstruction takes place and the moved phrase is interpreted as if it is in its original place.

Lastly, a movement analysis makes the wrong prediction with respect to bound variable interpretations.\(^\text{24}\)

(74) a. Every one of them married a man who later became the president

---

\(^{\text{22}}\) This is suggested by Akira Nakamura (p.c.).

\(^{\text{23}}\) The notion of semantic reconstruction and higher type traces are introduced to account for certain reconstruction effects of scope ambiguity. See Rullmann (1995) and Cresti (1995).

\(^{\text{24}}\) Pointed out to me by Angelika Kratzer (p.c.).
b. Many students submitted a paper to *LI* which was accepted within three months

It is well known that expressions like *later* and *within three months* in these examples can have a bound variable like interpretation.\(^\text{25}\) For instance, (74a) can have an interpretation in which every one of them married a different man who became the president later than their marriage time. This reading can be derived by assuming that expressions like *later* and *within three months* have an implicit temporal variable that can be bound by a certain tense operator. In these examples, the binder of these implicit variables is the matrix past tense operator under the intended interpretation. This analysis together with a movement analysis of the later-than-matrix interpretation predicts that the later-than-matrix interpretation is incompatible with the bound variable interpretation of these expressions. The relative clauses contain two elements that have contradictory requirements: on the one hand, the embedded tense has to take scope over the matrix tense. On the other, the implicit variable has to be in the scope of the matrix tense.

Under our proposal, the embedded tense may be evaluated with respect to the speech time in situ. The (a) sentence, for instance, has the following LF:

\(^{25}\) Expressions that induce bound variable like interpretations of this kind are discussed in Mitchell (1986) and Partee (1989).
(75)  

\[
(75) \quad \text{TP} \\
\quad \text{t*} \\
\quad \text{PAST} \\
\quad \lambda_i \\
\quad \text{past}_i \quad \text{VP} \\
\quad \text{NP} \quad \text{V'} \\
\quad \text{every one of them} \quad \text{V} \quad \text{NP} \\
\quad \text{I} \\
\quad \text{marry} \quad \text{a} \quad \text{N'} \\
\quad \text{man} \quad \text{CP} \\
\quad \text{who}_k \quad \text{TP} \\
\quad \text{t*} \\
\quad \text{PAST} \\
\quad \lambda_j \\
\quad \text{past}_j \quad \text{VP} \\
\quad \text{AdvP} \quad \text{VP} \\
\quad \text{later} \quad t_i \quad t_k \quad \text{V'} \\
\quad \text{become the president}
\]
The embedded past tense is evaluated relative to the speech time, and locates the time of the relevant individuals' becoming the president before the speech time. The adverb *later* further restricts the embedded event time in such a way that it is after the matrix event time. This correctly yields the intuitive meaning of the sentence.

We hope to have shown that the interpretation of tense in relative clauses and the scope of the NPs that head those relative clauses do not correlate in the way that the traditional tense logic or any variant of it such as Ogihara (1996) and Stowell (1993) requires. The interpretation of tense in relative clauses does not rely on their syntactic position, either. The availability of the independent interpretation of tense in relative clauses must be possible regardless of the syntactic scope of matrix tenses and tenses in relative clauses.

2.2. Temporal Interpretation of Tenseless Expressions

We have proposed a compositional semantic analysis of tense in relative clauses. We followed the standard analysis of relative clauses, and assumed that a relative pronoun is generated in the gap position and moved to Spec-CP of the relative clause. It functions as an abstractor of the trace it left, making the entire relative clause denote a set of individuals. This standard analysis is combined with the proposed analysis of tense. When a relative clause receives a temporally independent interpretation, the tense in the relative clause behaves like it is not embedded. Thus as far as the temporal interpretation is concerned, no element that takes syntactic scope over the relative clause directly affects its interpretation.

Let us repeat an example of compositional interpretation:
How does this structure modify a noun? If we follow the standard analysis again, one question arises. In an extensional framework, when tenses and temporal interpretations are ignored, nouns and relative clauses that modify them both denote sets of individuals, i.e., of type $<e,t>$. The denotation of a constituent $[N' N CP]$, where CP is a relative clause, is derived by intersecting the two denotations:
Since we are concerned with temporal interpretations, and assume that all predicates have an extra argument for time, noun denotations are of type \(<e,\text{it}>\), not \(<e,\text{t}>\). Our relative clause denotations are of type \(<e,\text{t}>\), however. This is because relative clauses are tensed and under our analysis, the time argument of the relative clause predicate is saturated. To derive the denotation of N', we have three options: the first one is to introduce nouns as with an unsaturated time argument slot, as follows:

(78) \[
N': \lambda x[N(x)(t) & CP(x)]
\]

N: \(\lambda x[N(x)(t)]\)  CP: \(\lambda x[CP(x)]\)

This implies that we need a rule like the following to get the denotation of the N'.

(79) Individual identification (Cf. Kratzer 1994a,b)

If \(\alpha\) is a branching node and \(\beta\) and \(\gamma\) its daughters, and \(\beta\) denotes a function \(f\) of type \(<e,\text{it}>\) and \(\gamma\) a function \(g\) of type \(<e,\text{t}>\) then \(\alpha\) denotes a function \(h\) of type \(<e,\text{it}>\) such that for all \(t \in D_1\) and \(x \in D_e\), \(h(x)(t) = 1\) iff \(f(x)(t) = 1\) and \(g(x) = 1\).

This enables us to compose conditions for the individual we intend to pick up. In this system, the time argument of the noun is unsaturated, and hence the temporal interpretation of the noun is not determined at this point. It will later be affected by expressions like tense operators.
Alternatively, we could overtly represent the time argument of the noun:

\[(80) \quad N': \lambda x[N(x)(t_i) & CP(x)]\]

\[
N: \lambda x[N(t_i)(x)] \\
CP: \lambda x[CP(x)] \\
\lambda t_\lambda x[N(t)(x)]^{26}
\]

The time argument of the noun is saturated by the time variable \(t_i\). It could be left free or be bound. In either case, the temporal interpretation of the noun is determined at this point. The denotation of the higher \(N\) is the function such that when applied to any individual \(x\), it is true when \(x\) has the property \(N\) at \(g(i)\).

Finally, we can represent the time argument of nouns in syntax as a time variable but bind it locally as follows:

\[(81) \quad N': \lambda x\lambda t[N(x)(t) & CP(x)]\]

\[
\lambda t\lambda x[N(t)(x)]^{26}
\]

Semantically, this is equivalent to the first option.

---

\(^{26}\) The order of the time argument and the individual argument in this denotation of a noun is different from that in the denotation in (78). This is because we have not resolved the issue of whether or not individual arguments are syntactically realized inside NPs, and followed the standard assumption that they are not syntactically realized. But see Heim (1997b).
Recall our proposed tense system, where we argued that tense morphemes are responsible for saturating the time argument of predicates. This implies that tenseless predicates such as nouns in subject and object NPs do not have their time arguments overtly realized since they are not accompanied by a tense morpheme in English. Therefore, structures like (80) and (81) are not possible under our proposal. We will come back to this later.

But for the time being, we will examine these three systems independently of our proposal. The question we are asking here is whether we employ explicit quantification over times for non-verbal predicates like nouns. The two systems make different predictions as to the temporal interpretations of non-verbal expressions. In order to find an answer to this question, we will have to examine more closely the temporal interpretation of nouns.

### 2.2.1. Temporal Interpretation of Nouns

In this section, we will investigate the temporal interpretation of nouns. We will first discuss a scope-based analysis within Priorian tense logic. (We will translate it into our system, though, since we have already seen inadequacies of a system like Priorian tense logic regarding tense interpretation.) We will then present Enç's (1981, 1986) arguments against a scope-based analysis, and an alternative system with explicit quantification over times in nominal domains as well as verbal domains presented in Enç (1986). We will show that the alternative has its own problems. One is pointed out in Musan (1995) concerning the difference between cardinal and presuppositional NPs. Another concerns the interpretation of free time variables. Finally we will present (a modified version of) Musan's analysis of temporal interpretation of NPs. We will argue that the time argument of nouns are not syntactically represented as a time variable, and show evidence for the proposal.

Let us begin with Priorian tense logic. Tenses determine the temporal interpretation of predicates they 'modify'. In sentences like *Jen went to Boston*, for instance, the past tense
on the main verb *go* determines its temporal interpretation. What determines the temporal interpretation of other expressions in a sentence? Priorian tense logic makes particular predictions in this respect under the assumption that the denotations of all predicates are relative to a temporal index. The sentence (82a), for instance, has the truth conditions in (82b), with the semantics of the past tense in (83) and the predicates *frog, catch,* and *a* in (84). The past tense operator has scope over the entire sentence and the temporal interpretations of both the verb *catch,* the noun *frog,* and the determiner *a* are with respect to the past time that the operator introduced. We tentatively assume that the determiner *a* is of type $<<e,t><<e,t,t>>$. This means that the object NP is of a generalized quantifier type, i.e., $<<e,t,t>>$ and it is not interpretable in situ. Therefore let us assume that it undergoes QR and adjoins to the VP.

(82)  
\begin{itemize}
  \item a. I caught a frog
  \item b. \[ TP \]
  \[ Past \]
  \[ VP \]
  \[ NP \]
  \[ $\lambda_i$ \]
  \[ VP \]
  \[ a\ frog \]
  \[ I \]
  \[ V' \]
  \[ catch \]
  \[ t_i \]
  \item c. $[[\text{(82b)}]]^{g,c,t} = 1$ iff there is a time $t'$ such that $t' < t$ and that there is an individual $x$ such that $x$ is a frog at $t'$ and that I catch $x$ at $t'$
\end{itemize}
(83) Where \( \phi \) is a tenseless sentence,

\[
[[\text{Past } \phi]]_{g,c,t} = 1 \text{ iff there is a time } t' \text{ such that } t' < t \text{ and } [[\phi]]_{g,c,t'} = 1
\]

(84) a. \( [[\text{frog}]]_{g,c,t}(x) = 1 \text{ iff } x \text{ is a frog at } t \)

b. \( [[\text{catch}]]_{g,c,t}(x)(y) = 1 \text{ iff } y \text{ catches } x \text{ at } t \)

c. \( [[\text{a}]]_{g,c,t}(P)(Q) = 1 \text{ iff there is an individual } x \text{ such that } P(x) = 1 \text{ at } t \text{ and } Q(x) = 1 \text{ at } t \).

This correctly represents the intuitive interpretation of (82a).

Since we already know that a single-index system like Priorian tense logic is not an empirically adequate one for tensed expressions in natural language, let us translate it into our current framework. Denotations of the past tense operator, the past tense morpheme, 'one-place' and 'two-place' predicates like \textit{catch} and \textit{frog} are as before. The denotation of the determiner \textit{a} is in this framework is given below:

(85) a. I caught a frog
b. TP
   └── t*
      └── PAST
          └── λj
              └── pastj VP
                  └── NP
                      └── λi VP
                          └── a frog
                              └── I V' catch t_j

(86) \[ [[(85b)]]|\_g.c = f: D_{<e,<i,st>>} \rightarrow D_{<<e,<i,st>>, <i,st>>} \]

For all P and Q \( \in D_{<i,st>>} \), \( t \in D_i \), and \( w \in D_S \), \( f(P)(Q)(t)(w) = 1 \) iff there is an individual \( x \) such that \( P(x)(t)(w) = 1 \) and \( Q(x)(t)(w) = 1 \)

The noun \( frog \) is translated into \( \lambda x \lambda t[frog(t)(x)] \), and its temporal interpretation is determined by the past tense operator. The following example shows, however, that tense operators do not always take scope over entire sentences. If they do, we get the interpretation (87b) for (87a).
(87)  a. Every family member of Mary's graduated from UMass

b. \([\{t^* \{\text{PAST } \lambda i \text{ past}_i \text{ every family member of Mary's graduate from UMass}\}\}]^{g,c} = 1 \text{ iff there is a time } t' \text{ such that } t' < s^* \text{ and that for all } x \text{ such}

that } x \text{ is a family member of Mary's at } t', x \text{ graduates from UMass at } t'

(88) \([[\text{every}]^{g,c} = f: D_{<e,<i,\text{st}>} \rightarrow D_{<e,<i,\text{st}>,<i,\text{st}>}}\]

For all } P \text{ and } Q \in D_{<i,\text{st}>}, t \in D_i, \text{ and } w \in D_S, f(P)(Q)(t)(w) = 1 \text{ iff for all } x \text{ such}

that } P(x)(t)(w) = 1, Q(x)(t)(w) = 1

These truth conditions require that the individuals under discussion be family members of Mary's at the time they graduate. It also requires that all individuals in question graduate at the same time. This is certainly not the most prominent interpretation, though not an impossible one. Tense systems like Priorian tense logic (including the modified version presented here) predicts that a different interpretation is available, together with the assumption that tense operators scopally interact with other scope taking elements such as determiner-quantifiers. The subject NP can undergo QR to adjoin to the TP and escape from the scope of the tense operator, which will yield the following LF. (Adjoining to VP is another option, but this will yield the same interpretation as above. Adjoining above } t^* \text{ would be uninterpretable. As a consequence, adjoining right above the past operator is the only option that results in an interpretation distinct from the one above.)
b. $[[\text{170a}]]g.c = 1$ iff for all $x$ such that $x$ is a family member of Mary's at $s^*$, there is a time $t'$ such that $t' < s^*$ and that $x$ graduates from UMass at $t'$

Enç (1981, 1986) argues against this way of getting the temporal interpretation of NPs with Priorian tense logic. Her criticism is based on the assumption that each tense operator corresponds to a tense morpheme in English. We will come back to this issue later, as Enç did in her paper. In what follows, we will present Enç's three arguments.

