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SEQUENCE OF TENSE AND THE BINDING THEORY*

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This paper deals with the phenomenon of Sequence of Tense (SOT), and with the question of whether a rule of SOT is desirable in a reasonable account of tense. The data in (1) illustrate the phenomenon under consideration:

(1) a. Tony says that Alex has the papers. (present-under-present, simultaneous reading)
b. Tony says that Alex had the papers. (past-under-present)
c. Tony said that Alex had the papers. (past-under-past, simult. or shifted reading)
d. Tony said that Alex has the papers. (present-under-past, dual-access reading)

In (1a), the lower clause is interpreted as simultaneous with the matrix clause. (1c) is ambiguous; the embedded clause can be understood as taking place either at the same time as the matrix clause (the simultaneous reading), or prior to the time of the matrix clause (the shifted reading).[1] While the simultaneous reading is more salient in (1c), the shifted reading can be brought out with adverbs, or with the right context. In (1b), the lower clause is interpreted as holding over an interval prior to the time of the matrix clause, while in (1d), the dual-access reading (Enç 1987) is required, with the lower clause holding over an interval including both the time of the matrix clause and the moment of speech.

Traditionally, these facts have been accounted for (Comrie 1985) by a late rule substituting past tense for present in the domain of a past tense verb, deriving (1c) from a source like (1d). A possible derivation is given in (2).

(2) PAST(Tony say (PRES (Alex have the papers))) → (SOT Rule)
PAST(Tony say (PAST (Alex have the papers))) → (Other rules)
Tony said that Alex had the papers

Some languages, like English and French, have an SOT rule, while others, like Russian and Japanese, do not. In these languages, a sentence with tense forms corresponding to (1d) has the meaning corresponding to the English (1c).

Ladusaw (1977), discussing problems with Montague's (1970) treatment of tense, proposed that present and past tenses should be taken as relating directly to the moment of speech. Enç (1987) argues against the standard treatment of tense as a sentential operator, and develops a referential theory with no SOT rule. She uses a version of binding to account for the simultaneous and shifted readings. Abusch (1988), following Kamp and Rohrer (1984), argues for two different Past tenses in English, one of which means essentially the same thing as the present, and occurs only in Transposition Contexts. These are the contexts in which the rule of SOT applied. Her argument is based on sentences like (3).

(3) John decided a week ago that in ten days at breakfast he would tell his mother that **they <u>were</u> having their last meal together.**

The problem with (3) is the boldfaced embedded clause. This clause is marked with past tense, although it denotes an event that is not prior to any other event, nor

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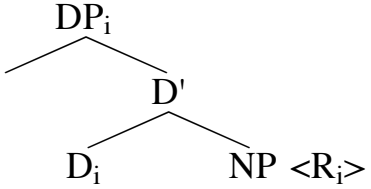
[1]The aspectual properties of the embedded clause play an important role in determining which of these readings is most salient. This issue is left aside here due to space limitations.

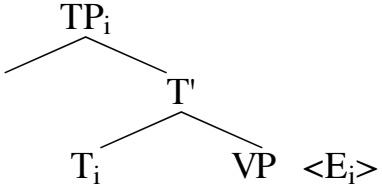
indeed to the moment of speech. The event described in this clause will not take place until three days after the moment of speech, and there are no other events in the sentence that take place later. Therefore, Abusch reasons, any analysis of past tense that requires it to precede some other moment or interval is doomed to failure. However, Abusch's analysis merely stipulates the solution, since nothing in her paper explains why there are two past tenses in English, why one of them is essentially identical in meaning to the present, and why that particular tense is restricted to appearing in transposition, or SOT, contexts.

I now turn to my own referential theory of tense, showing how it can account, first for the simple cases in (1), and then for the complex case in (3).[2] The theory is modelled on the way reference works in nominals. Noun phrases have at least the structure shown in (4). NP has an open place, R (Williams 1980), which must be bound in order for the nominal to refer. The determiner normally binds this place, making the DP as a whole a referential expression. DP thus bears the referential index. Analogously, clauses have (at least) the structure in (5).

(4)



(5)



Like NP, VP has an open place, E (Higginbotham 1985), which must be bound. T, like D, binds the open place, making the TP a (temporally) referential expression.[3] Assuming, following Ritter (1995), that pronouns are members of the category D, the referential properties of a nominal, that is, a DP, follow in large part from lexical properties of the D heading the projection. In particular, the binding properties of a nominal are due to lexical properties of the pronoun.

I have argued elsewhere (Cowper 1996) that the binding properties of a TP follow from lexical properties of the tense morpheme heading the TP. Tense morphemes, like nominals, can be divided into three categories: those which must be bound (anaphors), those which must be free (R-expressions) and those which may be either free or bound (pronominals).[4]

Reference in nominals involves indexing to an element in the universe of discourse, commonly called Domain D. In addition to ordinary individuals, Domain D includes various intervals and moments, as shown in (6):

(6) a. I spent **a year** in France, and **it** was the best year of my life.