A first argument against the scope analysis of the temporal interpretation of NPs is the following: sometimes the temporal interpretation of NPs does not depend on the original evaluation time nor the time introduced by a tense operator in the sentence. Consider the following example. The scope analysis predicts one and the same interpretation for the sentence; the sentence means that every current fugitive is in jail.
Every fugitive is now in jail
a. $[[t^* [\text{PRES} \lambda i \text{ presi} [\text{every fugitive be in jail}]])^{g,c} = 1 \text{ iff for all } x \text{ such that } x \text{ is a fugitive at } s^*, x \text{ is in jail at } s^*$

b. $[[t^* [\text{every fugitive } \lambda x \text{ PRES } \lambda i \text{ presi} [x \text{ be in jail}]])^{g,c} = 1 \text{ iff for all } x \text{ such that } x \text{ is a fugitive at } s^*, x \text{ is in jail at } s^*$

The sentence is contradictory under this interpretation unless we consider that the individuals under discussion escaped from something other than jail. But there is a more sensible interpretation for this sentence. The subject NP is most naturally understood as past fugitives. And the sentence asserts that those individuals who were fugitives in the past are all in jail now. Under the assumption that the past tense morpheme is what introduces the past operator, this interpretation is not predicted.

The next example shows that we would sometimes want to evaluate NPs with respect to more than one temporal index.

Every rich man was an obnoxious child
a. $[[t^* [\text{PAST} \lambda i \text{ pasti} [\text{every rich man be an obnoxious child}]])^{g,c} = 1 \text{ iff there is a time } t' \text{ such that } t' < s^* \text{ and that for all } x \text{ such that } x \text{ is a rich man at } t', x \text{ is an obnoxious child at } t'$

b. $[[t^* [\text{every rich men } \lambda x \text{ Past } \lambda i \text{ pasti} [x \text{ be an obnoxious child}])])^{g,c} = 1 \text{ iff for all } x \text{ such that } x \text{ is a rich man at } s^*, \text{ there is a time } t' \text{ such that } t' < s^* \text{ and that } x \text{ is an obnoxious child at } t'$

According to the scope analysis, there are only two possibilities for interpreting the subject NP: it could either be inside or outside the scope of the past tense operator. The first

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27 We changed Enç's original example *all rich men were obnoxious children* into the example (91), since, as Kyle Johnson and Barbara Partee pointed out to me, the third reading of Enç's sentence described below may be a generic interpretation of *all.*
interpretation where the NP every rich man is understood to be past rich men implies that they have to be rich men and obnoxious children at the same time, which is contradictory. The second interpretation is derived when the subject NP scopes out. The NP is interpreted relative to the original evaluation time. Under this interpretation, the sentence is about current rich men, and it is not contradictory. This means that the subject NP can never be understood as past rich men. Intuitively, however, a third reading is available, where every rich man is understood to be all present and past rich men and they were all obnoxious children sometime before they became rich men. This reading is impossible to derive under the scope analysis.

A third problem of the scope analysis is that it leads to scope paradoxes. Under the following context, the sentence every congressman who remembers an astronaut will be at the party can have the interpretation where every congressman is interpreted as every future congressman, an astronaut is understood to be a present astronaut, and the congressmen's being-at-the-party time is in the future.

(92) a. [Context: suppose that NASA is closed down tomorrow and there will be no astronauts from now on. In the future, a party will be given for individuals who are congressmen then and who are old enough to remember a present astronaut.]

   Every congressman who remembers an astronaut will be at the party

b. There will be a future time f such that for every f-congressman x such that there is a present astronaut y such that x remembers y, x is at the party at f

However, in order to get this reading under the scope analysis, the future operator has to take scope over every congressman, every congressman has to take scope over an astronaut so that they do not have to remember the same astronaut, but an astronaut has to be outside the scope of the future operator since there will be no future astronaut. This is a paradox.
All these problems arise because of the assumption that each tense operator corresponds to a tense morpheme in English. Although this seems a reasonable assumption, it is not impossible to do without it. Enç considers doing this. The intuitive meaning of the sentence *every fugitive is in jail*, for instance, may be represented as in (93b) according to Enç.

(93) a. Every fugitive is in jail
b. \[\forall x [\text{Past} \ [\text{fugitive}(x)] [\text{in-jail}(x)]]\]

Her suggestion is to generate a silent element inside the NP that yields a past fugitive meaning. What LF do we need? What denotation should such a silent element have? In order to derive representations like (93b), we must have one of the following LFs.

c. \[t^* \ [\text{PRES} \ \lambda i \ \text{pres}_{i} \ [\text{everyPast} \ [\text{fugitive}] \ \text{be} \ \text{in jail}]]\]
d. \[t^* \ [\text{everyPast} \ [\text{fugitive}] \ \text{PRES} \ \lambda i \ \text{pres}_{i} \ [\text{be} \ \text{in jail}]]\]

Note that *Past* in these representations cannot be a sentential operator as originally defined in Priorian tense logic. *Past* has to be of the type of noun modifiers, for instance, of the type \(<e, it>, <e, it>\). Enç does not go beyond stating the intuitive meaning as in (93b) and does not ask questions like those above. What follows is our implementation of how this idea of Enç’s should work.

This is similar to what has been proposed for intensional adjectives such as *former* in Montague (1974). In Dowty, Wall, and Peters (1981), the adjective *former* is analyzed as having the following denotation:

(i) \[\text{[ [former] ]}_{g.c} = f: D_{<e, it>} \rightarrow D_{<e, it>}\]

For all \(P \in D_{<e, it>}, x \in D_{e} \) and \(t \in D_{i}, f(P)(x)(t) = 1\) iff there is a time \(t'\) such that \(t' < t\) and that \(P(x)(t') = 1\), and it is not the case that \(P(x)(t)\).

Note that there is a difference between this denotation of *former* and the past modifier proposed above. *Former* requires that the individuals under discussion no longer have the relevant property at the evaluation time. Thus, the set of former presidents at the present moment, August 16, 1999, does not include Bill Clinton. Note that there is a time before the
If silent adjectives like the above can freely be inserted to modify a noun, we can correctly predict that the temporal interpretation of a noun is not dependent on the tense of the sentence it occurs in. If we were to pursue this line of analyzing the temporal interpretation of NPs, then our task would be to define the right operators to get the right temporal interpretations.30

speech time at which Bill Clinton is president (He was president the day before, for instance.) Thus, the last clause in the denotation of former is crucial. This requirement is not present in the denotation of the past modifier above. This distinction is necessary to account for the difference between, say, former senator and (contextually salient past) senator. Suppose that we are talking about three people, John, Bill, and Chris, who were senators 8 years ago. Compare the following sentences under this situation.

(ii) a. My mother will meet those former senators tomorrow
    b. My mother will meet those senators tomorrow

By uttering the sentence (iia), the speaker asserts that John, Bill, and Chris are no longer senators at the present moment. But in (iib) the speaker is neutral about whether they are still senators or not. The semantics of the past modifier above correctly predicts this. I thank Barbara Partee (p.c.) for pointing this out to me and for discussion.

30 Recall that Enç presents three different arguments against a scope analysis within Priorian tense logic. Defining temporal modifiers like above solves the first problem concerning sentences like every fugitive is in jail. In addition, we will need at least two different types of temporal modifiers to deal with examples presented by Enç. One is a modifier like the following:

(i) \[[[Wadj]]]]^g_c = f: D_{<e, it>} \rightarrow D_{<e, it>}

For all \( P \in D_{<e, it>} \), \( x \in D_e \) and \( t \in D_i \), \( f(P)(x)(t) = 1 \) iff there is a time \( t' \) such that \( t' < t \) and that \( P(x)(t') = 1 \)

This is what Enç calls a we-don't-care-when operator. (We changed Enç's denotation of this element as a sentential operator into an adjectival one.) This allows us to quantify over more than one tense slot, and enables us to deal with examples like every rich man was an obnoxious child.

Another is to have speech time sensitive operators like the following:
One potential problem for this line of analysis is the issue of how freely we may generate these phonetically null temporal modifiers. These modifiers should be freely used inside NPs. They should not be able to modify tensed predicates, however. The sentence *John is sick*, for instance, should not have an LF like *Pres [John be [Pastadj sick]].* In other words, the temporal interpretation of NPs may be independent of the tense of the sentence they are in while that of the tensed predicates is not. This seems like an intuitively correct generalization. But if the source of temporally independent interpretations is null temporal modifiers, the generalization does not naturally follow.

Instead of pursuing this line of capturing the temporal interpretation of NPs, Enç (1986) presents an alternative view. She suggests employing explicit quantification over times in nominal domains as well as verbal domains. Under this view, the LF for the sentence (95a) is something like (b), where both predicates, *fugitive* and *in jail*, have their own time argument slots explicitly saturated at LF. (The subject NP is moved from the VP internal position leaving a trace _x_k._)

(95) a. Every fugitive is in jail

\[ ([\text{Presadj}]^\text{g,c} = f; D_{\llangle e,It \rrangle} \rightarrow D_{\llangle e,It \rrangle}) \]

For all \( P \in D_{\llangle e,It \rrangle} \) and \( x \in D_e \), \( f(P)(x) = 1 \) iff there is a time \( t' \) such that \( t' < t_c \) and that \( P(x)(t') = 1 \)

This will solve the scope paradox of the astronaut example.

(95) b. Every congressman who remembers an astronaut will be at the party

\( t^* \ [\text{Fut} \ [\text{every congressman who remembers [an Presadj astronaut] be at the party}]] \)

\[ 31 \text{ Enç (1986) in fact presents two alternatives. One is the analysis with explicit quantification to be discussed below. I do not quite understand what Enç has in mind as the other alternative. Here is what she says: "The temporal arguments of nouns are not represented by any constituents in the syntax of the language. They are supplied in the course of the interpretation". (Enç 1986, p.422) Perhaps the idea is to leave the time argument of nouns unsaturated at the sentence level and let entire sentences denote properties of times.} \]
The time variables are assignment function dependent, allowing them to be independent of each other and denote contextually salient intervals.

This alternative is subject to the same criticism as any other theories of tense without existential quantifiers. (Recall our discussion of Partee's stove example under her 1973 theory.) Since the time variable $t_i$ above is free, it is subject to the appropriateness condition. The context for the sentence *every fugitive is in jail* has to assign the value of the time argument of *fugitive*. But in uttering the sentence, the speaker does not have to know when the individuals under discussion were in jail. S/he merely needs to know that there are past times at which those individuals are fugitives. It also predicts that the relevant individuals were fugitives at the same time.

If we strictly follow Enç (1986) and assume that the temporal argument of the main predicate is introduced by the tense morphemes, we lose the one-to-one correspondence between what we see and what we interpret. The time argument of *in-jail*, $t_j$, corresponds morphologically to the past tense morpheme on the verb *be*, while there is no such correspondence for the time argument of *fugitive*, $t_i$. If, on the other hand, the time argument of the main predicate at LF is not related to the tense morpheme, then we need to constrain the value of the time argument of the main predicate in such a way that it matches the intuitive meaning of the tense morpheme of the sentence.
It looks like deriving temporally independent interpretations by means of explicit quantification over times raises more problems that it can solve. Therefore, the null temporal modifier analysis seems empirically more adequate. As we mentioned, one weakness of the theory is that it misses the generalization that the temporal interpretation of the main predicates of a clause is dependent on the tense of the sentence while that of NPs is not.

Musan's (1995) analysis of temporal interpretations of nouns addresses this issue. Musan's idea is similar to the null temporal modifier analysis in the following two respects: times are manipulated in the meta-language and they are existentially quantified. What follows is a rough sketch of what Musan's idea is.\(^{32}\) Instead of generating phonetically null temporal modifiers inside NPs that determine the temporal interpretation of nouns that head these NPs, Musan argues that determiners and quantifiers are responsible for the temporal interpretation of NPs. Specifically, she proposes that determiners and quantifiers introduce an existential quantifier. If we choose to manipulate time in the meta-language as temporal indices, Musan's idea can be translated as follows:

\[(96)\] (To be revised)

For any determiner D, \([D] = f: D^{e,i,s,t} \rightarrow D^{e,i,s,t}, i, s, t\]

For all P and Q ∈ D^{e,i,s,t}, t ∈ D_{i}, and w ∈ D_{S}, f(P)(Q)(t)(w) = 1 iff for D-many x such that there is a time t’ and that P(x)(t’)(w) = 1, Q(x)(t)(w) = 1

Due to the existential quantifier introduced by the determiner, the evaluation time of the noun that is an argument of the determiner may be different from the original evaluation time. This allows a temporally independent interpretation of NPs.

\(^{32}\) One main point in the analysis of Musan (1995) is to argue that determiners do not quantify over individuals but stages of individuals. Since this complicates the picture, we choose not to introduce stages. Because of this, we might lose some of Musan's insights.
Enç's analysis with explicit quantification over times in nominal domains and Musan's analysis with existential quantification in determiner meanings both allow the temporal interpretation of NPs to be independent of the temporal interpretation of the main predicates. There are, however, some differences. As we pointed out, Enç's analysis is too context dependent. It requires that the speech context of sentences like *every fugitive is in jail* specify the value of the time variable of the relevant individuals' being fugitives.

Musan's analysis, on the other hand, does not require it. It merely introduces a time, any time, that the relevant individuals are fugitives. We might wonder if Musan's existential analysis is too unrestrictive. As it stands, it does not seem to take into account any context dependency of the temporal interpretation of NPs. But as both Enç and Musan note, whether an NP can have a temporally independent interpretation or not is largely context dependent. For instance, in the following example from Musan (1995), the time of the relevant individuals being students is independent of the time of giggling. The subject can easily be understood to mean most former students from the class of 1982.

(97)  [36 former students of the class 1982 came to the alumni meeting last year. When it was announced that the campus was haunted by a ghost, ...]

Most students giggled

The truth conditions of the sentence derived under Enç's analysis are the following, where the time of the relevant individuals' being students is given by the assignment function. (In what follows we ignore the temporal interpretation of the main predicate and how it is derived.)
b. For most x such that x is a student g(i), x giggled at g(j)

Since the time of the individuals' being students is just mentioned in the previous context, the value of g(i) could easily be the period of 1982. In our version of Musan's story, the context dependency of the temporal interpretation of NPs does not seem so straightforward. The truth conditions under our version of Musan's analysis are the following:
The truth conditions allow the time of the relevant individuals' being students to be different from the time of the main predicate. But as stated in (99b), nothing guarantees that the time of the relevant individuals' being students should be understood as the year 1982 in this context. It is merely compatible with this interpretation. But it is also compatible with an interpretation where the relevant time is the year of 1981, 1983, or any other year. Does it mean that context dependency of this sort is better captured by analyses like Enç's? Not necessarily. As we discussed in §1.4. and 2.1., context dependency can be explained with implicit restriction on quantifier domains. There may be an implicit restriction on the existential quantifier introduced in the semantics of determiners, which gives the reading where the time of the relevant individuals' being students is in 1982.33

Another point Musan (1995) raises in criticizing Enç's treatment of the temporal interpretation of NPs is the contrast in the following examples:

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33 Musan achieves this by implicit restrictions on quantifier domains. (See Westerståhl 1984 and von Fintel 1994 for contextual restrictions on quantifier domains in general.)
(100)  a. Every fugitive is now in jail
       b. There are now many fugitives in jail

(100a) is the kind of example discussed in Enç (1981, 1986) to show that the time of the relevant individuals being fugitives can be independent of the time of the main predicate. Based on examples like these, Enç concluded that the temporal interpretation of NPs is not restricted by the tense of the sentences they appear in. Musan argues that Enç's result is an overgeneralization. Not all NPs can get temporally independent interpretations. According to Musan, (100b) is a case in point; the subject NP in (100b) cannot be understood as former fugitives. The individuals mentioned there have to be fugitives now. Musan further argues that the relevant distinction as to whether NPs readily allow temporally independent interpretations or not is whether they are understood as presuppositional or cardinal NPs. NPs headed by so-called strong determiners such as every, most, and the allow temporally independent interpretations. NPs headed by so-called weak determiners such as many, few, and some can allow temporally independent interpretations only when they are understood presuppositionally. When they are understood cardinally in there-constructions, such as (100b), temporally independent interpretations are not available.  

34 Musan (1995) notes that what she calls existence-independent predicates are exceptions to this generalization. Existence-independent predicates are those that can be applied to dead people with a present tense without causing the so-called lifetime effects. (See Musan 1995, 1997 for detailed discussion.)

(i)  [Context: Gregory is alive]
   a. Gregory is from America
   b. Gregory is famous

(ii) [Context: Gregory is dead]
   a. # Gregory is from America
   b. Gregory is famous

The above examples show that predicates like from-America are odd with the present tense when the subject is dead while predicates like famous is not.

Now suppose that we have just been talking about the people who were members of the MIT linguistics department at around 1980, and consider the following examples:
According to Musan, the determiner *lauter* can only have a cardinal interpretation. The generalization that only presuppositional NPs can get a temporally independent interpretation is correct with respect to (ia): the sentence cannot be understood as a statement about the present state of health of students from 1980. (ib), on the other hand, has an existence-independent predicate, and it can be used to make a statement about the fame from students in 1980.

There may be potential counter-examples to this generalization. The following is what I came up with.

(i) [Context: The U.S. economy was very bad last year and there were many homeless and unemployed people. Those who were in Massachusetts decided to appeal to the governor that he should take some action to improve the situation. The governor took immediate action and built publicly financed apartments and created job opportunities. The former homeless and unemployed people decided to get together again to celebrate their victory.]

There are few homeless people at the rally

My informants accept this sentence uttered in the context given above, and the subject of the sentence is understood to mean people who were homeless before.

Barbara Partee (p.c.) has given me the following example:

(ii) There are three presidents (of the U.S.) at the funeral

This sentence can be truthfully uttered when Ronald Reagen, George Bush, and Bill Clinton are at the funeral. Consider the following example, also due to Barbara Partee:

(iii) How many Yankees are there in the Baseball Hall of Fame?

We could answer this question by saying, "Zero, because none of them belong to Yankees." But in normal circumstances, the question is considered felicitous.

Barbara Partee suggested that there is a difference between predicates like *president* or *Yankees* and predicates like *third-year students*. Her intuition is that an individual can be considered to be a president or a Yankee at a time t even when s/he does not hold the title of president or does not belong to Yankees at the time t, whereas this is not the case for predicates like third-year students. Many of my informants independently expressed their intuition about this difference. But I am not sure this way of stating the difference is correct. This is partly because I believe that it would wrongly predict no difference among the following three examples.

(iv) a. Bill Clinton is a president
    b. # George Bush is a president
    c. # John F. Kennedy is a president
If Musan is right about this generalization, Enç's analysis overgeneralizes: if the
time argument of nouns is explicitly represented in the object language, there is no reason to
say that it can denote a past interval in (100a) but not in (100b). Instead, Musan argues that
the problem of whether a given NP can get a temporally independent interpretation or not
lies in the semantics of determiners. Translating it into our framework, this roughly means
that the semantics of presuppositional and cardinal determiners is fundamentally different in
that the former contain an existential quantifier over times that introduces a new time while
the latter does not. We differ from Musan in analyzing cardinal NPs as detransitivizing
modifier, i.e., modifiers that take a transitive verb and give an intransitive verb, following de
Hoop (1992), and propose the following denotations for presuppositional and cardinal
determiners.36

But I am not sure if my argument above is sound. It seems appropriate (or at least less
infelicitous) to me to use (ivb,c) when we are looking at pictures of famous people, and I am
describing who they are. The above examples also show that the difference we are
concerned with here is not about whether they are existence-independent predicates or not.

(v)  
    a. Barbara Partee is a semanticist
    b. Richard Montague is a semanticist

The issue is complicated, and we are unable to come up with any conclusive descriptive
generalization. Therefore, we do not know whether examples like (i),(ii), and (iii) above are
genuine counter-examples to Musan. So we will proceed, assuming that Musan's
generalization is correct.

36 We must mention again that these denotations are significantly different from
Musan's denotations of presuppositional and cardinal determiners in other respects, too.
For one thing, she argues that determiners quantify over stages of individuals rather than
whole individuals, and derives the temporal interpretation of nouns from stages without
introducing a time argument in nouns. She also takes into consideration implicit restrictions
on quantifier domains, and assumes that determiners takes three arguments that correspond
to properties of individuals, one introduced by a noun, another introduced by a domain
restriction variable C and the third introduced by the rest of the sentence. What we attribute
to Musan is the idea that presuppositional determiners introduce an existential quantifier
and that this is responsible for temporally independent interpretations.
For any presuppositional determiners $D_{\text{pre}}$,

$$[[D_{\text{pre}}]] = f: D_{<e, <i, <s, t>>} \rightarrow D_{<e, <i, <s, t>, <i, <s, t>, t>>}$$

For all $P$ and $Q \in D_{<e, <i, <s, t>>}$, $t \in D_i$, and $w \in D_s$, $f(P)(Q)(t)(w) = 1$ iff for $D$-many $x$ such that there is a time $t'$ and that $P(x)(t')(w) = 1$, $Q(x)(t)(w) = 1$

b. For any cardinal determiners $D_{\text{car}}$,

$$[[D_{\text{car}}]] = f: D_{<e, <i, <s, t>>} \rightarrow D_{<e, <i, <s, t>, <e, <i, <s, t>>, t>>}$$

For all $P \in D_{<e, <i, <s, t>>}$, $R \in D_{<e, <e, <i, <s, t>>, t>>}$, $x \in D$, $t \in D_i$, and $w \in D_s$, $f(P)(R)(x)(t)(w) = 1$ iff for $D$-many $y$ such that $P(y)(t)(w) = 1$, $R(y)(x)(t)(w) = 1$

For weak determiners that can give rise to both presuppositional and cardinal readings, we can assume that they are lexically ambiguous, or that there is a type-shifting rule. (See de Hoop 1992).

Since NPs with cardinal determiners are detransitivizing modifiers, they are interpreted in their in situ position. As a result, the time argument slot of the noun is 'bound' by the tense in the same sentence. On the other hand, the time argument slot of a noun in an NP with a presuppositional determiner is 'bound' by an existential quantifier introduced by the determiner itself. Thus, it can be temporally independent of the tense in the sentence it occurs.

Although one of the main points of Musan's thesis is to capture the difference in examples (100), she crucially differs from Enç's (1986) analysis with explicit quantification over times in nominal domains. Adopting Musan's analysis, temporally independent interpretations can be derived without resorting to explicit quantification over times.

Since we have already seen some problems with a system which has explicit quantification over times concerning temporally independent interpretation of nouns, this is a welcome result. The analysis also captures the difference between the temporal interpretation of the main predicate of a clause and that of nouns. In what follows, we will adopt this analysis of the temporal interpretation of nouns: the time argument of a noun is
not saturated in the syntax. Its temporal interpretation is determined by the determiner that modifies it.

Now let us come back to where we started. The discussion of the temporal interpretation of nouns started when we were trying to determine how a sentence with a relative clause is interpreted. Specifically, we were trying to determine the syntax of nouns regarding their time argument.

(102) a. \[ N' : \lambda x[N(x) \& CP(x)] \]

\[ N : \lambda x\lambda t[N(t)(x)] \]

\[ CP : \lambda x[CP(x)] \]

b. \[ N' : \lambda x[N(x)(ti) \& CP(x)] \]

\[ N : \lambda x[N(ti)(x)] \]

\[ CP : \lambda x[CP(x)] \]

\[ N \quad ti \]

c. \[ N' : \lambda x\lambda t[N(x)(t) \& CP(x)] \]

\[ \lambda t_i \]

\[ CP : \lambda x[CP(x)] \]

\[ N \quad ti \]

Among the three representations we considered, we discarded the second option (102b): it gives an interpretation that is too context dependent. It also misses Musan's generalization. The (a) and (c) representations are semantically equivalent. So let us tentatively assume the (a) representation and see how sentences containing relative clauses should be interpreted.
Under this analysis of the syntax of nouns, the LF for the sentence *Hillary married a man who became the president* should look like (103a) with the truth conditions in (103b):
(103) a. TP
   t*  
   PAST
   \lambda_i
   past_i VP
   \lambda_j
   past_j VP
   \lambda_k
   V'  
   V    NP
   t_k  
   V'    
   V      NP
   |  
   become the president
b. \[
[[103a]]^g\mathcal{L}_c = 1 \text{ iff there is a time } t \text{ such that } t < s^* \text{ and there is an individual } x \text{ such that } x \text{ is a man at } t \text{ and Hillary married } x \text{ at } t \text{ and there is a time } t' \text{ such that } t' < s^* \text{ and that } x \text{ becomes the president at } t'.
\]

The truth conditions we get in (103b) seem intuitively correct. The same truth conditions are derived when we assume the syntax in (102c). Does this mean that both LFs are conceivable? We would like to argue that ones with explicit quantification over times, i.e., ones like (102c) are in fact not possible LFs. One reason is the inventory of variables of type \(<i>\). We have proposed that present and past tense morphemes are variables of this type. We have also proposed a third variable, the distinguished variable. If these three variables are the only variables of type \(<i>\) in the inventory of English, it follows that LFs like (102c) are not generated.

Is there independent evidence that supports our analysis? The contrast between the following examples may be such evidence. The example in (104a) is a temporal donkey sentence. The adverb \textit{then} is understood to pick up the time of each relevant individual's being a president. The same interpretation is not readily available for the example in (104b).

(104) a. Every person who was once a president believes now that he did a good job then
   
   b. ?? Every former president believes now that he did a good job then

This is analogous to nominal donkey sentences like the following discussed in Heim (1982, 1990):

(105) a. Every person who owns a donkey takes good care of it
   
   b. ?? Every donkey-owner takes good care of it
Pairs like this are presented to argue against an analysis of donkey anaphora that relies on pragmatics or other extra-grammatical factors. (See Heim 1982 and Kadmon 1987 for details.) Heim (1990) argues with Evans (1977) that there should be a 'formal link' between pronouns and their antecedent. She implements this idea by means of coindexing. Informally speaking, the pronoun *it* and its antecedent *a donkey* in (105a) are coindexed, and there is a transformational rule to derive the appropriate LF for interpretation. In (105b), however, there is no element that can serve as the antecedent of the pronoun. Hence a donkey anaphora interpretation is not readily available. If this analysis is correct and can be carried over to temporal donkey anaphora cases like (104), it provides support for our view that the event time of nouns is not syntactically represented. If it were, the LF for the subject NP of (104b) should look like the following:

(106)
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(\lambda t) every former
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The time variable *t* in this LF should be able to serve as an antecedent for the adverb *then*, predicting no difference in the availability of a bound variable interpretation between the two examples. On the other hand, if the time argument of the noun *president* is not represented in the syntax as we propose, the example is parallel to cases like (105b), and we have a straightforward explanation for the contrast.