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[2]Enç (1987) also calls her theory a referential theory, but her approach is quite different from mine. The differences will be pointed out where relevant.

[3]This view constitutes the first major difference between my approach and that of Enç. Whereas I take the referential category of tense to be the entire TP, she takes it to be the tense morpheme itself. For Enç, the tense morpheme encodes a temporal relation, relating the time of its clause to the time of an abstract element in the complementizer governing the clause. In the present analysis TP's, like DP's, are indexed to a referential domain.

[4]I use the term 'bound' in a different sense from that used by Enç. For her, a bound tense, whether it be a past or a present tense, necessarily denotes the same interval as its binder. The simultaneous reading of a past-under-past sentence like (1c), in Enç's analysis, involves the binding of the embedded past tense by the matrix past tense. In contrast, in the analysis to be presented here, a bound TP is called bound because it is referentially dependent upon its binder, but does not necessarily denote the same interval.

b. **The day after tomorrow** is expected to be an ordeal for all of us.

TP's themselves, however, are much more restricted in what they can refer to. I will show that in fact, all free TP's are indexed to what is often misleadingly called the speech time. I prefer to call the entity in question the Discourse Anchor (DA), since quite frequently the Discourse Anchor is not the moment of speech. Let us now look at some examples. The tense morphemes of English are the set of modals and the elements listed in (7).

(7)

ES (present indicative)	SBJPR (present subjunctive)
ED (past indicative)	SBJPA (past subjunctive)
ING (present participial)	TO (infinitival)
EN (past participial)	

These elements are discussed in some detail in Cowper (1996). I focus here exclusively on the binding properties of the elements in the left-hand column in (7). Some properties of modals will be discussed below.

EN and ING are participial morphemes, heading TP's that occur as the complements of the auxiliary verbs *have* and *be*, and in the case of ING, in other contexts as well. Both ING and EN are, I claim, temporal anaphors, in that the TP's they head must be referentially dependent. Consider (8) and (9):

(8) a. Hedda has [$_{TP}$ PRO seen the movie]
b. Hedda had [$_{TP}$ PRO seen the movie]

(9) a. Deborah is [$_{TP}$ t watching TV]
b. Deborah was [$_{TP}$ t watching TV]
c. We found [$_{TP}$ Deborah watching TV]
d. She fell asleep [$_{CP}$ while [$_{TP}$ PRO watching TV]]

The embedded TP's in (8) are backshifted with respect to the time of the matrix TP, while those in (9) are simultaneous with the time of the matrix TP. I claim that, with both ING and EN, the embedded TP is coindexed with, and bound by, the matrix TP. At first this seems implausible, since EN and ING encode two quite different temporal relations. EN encodes a precedence relation while ING encodes a relation of simultaneity. However, Saxon (1984) discusses an anaphor in Dogrib which has a similar property: it requires a local disjoint antecedent. In other words, this anaphor has a coindexing relation with a local antecedent, but the relation expressed by the coindexing is not identity, but rather disjoint reference. I propose that EN involves essentially the same mechanism. EN is a temporal anaphor, in that its reference depends on a local linguistic antecedent, the governing TP. However, what is encoded by coindexing is not identity, or simultaneity in temporal terms, but rather precedence. ING, the present participial morpheme, is also coindexed with a governing TP, but the relation encoded by coindexing is the unmarked one, simultaneity.

We now consider the present and past indicative tense morphemes, ES and ED. These cannot be anaphors, since they appear heading matrix TP's, as in (10).

(10) a. Johan likes spaghetti.
b. Karin enjoyed the hike.

Using the two types of coindexing relations proposed for the participial morphemes, we can say that the matrix TP in each example in (10) is coindexed with the DA. ES encodes the unmarked relation of simultaneity, while ED encodes the marked relation of precedence.

We can now consider the question of whether the SOT phenomenon requires a rule of SOT. The issue will be resolved, in part, by determining the binding properties of ES and ED. Consider (1c), repeated as (11).

(11) Tony said that Alex had the papers.

The matrix TP is free, and coindexed so as to precede the DA. If the embedded TP were bound by the matrix TP, then it would be coindexed so as to precede the matrix TP, giving the shifted reading. Alternatively, if the embedded TP were free, coindexed with and preceding the DA, then one interpretation would be that the two TP's are simultaneous with each other. This is the most salient interpretation of (11). However, if the embedded TP is free, we expect the times of the two TP's to be freely ordered with respect to each other, giving the shifted reading, the simultaneous reading, and a non-existent forward-shifted reading, with a meaning equivalent to that of (12).

(12) Tony said that Alex would have the papers.