To sum up, we have argued that the time argument of a noun is not syntactically realized, and therefore the temporal interpretation of nouns is not obtained by overt quantification over times. This follows from our proposal that there are only three variables of type <i> in the inventory of English lexicon, *past, pres*, and *t*.

We then presented
Musan's analysis of the temporal interpretation of nouns. Combined with the proposed analysis of tense in relative clauses, we can successfully give a compositional interpretation of sentences with relative clauses.

2.2.2. Temporal Interpretation of Participles

The proposal has an interesting implication for the temporal interpretation of other types of noun modifiers. In this section, we will examine the temporal interpretation of participle constructions.

Before discussing the semantics, let us present the syntactic structure we assume for participles. Following the standard analysis of to-infinitives, we assume that the participle morpheme -ing also heads its own projection, which we call a participle phrase. It takes a VP as its complement. The subject of the VP is realized as PRO and moves to the Spec of the 'PartP' to check a null Case. (See Chomsky and Lasnik 1993.)

(107)  
\[
\begin{array}{c}
\text{'PartP'} \\
\text{PRO}_i \\
\text{Part'} \\
\text{-ing} \\
\text{VP} \\
\text{t}_i \\
\text{V'} \\
\end{array}
\]

Now let us consider the temporal interpretation of participles. In Chapter 1, we have observed that sentences like the following have a truth-conditionally identical interpretation.

(108)  

a. Eva talked to a boy who was crying like a baby
b. Eva talked to a boy crying like a baby

The sentence (108a) can have two distinct LFs: the embedded past tense can be a true past tense or a vacuous one. When it is a true past tense, the past tense operator (*PAST*) appears in the embedded clause and it binds the event time variable of the predicate *be-crying* (i.e., the time variable *past* that saturates the predicate’s time argument slot). When it is a vacuous past tense, there is no tense operator and the event time variable is bound by the tense operator in the higher clause as shown in the following LF:
This yields the simultaneous interpretation.

The sentence in (108b) also has a simultaneous interpretation. Does this mean the temporal interpretation of participles is obtained in the same manner as that of relative clauses? If so, the internal structure of the object NP should look like the following:

(110) NP

   a N': \( \lambda x \lambda t[\text{boy}(t)(x) \& \text{crying-like-a-baby}(t_i)(x)] \)

   \( \lambda x \lambda t[\text{boy}(t)(x)] \)

   \( \lambda x[\text{crying-like-a-baby}(t_i)(x)] \)

   boy

   \( \lambda_k \)

   t_i 'PartP'

   PRO_k Part'

   -ing VP

   t_k V'

   cry like a baby

This structure is identical to the structure of the relative clause in (109) as far as the semantic interpretation goes. The time argument of the predicate _crying like a baby_ is syntactically realized as a time variable \( t_i \). When this structure is embedded in the same way
as (108b), the time variable is bound by the matrix past tense operator, yielding the simultaneous interpretation.

But haven't we already argued against the existence of time variables like \( t_i \) above?

If we are correct about the inventory of the English lexicon, the LF of participles should look like the following instead.

(111)         NP
               /
            a N': \( \lambda x \lambda t [\text{boy}(t)(x) \& \text{crying-like-a-baby}(t)(x)] \)

Here, participles pattern with nouns in that their time argument is not syntactically realized.

The two analyses of the temporal interpretation of participles yield the same truth conditions in this case. But they differ in the following respect. The explicit quantification analysis, which yields LFs like (110), predicts that the temporal interpretations of nouns and participles can be independent of each other. This is because in this representation, the time argument of the participle is saturated by a temporal variable \( t_i \) in the syntax. And therefore, the value assigned to it is only dependent on an assignment function \( g \) whether it is bound...
or not. In the latter analysis, which yields LFs like (111), we predict that the temporal interpretations of nouns and their modifiers have to agree. This is due to the intersection operation.

Enç briefly discusses the temporal interpretation of noun modifiers giving the following examples.37

\[(112)\]  
a. We spoke to every intelligent linguist  
b. The dead president (was buried yesterday)

According to her, the (a) example does not seem to have the independent reading where the individuals we spoke to are intelligent at some time and linguists at another time. On the other hand, the NP *the dead president* can refer to somebody who was a president but is now dead.

Our first task is to determine when it is possible for nouns and their modifiers to be temporally independent of each other. Consider the following example:

\[(113)\]  
[There were 20 fugitives in the state of Massachusetts last year. They were all caught and put in jails in Framingham and Concord.]  
a. Most of the fugitives that are doing time in the Concord jail were caught by Officer Jones.  
b. Most of the fugitives doing time in the Concord jail were caught by Officer Jones.

Assuming that fugitives are people who escaped from jail, an individual cannot be a fugitive and doing time in jail at the same time. This means that the noun and its modifier have to have a temporal interpretation where they are independent of each other. We understand

---

37 The (a) example is discussed in Enç (1986, p.419) and the (b) example is given in footnote 13 in Enç (1986).
from the context that the relevant individuals are former fugitives. In this case, the relative clause and participle modification are both fine.

Compare (113) with the following examples:

(114) [There are 20 fugitives in the state of Massachusetts now. Half of them were doing time in a prison in Concord and the other half were in a prison in Framingham.]

a. Most of the fugitives that were doing time in Concord are on the loose in Springfield now.

b. # Most of the fugitives doing time in Concord are on the loose in Springfield now.

The context given above provides the information that the fugitives under discussion were doing time before they escaped. The (a) continuation with relative clauses is fine, and the sentence can have a sensible interpretation in which the subject NP refers to the individuals who are currently fugitives but were doing time before they escaped. The (b) sentence sounds strange, indicating that the same interpretation is not available for it.

The same contrast between (113) and (114) can be found in between examples (115) and (116):

(115) [Last year we had extremely cold winter in New England. Many homeless people died. The state of Massachusetts decided to give homeless people special financial support for their housing.]

a. Most of the homeless people that live in apartment complexes in Amherst used to live on the main street of Northampton before.

b. Most of the homeless people living in apartment complexes in Amherst used to live on the main street of Northampton before.
[Last year the US economy went down considerably and many people lost their jobs and even lost their places to live. They became homeless.]

a. Most of the homeless people that lived in apartment complexes in Amherst are now living on the main street of Northampton

b. # Most of the homeless people living in apartment complexes in Amherst are now living on the main street of Northampton

It looks like we have the following pattern:

<table>
<thead>
<tr>
<th>nouns</th>
<th>participles</th>
<th>relative clauses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>now</td>
<td>past</td>
</tr>
<tr>
<td>now</td>
<td>√</td>
<td>#</td>
</tr>
<tr>
<td>past</td>
<td>√</td>
<td>√</td>
</tr>
</tbody>
</table>

Table 1: Temporal Interpretation of Nouns, Participles, and Relative clauses

Relative clauses can always have an interpretation that is temporally independent of that of the noun they modify. On the other hand, participles do not always allow a temporally independent interpretation. When the property denoted by a noun is understood as a past property and the property denoted by a participle is understood as a property that currently holds, sentences have a non-contradictory interpretation. When the property denoted by a noun is a current property and the property denoted by a participle is understood as a past property, sentences do not seem to have a sensible interpretation.

If this is a correct generalization, what does it tell us? Does it help us in choosing between the two analyses of the temporal interpretation of participles? The observed difference between relative clauses and participles seems to go against the explicit quantification analysis. If the time argument of participles is overtly realized as a time variable, why can't it pick up a contextually salient interval when left free? On the other hand, the fact that participles can get a temporally independent interpretation at all seems
problematic for the other analysis, where nouns and participles are both functions from individuals to intervals when they are intersected.

We would like to argue, however, that this is exactly what we expect under our analysis of tense and temporal interpretations. Recall that our inventory of temporal variables consist of the following three:

\[(117)\]

a. \([\text{past}]_{g,c} = g(i)\]

b. \([\text{pres}]_{g,c} = g(i)\]

c. The variable \(t^*\) may be bound in an intensional context.

\[\text{When it is bound, } [[t^*]]_{g,c} = g(i)\]

\[\text{When it is free, } [[t^*]]_{g,c} = \text{the speech time of } c, s^*\]

Since the first two variables are morphologically realized as the past and present tense morphemes, we can detect their existence when they are there. Participle constructions are tenseless in English, and therefore the past and present tense morphemes cannot be what is responsible for saturating the time argument slot of participles. The distinguished variable is the only variable that can do so. Suppose that when a participle denotes a property that currently holds, its time argument is saturated syntactically by the distinguished variable as shown in the following LF:
Otherwise, we have the following LF:
If these are the only possible LFs, we correctly capture the generalization we made: the temporal interpretation of participles can be independent only when the property denoted by the participles is understood to be a current property.

On the other hand, relative clauses are tensed, therefore they can get their own temporal interpretation without being dependent on the temporal interpretation of the noun they modify. We predict that the temporal interpretation of relative clauses can always be independent.

One might argue that in this case the issue is not explicit quantification over times. In examples like the following where there is a difference between relative clauses and participles, the past tense in the relative clause is not a vacuous one. This is not an SOT environment.
(120) [There are 20 fugitives in the state of Massachusetts now. Half of them were doing time in a prison in Concord and the other half were in a prison in Framingham.]

a. Most of the fugitives that were doing time in Concord are on the loose in Springfield now.

b. # Most of the fugitives doing time in Concord are on the loose in Springfield now.

This means that the relative clause contains not only a time variable that saturates the time argument slot of the relative clause predicate but also an operator tense that binds it. The time variable is not left free. On the other hand, if there is a time variable that saturates the time argument position of the participle predicate, it has to be left free and get a value from the context to yield the intended interpretation. Perhaps, there is a condition on time variables that they have to be bound. This story explains the observed difference between relative clauses and participles without resorting to the way they differ in explicit quantification over times. The following examples show, however, that this line of explaining the difference is untenable. The temporal interpretation of relative clauses, but not participles, may be dependent on the tense in matrix clause.

(121) [There are 20 fugitives in the state of Massachusetts now. Half of them were doing time in Massachusetts, and the other are from Connecticut.]

a. The fugitives that were doing time in Massachusetts were all in the Concord jail

b. # The fugitives doing time in Massachusetts were all in the Concord jail

The first sentence has a sensible interpretation where the individuals that are now fugitives but were doing time were in the Concord jail when they were doing time. This interpretation is not available to (121b). If the event time of the predicate doing time in these examples is
overtly realized in the syntax and gets bound by the matrix past tense, we should not expect a difference between the two examples.

2.2.3. Summary

In this section, we have seen a consequence of the proposed tense system. In our tense system, only tensed predicates have their time argument represented in syntax, and the temporal argument of tenseless predicates are manipulated only in the meta-language. We have seen that this does not conflict with Enç's observation regarding the temporal interpretation of noun phrases. Adopting Musan's analysis of determiners, we can correctly predict temporally independent interpretations of nouns. We have also seen that the difference between relative clauses and participles we observed in Chapter 1 follows from our tense system and from the fact that relative clauses are tensed and participles are not.

2.3. Tense in Relative Clauses in Non-SOT Languages

This section investigates the tense behavior of relative clauses in non-SOT languages such as Japanese, Polish, and Russian. As we have seen, these languages are classified as non-SOT languages because of the behavior of tense in clausal complements. Unlike languages like English, these languages do not exhibit the SOT phenomena. There are two differences that distinguish between SOT and non-SOT languages: one is that past under past constructions in non-SOT languages do not allow the simultaneous interpretation, and the other is that the simultaneous interpretation is rendered by present under past constructions in non-SOT languages.

For instance, the English sentence of a past under past construction in (122a) can have the simultaneous interpretation: Bernhard's actual utterance may be something like "Junko is sick". The same reading cannot be obtained by the word for word translation of the same sentence into Japanese, (123a). The present tense has to be used instead as in (123b). This is the first difference. The second one is this: in English, when a present tense
is embedded under a past tense as in (122b), a special meaning, what we call the double-access reading, arises. No such special reading is obligatory in Japanese.

(122)  
  a. Bernhard said that Junko was sick  
  b. Bernhard said that Junko is sick

(123)  
  a. Bernhard-wa Junko-ga byookidatta to it-ta  
      B-top J-nom sick-*past* comp say-*past*  
      'Bernhard said that Junko had been sick'

  b. Bernhard-wa Junko-ga byookida to it-ta  
      B-top J-nom sick-*pres* comp say-*past*  
      'Bernhard said that Junko was sick'

This is shared by Polish and Russian, and of course other non-SOT languages.

We have seen in Chapter 1 that this uniformity of tense behaviors across non-SOT languages is only observed in clausal complements. Tense behaviors in relative clauses in Japanese on the one hand, and in Polish and Russian on the other are quite different.

In Japanese, when a present tensed relative clause is embedded under a past tense, the sentence is ambiguous:

(124)  
  Mariko-wa naiteiru otokonoko-ni hanasikaketa  
    M-top cry-teiru-pres boy-to talk-*past*  
    'Mariko talked to a/the boy who is (now) crying' (the speech time interpretation)  
    'Mariko talked to a/the boy who was crying (at the time of her talking to him)' (the simultaneous interpretation)
The sentence (124) has a past tense in the matrix clause and a present tense in the relative clause. It may have the interpretation where the embedded event is understood as a currently on-going event --- the speech time interpretation, but it also allows the interpretation where the boy was crying at the time of Eva's talking to him, but no longer is -- the simultaneous interpretation.

In English, a present tense embedded under a past tense behaves like an indexical. For instance, when a present tense is embedded in a relative clause under a past tense, the event of the present-tensed predicate is understood as an on-going event at the speech time.

(125) a. Eva talked to the boy who is crying (the speech time interpretation)
   b. Eva talked to the boy who was crying

The sentence (125a) can only be true when the boy Eva talked to at some point in the past is crying now. The simultaneous interpretation may be obtained by using the past tense as in (125b).

Not all non-SOT languages behave like Japanese. Kondrashova (1992, 1998) observes that in Russian, when a present tense is embedded in a relative clause under a past tense as in (126a), only the speech time interpretation is available.

(126) a. Ma_a videla _eloveka, kotoryi pla_et
   M. see/past/imp man who cry/pres
   'Masha saw a/the man who is (now) crying' (the speech time interpretation)

   b. Ma_a videla _eloveka, kotoryi plakal
   M. see/past/imp man who cry/past/imp
   'Masha saw a/the man who was crying'

In order to yield the simultaneous interpretation, the past tense has to be used.
The same is true in Polish:

(127) a. Ania spotkala _lopca, ktory placze.
    Ania meet/past/imp boy who cry/present
    'Ania meet a/the boy who is crying'

b. Ania spotkala _lopca, ktory plakal.
    Ania meet/past/imp boy who cry/past/imp
    'Ania meet a/the boy who was crying'

Why does the present tense behave differently in relative clauses in Japanese vs. Polish and Russian? One might argue that the nature of the present tense in these languages is different; the present tense in Polish and Russian is like that in English in that it is indexical while Japanese present tense is not. Then we expect what we have in (126) and (127). The contrast is interesting because it is untenable to reduce the unavailability of the simultaneous interpretation in Polish and Russian sentences like (126) and (127) to the same reason that the simultaneous interpretation is not available to the English counterpart of (125). Here is why: recall that English is an SOT language and Polish and Russian are not. That is, when a present tense is embedded in a propositional attitude verb under a past tense, English on the one hand and Polish and Russian on the other behave differently as shown below.

(128) Gordon said that Josephine is pregnant (the double-access interpretation)

(129) a. Ma_a skazala, _to Vova spit
    M say/past/perf that V sleep/pres
    'Masha said that Vova was sleeping' (the simultaneous interpretation)
b. Ania powiedziała Marcin płacze
   A śni/past/perf that M płakał/pres

     'Ania said that Marcin was crying' (the simultaneous interpretation)

In English, the present tense uniformly shows an indexical-like behavior when embedded under a past tense while in Polish and Russian a present in the clausal complement of a past tensed verb allows the simultaneous interpretation. Reducing the unavailability of the simultaneous interpretation to the indexical nature of the present tense alone would not allow us to explain the behavior of the present tense in clausal complements.

We summarize the relevant data in English, Japanese, Polish and Russian below.

<table>
<thead>
<tr>
<th></th>
<th>English</th>
<th>Japanese</th>
<th>Polish/Russian</th>
</tr>
</thead>
<tbody>
<tr>
<td>clausal complements</td>
<td>*</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>relative clauses</td>
<td>*</td>
<td>√</td>
<td>*</td>
</tr>
</tbody>
</table>

Table 2: Availability of the 'Simultaneous' Interpretation of a Present Tense under a Past

Most previous cross-linguistic studies of the SOT phenomena focus on the distinction between SOT and non-SOT languages. They have proposed a parameter of some sort to divide languages into the two groups. As we have said, however, the distinction between the two groups is based on the behavior of tense in clausal complements, and many previous studies were unaware of the facts reported here. A successful theory of tense and temporal interpretations should be able to explain not only which particular interpretations are (un)available in each language but also why such variation exists. In what follows, we will try to answer these questions. We will argue that the difference between Japanese on the one hand and Polish and Russian on the other arises because of structural differences in relative clauses in these languages. Specifically, we analyze Japanese 'present tensed' relative clauses as tenseless clauses more or less parallel to the English participle
construction and Polish and Russian 'present tensed' relative clauses as full-fledged relative clauses parallel to English relative clauses. It follows that the temporal interpretation of 'present tensed' relative clauses in Japanese may be dependent on operators that embed them.

2.3.1. 'Relative Clauses' in Japanese
This section examines the nature of relative clauses in Japanese. We will argue that what we have been calling 'relative clauses' in Japanese is very different from English relative clauses.

One notable property of relativization in Japanese is that it does not exhibit island effects, as first noted in Kuno (1973). The examples (130b) and (131b) are examples of relativization out of relative clauses. The (a) sentences are their source sentences respectively, where the object is relativised in (130b) and the subject is relativised in (131b). The example in (132) is a case of relativization out of an adverbial clause.

(130) a. [sono sinsi-ga kiteiru] yoohuku-ga yogoretteiru
     that gentleman-nom wear-teiru-pres suit-nom dirty-teiru-pres
     'The suit which that gentleman wears is dirty'

b. [[kiteiru] yoohuku-ga yogoretteiru] sinsi (-ni atta)
     wear-teiru-pres suit-nom dirty-teiru-pres gentleman (-dat meet-past)
     '(I met) a gentleman whose suit is dirty'
     (Lit. (I met) a gentleman who the suit (he) wears is dirty)

(131) a. [hon-o syuppansita] kaisya-ga kazi-de yaketa
     book-acc publish-past company-nom fire-by burn-past
     'The company that publish the book was burned down by fire'
b. [[syuppansita] kaisy ga kazi de yaketa] hon (-o katta)
   publish-past company-nom fire-by burn-past book (-acc buy-past)
   '(I bought) the book whose publisher was burned down by fire'
   (Lit. (I bought) the book which the company that published (it) was burned
down by fire)

(132) a. [sono hito ga sinda] node minna ga naita
   that person-nom die-past because all-nom cry-past
   'Everybody cried because that person died'

b. [[sinda] node minna ga naita] hito (-wa Taroo da)
   die-past because all-nom cry-past person (-top T copula)
   (Lit. The person who, because (he) died, everybody cried (is Taroo))

The corresponding English sentences are completely ungrammatical.

(133) a. * I met the gentleman who\(\text{i}\) the suit \(t_i\) wears is dirty
   b. * I bought the book which\(\text{i}\) the company that publish \(t_i\) was burned down by
       fire
   c. * The person who\(\text{i}\) because \(t_i\) died everybody cried is Taroo

The ungrammaticality of these sentences is attributed to a constraint that prohibits
movement out of islands. Relative pronouns are moved out of relative clauses or adjunct
clauses in these sentences.

Why are the Japanese sentences grammatical then? If the explanation for the
ungrammaticality of the English examples is on the right track, we could have one of the
following two explanations: the same constraint is not at work in Japanese or there is no
movement involved in Japanese relative clause formation and therefore the constraint is irrelevant.

Perlmutter (1972) argues for the latter position. He claims that the lack of island effects in Japanese relativization is due to the absence of relative pronoun movement. He proposes that the gap in Japanese relative clauses is not the trace of a relative pronoun, but an empty pronoun, pro. Unlike pro-drop in Romance languages, Japanese allows pro-drop in the object position as well as the subject position.

(134) a. pro asita Boston -ni ikimasu
        tomorrow B-to go-pres
        'I will go to Boston tomorrow'

       b. Junko-wa [pro iku] to itta
          J-top go-pres comp say-past
          'Junko said that she would go'

(135) a. John-ga asita pro ai-ni kimasu
        J-nom tomorrow meet-to come-pres
        'John will come to see me tomorrow'

       b. Junko-wa [Taroo-ga pro nagutta] to itta
          J-top T-nom hit-past comp say-past
          'Junko said that Taroo hit her'

Pro may be base-generated in situ and does not have to move. If the gap in relative clauses may be pro rather than the trace of a relative pronoun, we would not expect them to exhibit island effects.
Although a pro account of relative clauses in promising, there seems to be a problem with this approach concerning the syntax-semantics interface. To see this, let us begin by considering an analysis of 'normal' relative clauses, ones with overt relative pronouns. (Although Japanese does not have any overt (in)definite determiners, we tentatively assume that it has covert ones corresponding English a and the.)

\[(136)\]
\[
\begin{array}{l}
\text{a. naiteiru otokonoko cry-teiru-pres boy 'Lit.) boy who is crying'} \\
\text{b. } \\
\text{NP} \\
\quad (a/the) \\
\quad \text{N'} \\
\quad \quad \quad \text{<e,t>} \\
\quad \quad \text{CP} \\
\quad \quad \quad \text{otokonoko} \\
\quad \quad \quad \quad \quad \text{<e,t>} \\
\quad \quad \quad \text{boy <e,t>} \\
\quad \quad \text{(who)}_i \\
\quad \text{IP} \\
\quad \quad \text{t}_{i} \text{ naiteiru cry-teiru-pres}
\end{array}
\]

The trace is interpreted as a variable which saturates an argument position of the predicate. Thus, in the previous example, the trace \(t_i\) saturates the agent argument position of the predicate be crying and the entire IP node denotes a truth value (ignoring tense and both time and world arguments for the moment). The relative pronoun, which has moved from its base position to the Spec-CP, is interpreted as abstractor over the trace, making the denotation of the CP a set of individuals. (See Heim and Kratzer 1998.) This abstraction is crucial for the next step. The denotation of a larger constituent N' is computed by intersecting the denotation of its daughters: a set of boys and a set of crying individuals.
The problem of a pro analysis is that if we allow pro to be generated in the subject position instead of a relative pronoun as in (137), the sister node of the noun boy denotes a truth value, resulting in uninterpretability.

\[(137)\]

```
NP
  \(\text{CP}\) otokonoko
  \(\text{IP}\) pro naiteiru
cry-teiru-pres
```

The pro-analysis of relative clauses in Japanese gives us a straightforward answer to the lack of island effects, but structures generated under this analysis are semantically uninterpretable. How can we get out of this dilemma? There is another question concerning structures like (137). How does pro in relative clauses receive an appropriate interpretation? The answer to the second question will lead us to solve the first problem.

Pro, like overt pronouns, is assignment function dependent. When it is unbound, as in the examples (134a) and (135a), it denotes a contextually salient individual, in this case, the speaker. But pro in (137) may not be unbound. This would result in the type mismatch we just observed. Pro can be bound by some element in the same sentence. The obvious candidate for the antecedent of the pro in this case is (a/the) boy. But in this analysis of relative clauses, there is no constituent that corresponds to the phrase, the boy.
What if we were wrong about the structure of relative clauses? If we assume the following structure, *pro* can be properly bound by the NP *the boy*.

(138)   
```
     NP
    /\  
   CP   NP_1
     /\  
    IP   (the) otokonoko
          boy
```

pro naiteiru
  cry-teiru-pres

But this would result in type mismatch anyway. The relative clause now denotes a function of type \( <e,t> \), assuming that the index on the antecedent abstracts over the *pro*. Since the lower NP denotes the contextually salient boy, which is of type \( <e> \), the entire NP ends up denoting a truth value.\(^{38}\)

Let us go back to our original structure of relative clauses. What we want as the denotation of the relative clause is a function of type \( <e,t> \) so that it could be intersected with the denotation of the noun *boy*. We propose to insert a binder index as follows:

\(^{38}\)This structure also gives rise to a presupposition that is different from our intended interpretation. Since only the noun *boy* is in the scope of the covert definite determiner, the presupposition is that there is only one contextually salient boy.
This analysis of relative clauses in Japanese implies that their structure could be different from English relative clauses. In all the tree structures of relative clauses above, the CPs are projected for no reason. In English, a relative pronoun is generated in an appropriate position and moves above the subject position of the clause. When the subject itself is relativized, the movement is invisible, but when other elements such as an object is relativized, we can see the movement from the word order. The position to which a relative pronoun moves is assumed to be Spec-CP in the standard analysis. If there is no relative pronoun movement in Japanese, it is possible that there is no C-projection in Japanese relative clauses. The following structures are also conceivable.
In her thesis, Murasugi (1991) argues for an IP (or TP in our framework) analysis of Japanese relative clauses. Her hypothesis is based on the following observation. Compare the following English and Japanese examples:

(141) a. the reason why Mary thinks that John left
   b. the way that John said that Mary solved the problem

The above examples are ambiguous; (141a) could mean either the reason for Mary's thinking that John left or the reason for John's leaving according to Mary. Under the analysis of English relative clauses we are currently assuming, the ambiguity is attributed to possible positions at which a relative pronoun is generated. In (141a), the relative pronoun why could be generated to modify the lower clause John left or the higher clause Mary thinks and move to Spec-CP of the higher clause.

Japanese counterparts of these examples are unambiguous, however.

(142) a. [Mary-ga [John-ga kaetta to] omotteiru] riyuu
   M-nom J-nom leave-past comp think-pres reason
'the reason Mary thinks that John left'

b. [John-ga [Mary-ga mondai-o toita to] itta] hoohoo
   J-nom   M-nom  problem-acc solve-past comp say-past way

'the way in which John said that Mary solved the problem'

(142a) could only mean the reason for Mary's thinking and (142b) could only be the way of John's saying. Given the pro analysis of Japanese relative clauses, this is a mystery.

Murasugi first argues, following Saito (1985), that there are no pros corresponding to what Saito calls true-adjunct PPs in Japanese. True-adjunct PPs are PPs that express reason and manner such as for that reason and in this way. Murasugi further argues that giving up the pro analysis and going back to the standard relative pronoun movement analysis alone cannot be a solution. This is because there is no reason to believe that such movement should be blocked in (142). The English examples are perfectly grammatical with the lower construal. She argues that the difference between English and Japanese is due to the structural difference between English and Japanese relative clauses, namely, English relative clauses are CPs and Japanese relative clauses are IPs (or TPs in our framework).39

39 Kaplan and Whitman (1995) argue that this explanation for the English/Japanese contrast is not tenable, citing a similar example from Korean.

(i) [Mary-ka [John-i ttena-ss-ka] sayngkakha-n-un] iyu
   M-nom   J-nom leave-past-ind-comp think-pres-comp reason

'the reason that Mary think that John left'

They argue, following Yoon (1990), that the so-called adnominal suffix is a complementizer and therefore Korean relative clauses are CP. Yet, the sentence in (i) is unambiguous: it can only mean 'the reason for Mary's thinking that John left'. Based on this fact, and some more, they argue that Japanese relative clauses are CPs. Their arguments for the CP analysis include (i) historical evidence, (ii) evidence from copula constructions, and (iii) evidence for null operator movement in relative clauses. We will not try to argue against each argument presented in Kaplan and Whitman as evidence for the CP analysis because (i) Kaplan and Whitman do not provide an explanation for why examples like (142) do not allow a relative pronoun movement from the lower clauses, (ii) therefore the contrast between relative clauses like (142) and wh-movement constructions like (144) remains unexplained in their analysis, and (iii) as far as I can tell, they do not provide evidence to show that all Japanese relative clauses are necessarily CPs.
refer interested readers to Murasugi (1991,§3.4.). Roughly, Murasugi's story goes as follows: the English example in (141a) has the LF structure in (143a) and the Japanese example in (142a) in (143b).

(143)  a. [the reason [CP why_i Ci [Mary thinks [CP t'_i C_i John left t_i]]]]

    b. [the reason [IP (why_i) [Mary thinks [CP t'_i C John left t_i]]]]

Murasugi (1991) assumes a version of the government theory developed by Lasnik and Saito (1992), according to which, each trace $t$ and $t'$ has to be properly governed. In English the proper governors are Cs in each clause, which is co-indexed with the element in its Spec under Spec-Head agreement. In Japanese, on the other hand, the trace $t'$ is not properly governed since there is no C in the higher clause. This results in ungrammaticality.

Contrast the examples in (142) above with the following examples with $wh$-phrases.

(144)  a. donna riyuu-de Mary-wa [John-ga kaetta to] omotteiru no

    'For what reason does Mary think that John left?'

\[\text{\[\text{\[\text{why}_i\] [Mary thinks \[\text{\[\text{why}_i\] C John left t_i}\]]}\]}\]

\[\text{\[\text{\[\text{why}_i\] [Mary thinks \[\text{\[\text{why}_i\] C John left t_i}\]]}\]}\]

---

40 This is due to the Empty Category Principle (ECP) defined below.

(i) The Empty Category Principle (Chomsky 1981)

\[\text{A non-pronominal empty category must be properly governed.}\]

41 Murasugi crucially assumes that only X-zero categories can be a proper governor, following Lasnik and Saito (1992).

(i) $\alpha$ governs $\beta$ iff

\[\text{a. $\alpha$ c-commands $\beta$,}\]

\[\text{b. $\alpha$ is X-zero, and}\]

\[\text{c. 1. $\alpha$ theta-marks or case-marks $\beta$, or}\]

\[\text{2. $\alpha$ is co-indexed with $\beta$ and $\beta$ is subjacent to $\alpha$.}\]
b. donna hoohoo-de John-wa [Mary-ga mondai-o toita to] itta no
what way-in J-top M-nom problem-acc solve-past comp say-past Q
'In what way did John say [that Mary solved the problem]?'

These examples are ambiguous: the *wh*-phrases may be associated with the embedded clauses as well as the matrix clauses. Under Murasugi's IP analysis of relative clauses, the contrast between (142) and (144) follows. Suppose that the *wh*-phrases in (144) are generated in the embedded clauses and moved to the sentence initial position. In (144), the embedded clauses are not relative clauses, and therefore we have no reason to believe that they are IPs. Moreover, *to* is usually considered to be a complementizer. If they are CPs, the intermediate traces are properly governed.

We are not in a position to evaluate Murasugi's analysis. If her analysis is right, it gives further support for Japanese relative clauses not involving a C-projection. But for our purposes, it suffices to see that we have no reason to assume a C-projection in Japanese relative clauses.

In what follows, we further argue that Japanese relative clauses do not have to contain a T(ense)-projection, either. In order to do so, we will first have to look more closely at the morphology of what we have been calling the present tense. There are three morphological variations of the 'present tense' depending on whether it attaches to adjectives, adjectival nouns, or verbs, as shown below.

(145) a. Mina-wa kawai-i
Mina-top pretty-pres
'Mina is pretty'
b. kono eiga-wa taikutu-da
   this  movie-top boring-pres
   'This movie is boring'

c. John-wa eigo-o hanas-u
   J-top     English-acc speak-pres
   'John speaks English'

We have been calling these endings 'present tense morphemes' (glossed as 'pres'). They have also been referred to as 'non-past endings' (Nakau 1976, Soga 1983) or 'basic endings' (Teramura 1984). There has also been a long tradition of Japanese linguistics in which traditional grammarians deny the existence of a tense system in the Japanese language. (See Matsushita 1930, Kunihiro 1967.) These grammarians often call these endings 'imperfective endings'.

Notice that there is no verbal element that corresponds to the English verb be in (145a,b). In Japanese, adjectives and adjectival nouns inflect in a way similar to the verbs do. These classes of predicates conjugate depending on what affixes they are attached to. Traditional grammars of Japanese classify the conjugation patterns as follows:42

---

42The English terminology is from Unger (1993) except for mizen-kei, for which he used the term negative form. The term irrealis form for mizen-kei is due to John Whitman (Jennifer Smith p.c.).
<table>
<thead>
<tr>
<th>keiyoon</th>
<th>keiyoodoooon</th>
<th>dousi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjectives</td>
<td>Adjectival nouns</td>
<td>Verbs</td>
</tr>
<tr>
<td>ex. kawaii-</td>
<td>ex. taikutu-</td>
<td>ex. hanas-</td>
</tr>
<tr>
<td>pretty</td>
<td>boring/bored</td>
<td>speak</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>mizen-kei</th>
<th>irrealis form</th>
<th>-karo</th>
<th>-daro</th>
<th>-o, (-a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(used when followed by affixes like -u 'will', 'let's')</td>
<td></td>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>renyoo-kei</th>
<th>continuative form</th>
<th>-kat</th>
<th>-dat</th>
<th>-i</th>
</tr>
</thead>
<tbody>
<tr>
<td>(used when followed by affixes like -ta 'past')</td>
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<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>syuusi-kei</th>
<th>conclusive form</th>
<th>-i</th>
<th>-da</th>
<th>-u</th>
</tr>
</thead>
<tbody>
<tr>
<td>(used when no elements follows)</td>
<td></td>
<td></td>
<td></td>
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<table>
<thead>
<tr>
<th>rentai-kei</th>
<th>attributive form</th>
<th>-i</th>
<th>-na</th>
<th>-u</th>
</tr>
</thead>
<tbody>
<tr>
<td>(used when modifying nouns)</td>
<td></td>
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<table>
<thead>
<tr>
<th>katei-kei</th>
<th>conditional form</th>
<th>-kere</th>
<th>-nara</th>
<th>-e</th>
</tr>
</thead>
<tbody>
<tr>
<td>(used when followed by -ba 'if')</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>meirei-kei</th>
<th>imperative form</th>
<th>N/A</th>
<th>N/A</th>
<th>-e</th>
</tr>
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| Table 3: Conjugation Patterns of Adjectives, Adjectival Nouns, and Verbs in Japanese |

The table represents the conjugation pattern of adjectives, adjectival nouns, and verbs in the following way: the top row represents stem forms of these elements. The leftmost column represents the terms that refer to the conjugation pattern in the Japanese grammars, and examples of environments that induce the conjugation. Take the verb *hanas-* 'speak', for instance. When the affix -u 'let's' is added to the verb, the vowel 'o' is added first to the stem. The resulting form is *hanas-o-u*. When the affix -ta is added, it becomes *hanas-i-ta*. |
-o- in hannas-o-u and -i- in hanas-i-ta are not considered to carry any meaning. They serve as a glue to connect the stem and the affixes. In this description, what we have been calling the 'present tense' morpheme is part of the conjugation called the conclusive form, which means that a stem has to be followed by this form when there is no other affix attached to it. This is because a stem cannot stand alone for morpho-phonological reasons.

How do we know, then, that these morphemes -i, -u, and -da are realizations of the present tense morphology? How do we know that these ending forms carry the meaning of temporal location of the predicates? One piece of evidence may be the fact that simple sentences with these endings above are understood to mean that the states or events described by the predicates hold at the present moment, namely the speech time. But aren't all sentences, whether they are present-tensed or past-tensed, evaluated with respect to the speech time? In discussing the semantics of the past tense, we argued for the existence of a phonetically null temporal variable that is realized in the syntax as the evaluation time of the past tense operator. If so, it is possible that the ending affixes -i, -da, and -u are only default affixes that morphologically support a stem and do not carry any semantics. The above description from the traditional grammar of Japanese certainly implies that the ending forms -i, -da, and -u should be treated on a par with other semantically vacuous conjugation morphemes.

We believe that it is not possible to determine whether these morphemes are tense morphemes or default ones on a morphological basis. It is not possible to do so on a semantic basis either. What we will do instead is to give rather indirect evidence by showing that assuming that these morphemes are default morphemes would give us an account for the observed difference in tense in relative clauses among non-SOT languages.

Under this analysis of what we have been calling the 'present tense morpheme', the structure of the sentence in (146a) for instance looks like the following. (We will continue to gloss these morphemes as 'pres'.)
The morpheme, which we have been calling the 'present tense morpheme', is affixed to the adjective stem locally. It is not a tense morpheme and it is semantically vacuous. The AP denote the set of times at which Mina is pretty. The evaluation time of this sentence is given by the time variable, \( t^* \), which by definition denotes the speech time.

If we are correct in analyzing these morphemes as default ones, what we have been calling 'relative clauses' might not be what we thought they were. Consider the following examples with an adjective, an adjectival noun, and a verb that modify nouns.

(147) a. Junko-wa siroi neko-o katta
J-top white-pres cat-acc buy-past
'Junko bought a white cat'
'Junko bought a cat which was white'

b. Satoshi-wa taikutuna koogi-o kiiteita
S-top boring-pres lecture-acc listen-teiru-past
'Satoshi was listening to a boring lecture'
'Satoshi was listening to a lecture which was boring'
c. Mariko-wa naiteiru otokonoko-ni hanasakaketa

M-top cry-teiru-pres boy-to talk-past

'Mariko talked to the crying boy'

'Mariko talked to the boy who was crying

When the temporal interpretations of these noun modifiers are understood as simultaneous with the matrix event times, there are at least two ways to translate these noun modifiers into English, either as simple adjectival modifiers (such as adjectives and participles) or as relative clauses.

In English, there are a number of visible differences between the two constructions as we have seen in the previous section. (i) An overt relative pronoun can be generated in relative clauses. (ii) Relative clauses contain a tense projection. (iii) There is also a positional difference. Relative clauses have to follow the nouns they modify while simple adjectival modifiers often precede them. On the other hand, Japanese does not have an overt relative pronoun, and noun modifiers in any form have to precede the nouns they modify. If these 'present tense morphemes' are not really tense morphemes, there is no way to tell whether what we have been calling 'relative clauses' are actually relative clauses in the same sense English relative clauses are. The 'relative clause' in the (c) example for instance can be analyzed parallel to unembedded sentences as in (148a) or as containing less structure as in (148b):

(148) a. [[VP pro naiteiru] t*]

b. [VP pro naiteiru]

If we take the (a) analysis, the entire sentence has the following structure:
If we stick to the semantics of the evaluation time variable $t^*$ as repeated below, we get the speech time interpretation.

\[
(150) \quad \text{The variable } t^* \text{ may be bound in an intensional context.}
\]

- When it is bound, $[[t^*]]^{\mathcal{E},c} = g(i)$
- When it is free, $[[t^*]]^{\mathcal{E},c} = \text{the speech time of } c, s^*$
Since $t^*$ is indexical in extensional contexts, both occurrences of $t^*$ in the structure denote the speech time. If we take the (b) analysis, the sentence is given the following structure:

(151)

This means that the time argument of the embedded predicate is not saturated in the syntax. Since the time argument of the predicate is not saturated, the temporal interpretation of the relative clause is dependent on other elements in the sentence.

Analyzing Japanese 'present tensed' relative clauses in this way means treating them as parallel to English participle constructions as far as the temporal interpretation is concerned: they are both tenseless, and they denote properties of times. Note that the
parallelism we propose here is a semantic one. There are differences between the two: participle constructions are only possible when the missing argument is the subject. The same interpretation of the sentence (152a) may be obtained by (152b), but there is no way to reduce the relative clause in (153a) into a participle construction.

(152) a. Eva talked to the boy who was crying like a baby
     b. Eva talked to the boy crying like a baby

(153) a. Eva talked to the dog Deanna was walking
     b. * Eva talked to the dog (that) Deanna walking

In Japanese relative clauses, this is not the case. The gap of relative clauses can be the subject or the object:

(154) a. Mariko-wa naiteiru otokonoko-ni hanasikaketa
     M-top cry-teiru-pres boy-to talk-past
     'Mariko talked to the boy crying'

     b. Mako-wa Junko-ga samposaseteiru inu-ni hanasikaketa
     M-top J-nom walk-teiru-pres dog-to talk-past
     'Mako talked to the dog Junko was (lit.is) walking'

Does this mean that it is wrong to analyze Japanese relatives as constructions analogous English participles? We believe not. There are independent reasons that make English sentences like (153b) ungrammatical but Japanese counterparts like (154b) grammatical. First, Japanese and English are different in their nominative case assignment system. Nominative case assignment is assumed to be done through tense projection in English. We can attribute the ungrammaticality of sentences like (153b) to the failure of nominative
case assignment to the embedded subject due to the fact that there is no tense projection in
the participle. On the other hand, Kuroda (1992) argues, for instance, that the Japanese
Case system is different from English in that it can be done linearly without INFL (such as
T). His basis for this claim is rather weak; there is no evidence to show that INFL is
involved in case-marking in Japanese. (But see Takezawa 1987, and Watanabe 1994.)
Here we present some examples to show that at least some occurrences of ga-marking is
possible without an overt tense marker, a claim made by Endo (1994).43

(155)  a. John-ga akuyaku-no eiga
       J-nom villain's role-gen movie
       'the movie in which John plays the villain's role'

       b. syusshin-ga Kyoto-no hito
           hometown-nom Kyoto-gen people
           'people who are from Kyoto'

       c. LING201-no seiseki-ga A-no gakusei
           LING201-gen grade-nom A-gen student
           'students whose grade in LING201 is A'

These examples all involve small clause like structures embedded under a noun. But the
embedded clauses are associated with the head noun by the genitive marker no, and we see
no elements that we may be able to call a tense projection. Yet the subjects of the small
clauses are marked by the nominative case marker ga.

Another difference between Japanese and English is the availability of pro. If the
failure to assign nominative case is what distinguishes English and Japanese, we predict that

43 The (a) example is from Endo (1994).
the phrase in (156a) could receive the structure in (156b) and can mean the politician who people in general are criticizing.44

(156) a. * the politician criticizing
   b. the politician PROi PROarb criticizing ti

The phrase (157a), the Japanese counterpart of (156a), can have this reading with an appropriate context, where the politician is understood as the one who is criticized.

(157) a. hihansiteiru seizika
       criticize-teiru-pres politician
       'politician criticizing'
   b. pro hihansiteiru proj seizikaj

We believe that the difference lies in the nature of PRO and pro. In explaining the contrast between the following two examples, Chomsky and Lasnik (1993) presents a new perspective on the theory of PRO.

(158) a. We never expected [PROi to be found ti]
   b. * We never expected [PROi to appear to ti [that Sally left]]

It was argued within Government and Binding theory of Chomsky (1981) that PRO cannot occur in a governed position.45 The movement of the PRO in (158a) may thus be justified

44 Pointed out by Kyle Johnson (p.c.).

45 This is called the PRO theorem and follows from the Binding theory and the nature of PRO as a pronominal anaphor. It is defined that PRO has both features [+pronominal] and [+anaphor]. As a consequence, PRO has to satisfy both the conditions A and B of the Binding theory:

(i) A: An anaphor must be bound in its governing category.
   B: A pronoun must be free in its governing category.
as a last resort to escape from being governed. Chomsky and Lasnik argue that this explanation is not satisfactory. It does not explain the ungrammaticality of (158b). The PRO in (158b) is generated in a governed position and moves to a non-governed position, just like the PRO in (158a).

Instead, Chomsky and Lasnik argue that the movement in (158a) is case-driven: the sister node of the verb found is not a case position and PRO moves to get Case, a null case that is assigned by to-infinitives. In (158b), PRO has no reason to move since it is already in a case position. Thus, movement is prohibited by the principle of Greed that says that movement of $\alpha$ is only allowed if morphological properties of $\alpha$ itself would not otherwise be satisfied in the derivation. (See Chomsky 1994.)

If this explanation is correct, the object PRO in (156b) is not allowed to move for the same reason. It cannot stay in situ either, since it receives the wrong case. If the missing arguments are PROs in (157a), we predict that the structure is ungrammatical for the same reason as its English counterpart. In Japanese, however, there is another possibility. Japanese is a pro-drop language and the missing arguments may be pros. Since pro, like overt pronouns, can receive accusative case, the resulting structure (157b) is well formed.

To sum up, we have claimed that 'present tensed' relative clauses in Japanese may be analyzed as tenseless constructions. Their time argument is not saturated overtly, and therefore their temporal interpretation is dependent on operators, such as tenses, that embed

(ii) $\alpha$ is the governing category for $\beta$ iff $\alpha$ is the minimal category containing $\beta$ and a governor of $\beta$, where $\alpha = NP$ or $S$.

(iii) $\alpha$ governs $\beta$ iff $\alpha$ m-commands $\beta$ and $\alpha$ and $\beta$ are in the same maximal projection.

(iv) $\alpha$ m-commands $\beta$ iff $\alpha$ does not dominate $\beta$ and the first maximal projection that dominates $\alpha$ dominates $\beta$.

If PRO has a governing category, it has to satisfy contradictory requirements that it has to be both bound and free in the same domain. Hence, the only way to avoid the paradox is to not have a governing category.
them. Under this analysis, the availability of the simultaneous interpretation when a 'present tensed' relative clause is embedded under a past tensed matrix clause is not due to the fact that Japanese is a non-SOT language. In other words, the availability of the simultaneous interpretation in relative clauses and that in clausal complements are given different explanations: the former is a consequence of 'present tensed' relative clauses being tenseless and denoting properties of times, and the latter is due to the binding of the variable $t^*$. This leaves us a possibility that there may be a difference among non-SOT languages. In the next section, we will look at Russian relative clauses more closely.

2.3.2. Russian Relative Clauses and Participle Constructions

We will begin this section by looking at verbal morphology in Russian. We will argue, as we did for Japanese 'present tense morphemes', that there is no morphological or semantic reason to assume that what we have been calling the 'present tense forms' are actually present tensed. In their paper "The Functional Structure of Slavic Clauses", Franks and Greenberg (1993, p.83) summarize the Russian verbal morphology as follows:

"Russian has only one explicit tense marker of tense, i.e., -l, which marks [+past]. This tense marker freely attaches to verb stems of either aspect and is followed by endings that match the gender of the subject rather than its person. ... The non-past endings are actually person endings, i.e., they invariably mark the person of the subject. The non-past endings result in difference tense readings depending on the aspect of the stem: imperfective conjugated verbs have present tense meaning and perfective conjugated verbs have future tense meaning."

The following table shows the pattern.⁴⁶

⁴⁶ The table is constructed based on Franks and Greenberg (1993, p.81-83) and Wade (1992, p.228, 257-258.) According to Wade (1992, p.2298), each Russian verb has an infinitive stem, from which the past tense, the future imperfective, and past participle are
Table 4: Morphology of Russian Verb Inflections

<table>
<thead>
<tr>
<th></th>
<th>Imperfective</th>
<th>Perfective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Past</td>
<td>imp/stem + l + past agr.</td>
<td>perf/stem + l + past agr.</td>
</tr>
<tr>
<td>Present</td>
<td>imp/stem + nonpast agr.</td>
<td>N/A</td>
</tr>
<tr>
<td>Future</td>
<td>copula + nonpast agr. + imp/stem</td>
<td>perf/stem + nonpast agr.</td>
</tr>
</tbody>
</table>

The fact that there is no overt present tense morphology in Russian does not necessarily mean that there is no present tense in the language. But it certainly is compatible with the picture that we gave for Japanese.\(^{47}\) Let us propose that what we see as a 'present tensed' verb is just a stem plus agreement morphemes (and the imperfective morpheme.) (See the table above. Morphologically this is exactly what a 'present tensed' verb contains.) Does this mean that 'present tensed' sentences in Russian are tenseless and they do not contain a T-projection? Given our assumption that checking of the nominative case feature and subject-verb agreement features is done thorough T-projection (see Chomsky 1994, 1995), this is untenable. We propose that the distinguished variable \(t^*\) is an element of T in Russian. The appearance of \(t^*\) is semantically necessary, too. Otherwise, sentences denote properties of times. Present tense morphology is not responsible for locating the event time at the speech time. The ongoing event interpretation of sentences like (159a) arises from the default presence of \(t^*\).

\(^{47}\) A similar argument is made by Enç (1990) and Johnson (1990) for English present tense; they argue on independent grounds that there is no present tense morpheme in English. I believe that this cannot be true for English, though. The existence of the double-access interpretation of present under past constructions suggests that something about what we see as the present tense makes a semantic contribution. And it is natural to assume that it is the present tense morpheme.
Recall that present tensed verbs in Russian do not have an imperfective vs. perfective distinction: they are all imperfectives. We follow Kratzer (1995, 1998), who builds on Klein's work (1994), and propose the following semantics for the imperfective morpheme.\(^{48,49}\)

\[
[[\text{IMP}]]^g_{\mathfrak{c}} = f: D_{<i<s,t>} \to D_{<i<s,t>}
\]

For all \(p \in D_{<i<s,t>}, t \in D_i, \text{ and } w \in D_S, f(p(t)(w) = 1 \text{ iff there is a time } t' \text{ such that } t \subseteq t' \text{ and } p(t')(w) = 1.\]

---

\(^{48}\) This semantics is different from Kratzer's in that she employs event arguments as well as time arguments. Taylor (1977) proposes the same denotation for the progressive in English.

\(^{49}\) This is a very simplified semantics. Since imperfective predicates give rise to the so-called imperfective paradox just like English progressive forms, intensionality has to be taken into consideration. See Dowty (1979), Parsons (1990) and Landman (1993). We will ignore it in this thesis.
Now let us look at relative clauses in Russian. As can be seen from examples like the following, an overt relative pronoun appears in a relative clause.

(161) Ma_a videla _eloveka, kotoryi pla_et

M. see/past/imp man who cry/pres

'Masha saw a man who is (now) crying'

The Case of a relative pronoun depends on its position in the relative clause. In this case, the gap is in the subject position, and hence the nominative marked relative pronoun kotoryi 'who' has to be used. Under our assumption of case assignment (or checking), this implies the existence of a tense projection. We also have evidence that relative pronouns are moved to a clause initial position, which is considered to be Spec-CP under the standard analysis.

(162) Masha videt zhen_inu, kotoruju Vova ljubit

M. see/past/perf woman whom V. love/pres

'Masha saw a woman whom Vova loves'

It looks like Russian relative clauses have full-fledged CP structures. Let us propose that the structures we assume for root clauses, i.e., structures like (159), are embedded as relative clauses. Then we have structures like the following:

(163) a. Ma_a videla _eloveka, kotoryi pla_et

M. see/past/imp man who cry/pres

'Masha saw a man who is (now) crying'
This necessarily yields the speech time interpretation, given the semantics of the variable \( t^* \), repeated here.

(164) The variable \( t^* \) may be bound in an intensional context.

When it is bound, \([[[t^*_1]]_g, c = g(i)\)
When it is free, $[[t^*]]^{E,c} = \text{the speech time of c, s^*}$

This analysis is supported by an interesting contrast between relative clauses and participles in Russian. Unlike Japanese but like English, Russian relative clauses and participles are clearly overtly distinguishable. Participles have their own unique inflection, different from the ones that we find in finite clauses. Participles have Case agreement with their modifiees. And there are no overt elements like relative pronouns that fill the gap position. What interests us especially is that participles in Russian are 'tensed'. We may assign two different translations for the following English sentence using participles.$^{50}$

(165) Mary met the child laughing from joy

(166) a. Ma_a videla rebjenka, smej-u__-egosja ot radosti  
    M see/past/imp child laugh-part/pres/act-sing/mas/acc from joy

b. Ma_a videla rebjenka, smej-a_-egosja ot radosti  
    M see/past/imp child laugh-part/past/act/imp-sing/mas/acc from joy

The participle used in the (a) example is called a present-active participle and the one in the (b) example is called a past-active participle. This present/past contrast should not be confused with present/past participles in English, i.e., the '-ing' form in phrases like the boy crying like a baby and the '-en' form in phrases like the talk given by Barbara. The English-type contrast is called active/passive contrast in traditional Russian grammar, and the ones in (166) are both active participles. Thus in Russian, the difference in present and past participles results in a difference in temporal interpretations.

$^{50}$ The data are taken from Kondrashova (1992). I thank Natalia Kondrashova for clarification and discussion.
Interestingly, 'present tensed' participles do allow the simultaneous interpretation. This contrasts with 'present tensed' relative clauses, which only allow the speech time interpretation. 'Past tensed' imperfective participles have the same range of temporal interpretations as past tensed imperfective relative clauses, namely the simultaneous interpretation, the earlier-than-matrix interpretation, and the later-than-matrix interpretation, the latter two of which may be made salient with appropriate contexts.\(^{51}\)

Let us first analyze the syntactic structure of active participles in Russian. Since we analyze the 'present tense' morpheme as default, the structure of 'present' active participles is parallel to English -ing participles.

\[
\text{(167) a.}
\]

```
(PartP)

(PROi [Part] ['-ing'] [AspP [IMP VP [ti V']]])
```

Past active participles, on the other hand, contain a T-projection. They can either contain a vacuous past as in (b), which yields the simultaneous interpretation, or a true past as in (c).

\(^{51}\)Wade (1992) seems to claim that only the simultaneous interpretation is possible with imperfective past-active participles embedded under a past tense. Natalia Kondrashova (p.c.) pointed out to me, however, that it is possible to get the earlier-than-matrix and later-than-matrix interpretations with appropriate contexts. The nature of imperfective aspect makes non-simultaneous interpretations difficult when there are no other intervals made salient in the contexts.
Under our analysis, the contrast between 'present tensed' participles and 'present tensed' relative clauses in their temporal interpretation is attributed to their structural difference. Relative clauses in Russian are full-fledged CPs, and therefore contain the variable $t^*$ in their tense projection. On the other hand, participles can be made of a smaller projection. The time argument of 'present' participles does not have to be saturated by an overt temporal variable, and as a result, participles denote properties of times. Therefore, the temporal interpretation of 'present' participles is dependent on other elements in the same sentence, for instance, the tense that embeds them.

Before concluding, let us briefly discuss another possibility to account for the interpretation of the present tense in relative clauses in Russian. One might argue that the object NPs in Russian always undergo QR, and thus escape from the scope of the matrix past tense. This can explain the difference between clausal complements and relative clauses regarding the availability of the simultaneous interpretation. The former allows the simultaneous interpretation while the latter does not. This could be due to the fact that clausal complements are not normally considered to undergo QR. Below we will present an argument against such a movement analysis.

When a present tense is embedded under a past tensed intensional predicate such as (168a,b), the double-access interpretation obligatorily arises with the opaque interpretation. By uttering the sentence (168a), the speaker asserts that Masha wanted a long-eared puppy, and implies that the relevant property of a puppy continue to hold at the speech time. In order not to induce double-access effects, the past tense has to be used as in (b) examples.

(168) a. Ma\_a xotela \_enka, u kotorogo dlinnye usi  
M. want/past/perf puppy at whom long ear  
'Masha wanted a puppy that has long ears'
b. Ma_a xotela enka, u kotorogo byli dlinnye usi
M. want/past/perf puppy at whom be/past/imp long ear
'Masha wanted a puppy that had long ears'

(169) a. Ivan iskal edinoroga, kotoryi ljubit ego
Ivan look-for/past/perf unicorn which like/pres him
'Ivan looked for a unicorn that likes him'

b. Ivan iskal edinoroga, kotoryi ljubil ego
Ivan look-for/past/perf unicorn which like/past/imp him
'Ivan looked for a unicorn that liked him'

The same effect is found in English.\(^{52}\)

(170) a. John looked for a student who understands the Incompleteness Theorem
b. John looked for a student who understood the Incompleteness Theorem

This shows that the present tense in the relative clauses is anchored to the speech time without moving out of the scope of the matrix past tense.

Moreover, this story has to assume that the object NPs undergo QR obligatorily when they are modified by a 'present tensed' relative clause, but optionally when they are modified by a 'present tensed' participle.

2.3.3. Summary of § 2.3.1. and § 2.3.2.
In the preceding two sections, we have given an explanation for the striking difference among non-SOT languages regarding the interpretation of the 'present tense' in relative

\(^{52}\) This fact is reported in Abusch (1988), and the examples are hers.
clauses that we observed in § 1.6. (repeated at the beginning of § 2.3.). We have argued that the tense semantics in these non-SOT languages is uniform: what we see as the 'present tense' does not have any semantic content. We have derived the observed difference in the temporal interpretation of 'present tensed' relative clauses from the structural differences of relative clauses. The analysis is partly based on what we proposed in § 2.2.2. concerning the temporal interpretation of participles. Under our proposal, tenseless expressions such as participles have their time argument slot unsaturated, and therefore, their temporal interpretations are dependent on operators that embed them. We analyzed Japanese 'present tensed' relative clauses as having a participle-like structure and Russian 'present tensed' relative clauses as having a full-fledged CP structure. We have shown that an analysis along these lines can also explain a difference seen in the temporal interpretation of 'present tensed' relative clauses and participles in Russian.

2.3.4. The Past Tense in Non-SOT Languages
So far, we have mostly been concerned with the temporal interpretation of 'present tensed' clauses in non-SOT languages. In representing past tensed clauses, we have used the same syntactic structure as that of SOT-languages. That is, we have assumed that non-SOT languages, as well as SOT languages, have two past tenses, a variable \textit{past} and an operator \textit{PAST}.

In this section, we will justify our view of the past tense in non-SOT languages, since this is not a widely held view. Let us first review what this proposal buys us regarding SOT languages. We know by now that some occurrences of the past tense in SOT languages are vacuous. That is, they do not carry any meaning of anteriority. Positing \textit{past} and \textit{PAST} makes it possible to account for SOT phenomena by saying that a variable \textit{past} can occur on its own only when it is in certain embedded contexts. We can structurally represent the ambiguity of sentences like the following:

(171) Bernhard said that Junko was sick
a. PAST Bernhard say-past [that PAST Junko be-past sick]
b. PAST Bernhard say-past [that Junko be-past sick]

The Japanese counterpart of the above sentence is unambiguous.

(172) Bernhard-wa Junko-ga byookidatta to itta

B-top J-nom sick-past comp say-past

'Bernhard said that Junko had been sick'

The sentence only has the earlier-than-matrix interpretation. This means that our motivation to posit a vacuous past tense is not there in non-SOT languages. This leads authors like Ogihara (1989, 1996) and Stowell (1993) to believe that there are no vacuous past tenses in non-SOT languages in both descriptive and technical senses.\(^{53,54}\) Descriptively, the embedded past tense in sentences like (172) cannot be vacuous. It would yield an unattested simultaneous interpretation. Technically speaking, however, it is possible that non-SOT languages have a variable past tense in their inventory. If, unlike in SOT languages, it cannot appear on its own in any environment, it would look as if there are no vacuous past tenses. For instance, if there is a constraint that excludes LFs like (173b) for sentences like (172), we can get the desired result.

(173) a. PAST Bernhard-wa [PAST Junko-ga byookida-past to] it-past

b. * PAST Bernhard-wa [Junko-ga byookida-past to] it-past

\(^{53}\) Ogihara argues that the SOT rule that operates at LF and deletes a past tense under a certain condition does not exist in non-SOT languages. Stowell argues that SOT languages only contain operator tenses.

\(^{54}\) See also Nakamura (1994b).
We argue that this is in fact the case, and propose that non-SOT languages have a different constraint on occurrences of the past variable:

(174) Condition on past (non-SOT languages)
past must be c-commanded by PAST in the same clause.

The (b) representation violates this condition since there is no PAST operator in the embedded clause. This also correctly captures the fact that past under past sentences such as (172) are unambiguous.

A similar situation may be found in differences in NPI licensing between English and Japanese. In English, an NPI does not have to occur in the same clause as its licensor. It can be done both locally as in (a) and non-locally as in (b).

(175) a. John did not bring anything
b. Susan did not believe that John brought anything

In Japanese, NPIs are not licensed by negation in the higher clauses. Thus, the (b) sentence is unacceptable.

(176) a. Junko-wa nanimo mottekonakatta
  J-top        anything bring-neg-past
  'Junko did not bring anything'

b. *? Ayumi-wa Junko-ga nanimo mottekita to sinzinakkata
  Ayumi-top Junko-nom anything bring-past comp believe-neg-past
  'Ayumi did not believe that Junko brought anything'
Similar to NPI licensing, the licensing condition on the variable *past* is different in terms of locality in SOT and non-SOT languages.

In cases like (172), the predictions of our proposal, and Ogihara's and Stowell's are identical. In what follows, however, we present evidence for our proposal that SOT and non-SOT languages do not differ in their inventory of the past tenses, but with respect to the locality requirement on the licensing condition of the past tense morpheme.

Consider the following examples:

(177) a. Junko-wa [Satoshi-ga sonotoki byookidatta to] itta J-top S-nom that-time sick-past comp say-past 'Junko said that Satoshi was sick then'

b. Mako-wa sonotoki zibun-wa yopparateinakatta to syutyoosita M-top that-time self-top drunk-teiru-neg-past comp insist-past 'Mako insisted that she was not drunk then'

The sentences have a past tense embedded under a propositional attitude verb with another past tense, exactly like (172). The sentences (177) are ambiguous, however: when there is a contextually salient past interval that the speaker has in mind, *sonotoki* 'then' is understood deictically. The sentence has the shifted reading. *Sonotoki* can, however, also be anaphoric to the time of the matrix events. In this case, the sentence has the simultaneous reading. Although what is going on here is intuitively simple, the availability of a simultaneous reading needs an explanation. If Japanese does not allow vacuous past tense, it yields a past-shifted reading no matter what lexical denotation we give to the adverb *then*. This is because the evaluation time of the embedded past tense is the matrix event time (or more precisely, what the subject takes to be 'now' at the time of her speech.)

In our story, the solution is simple since our system in principle allows vacuous past tenses in non-SOT languages. The non-vacuous past tense in examples like (172) is a
result of the locality effect of the licensing condition. We argue that in examples like (177), what we see as the past tense morphology is in fact a vacuous past that does not accompany any semantic PAST, and it is licensed by the past adverbial sonotoki 'then'.

What would Stowell and Ogihara say about this exceptional case? In their systems, no occurrences of the past tense in non-SOT languages may be vacuous (since there is only one past tense.) In order for them to get the simultaneous interpretation with examples like (177), the embedded past tense cannot be interpreted in situ. But, of course, we do not have to interpret it where it is. So, we could say that in cases like (177) we can (and have to in order to yield the simultaneous reading) interpret the embedded past tense as well as the adverb sonotoki 'then' as de re.

We will not try to show how this is done here. For one thing, we do not know what LFs with two res-movements should look like nor how to interpret them compositionally. This is a problem about a de re theory that relies on res movement in general, however, and we know that more than two elements in attitude complements may be understood de re.

Instead, we will show that there are cases where we do not want to construe embedded tenses as de re. Suppose that on July 2nd, John said, "Anita went to NY yesterday." Suppose further that John had no idea when on July 1st Anita went to NY. On July 3rd, we can report what he said as "Yesterday John said that Anita went to NY the day before (yesterday)". In this scenario, what my utterance should mean is that John said of the day before yesterday that it has a property of containing the time of Anita's going to NY, not that John said of a particular time in the day before yesterday that it has a property of Anita's going to NY. If we interpret the embedded past tense in the example above as de re, what we get is the latter interpretation.

Another case would be examples that contain adverbs of quantification. Suppose that Mariko said last summer, "I water the plants every other day these days". We could report her utterance this summer as "Mariko said that she watered the plants every other day then." There is no particular time that Mariko is acquainted with. Rather, Mariko is acquainted with the interval denoted by "then" as "days surrounding the day of my (=
Mariko's) speech", and she said of those days that they have a property of containing her watering plants every other day.

The above two arguments are true of Japanese, too. We take these to indicate that embedded tenses themselves are not necessarily interpreted as de re. This means that if all embedded past tenses are true past tenses in Japanese (or more generally in non-SOT languages), we are not able to derive the simultaneous interpretation with the adverb then. Under our analysis, however, the availability of the simultaneous interpretation is predicted by assuming that past denoting adverbs like then can also be licensors of a variable past when it occurs in the same clause.

2.4. Summary
In this chapter, we have proposed a tense system for natural language that employs explicit quantification over times in the object language, where the evaluation time slot of tense operators and the time argument slot of predicates are represented in the syntax as time variables of type <t>. This is a system that meets the criterion discussed in Chapter 1 that the natural-language tense system should be able to keep track of all times introduced in a given sentence.

We have argued that the evaluation time slot of tense operators is represented in the syntax as a special variable that we call the distinguished variable. The necessity of this variable is proven by showing that without it, a system has to rely on movement of some sort (QR or quantifying in) to derive what we call the later-than-matrix interpretation, which leads to a scope paradox.

We have also argued that the time argument slots of main predicates are saturated by a tense morpheme, which we proposed is a time variable. This analysis implies that not all predicates in natural-language sentences have their time argument overtly represented in the syntax. In other words, the time argument slot of tenseless expressions is not necessarily saturated. We have shown that this explains the asymmetry in temporal donkey sentences,
and the difference in the temporal interpretation of relative clauses and participle constructions.

Lastly, we have shown that the difference in the temporal interpretation of Polish and Russian vs. Japanese present tensed relative clauses is accounted for in terms of structural differences. Polish and Russian relative clauses are full-fledged relative clauses in which the time arguments of the relative clause predicates are syntactically saturated. Japanese relative clauses are 'participle-like' constructions which denote properties of times.