It is the absence of this forward-shifted reading that led Enç to propose her version of bound past tense, which must have a simultaneous interpretation, and that led Abusch to propose her second past tense morpheme, which is specified as simultaneous with, rather than preceding, its antecedent. I argue here that neither of these moves is necessary, and that the forward-shifted reading can be ruled out on independent grounds. First note, as Enç does, that a forward-shifted reading is available for a past tense in a relative clause, as shown in (13):

(13) Tony insulted the man who bought the house next to mine.

The forward-shifted reading is absent only when the embedded past TP appears in the intensional argument of a past tense verb, as Abusch (1988) points out. This is Kamp and Rohrer's Transposing Context, the context in which the standard SOT rule applies, and the only environment where, Abusch claims, the special simultaneous past tense can occur.

In fact, the forward-shifted reading should be ruled out on pragmatic grounds. There seems to be a constraint on propositions in intensional contexts, which limits the degree of certainty with which the proposition is expressed. Consider the set of utterances in (14):

(14)	*(On Tuesday evening, Alex says:)*	a.	It might rain tomorrow.
	(On Wednesday evening, Bill says:):	b.	Alex said it would rain today.
	OR	c.	Alex said it might rain today.

(14b) is false; (14c) is true. The only difference between the two sentences is the choice of modal. The degree of certainty expressed by *would* in (14b) is greater than that expressed by *might* in (14c), and this difference is sufficient to make (14b) an inaccurate report of the speech in (14a). (14b) can be ruled out as a report of (14a) by the pragmatic constraint stated in (15):

(15) **Preservation of Modality**
The degree of certainty of a proposition in an intensional context (an indirect proposition) cannot be greater than the degree of certainty of the corresponding direct proposition.

Preservation of Modality can be used to rule out a forward-shifted reading of a past TP in the intensional complement of a past tense verb. Consider (16).

(16) Gaby said that Pernilla knew the answer.

Suppose that Pernilla did not know the answer at the time that Gaby spoke, but came to know it at some time between then and the moment of speech. This would be the state of affairs described by a forward-shifted interpretation of (16). What, then, might Gaby have actually said? He could not have said (17a), which was false at the time he spoke. He must have said something like (17b).

But if what Gaby said was (17b), then (16) violates Preservation of Modality. The only way that (16) can respect Preservation of Modality is if Gaby said either (17a) or (18).

(17) a. Pernilla knows the answer.
b. Pernilla will know the answer soon.

(18) Pernilla knew the answer.

(17a) corresponds to the simultaneous reading of (16), and (18) to the shifted reading. Given Preservation of Modality, there is no need for a specific constraint on tenses to rule out the forward-shifted reading of (16). There is thus no need for Abusch's second past tense, or for Enç's version of bound tense. If the embedded TP is bound, in my sense, (16) will have a shifted reading. If the embedded TP is free, (16) will have either a shifted or a simultaneous reading.[5]

Let us now consider the case of (1d), repeated as (19).

(19) Tony said that Alex has the papers.

It is this type of sentence that led Enç to abandon the idea that English has an SOT rule. Such a rule would derive the simultaneous reading of (16) from a deeper structure in which the embedded clause contained a present tense. The present tense would be interpreted relative to the matrix tense, and would be converted to a past tense form by a late rule, perhaps at PF. The problem with such analyses is that they predict, either that sentences like (19) should be ungrammatical (if the rule were obligatory), or that a sentence like (19) should be synonymous with (20) (if the rule were optional).

(20) Tony said that Alex had the papers.

Neither of these predictions is correct; (19) is grammatical and has a special meaning of its own. Specifically, (19) means that the interval of the embedded TP must include both the time of the matrix TP and the Discourse Anchor. I will now show how this follows without any additional mechanisms.

First, assume that in English, the present indicative tense morpheme is an R-expression. It therefore cannot be coindexed with a higher TP, but only with the

[5]Note that when the embedded TP is bound, it gives a subset of the readings that are available when the embedded TP is free. This raises the question of whether ED in English is ever bound at all. I leave this question aside due to lack of space.

DA. It immediately follows that the interval of the embedded TP in (19) must include the DA. We now invoke Preservation of Modality, according to which Tony must have said (21a), and not anything like (21b).

(21) a. Alex has the papers.
b. Alex will have the papers (soon).

The only pragmatically possible interpretation of (19) is therefore the one in which the interval denoted by the embedded TP includes both the time of the matrix TP and the DA.

Under the approach just outlined, the difference between languages exhibiting SOT and those that do not can be accounted for straightforwardly. A language without SOT is, by definition, one in which a present-under-past sentence can have a purely simultaneous reading. In our terms this would mean that the embedded TP containing the present tense morpheme can be bound by the matrix TP containing the past tense morpheme. In other words, in non-SOT languages, the present (and possibly also the past) tense morphemes have the binding properties of pronominals.

Sentences like (19) are thus predicted to be ambiguous in these languages, between a dual-access reading like the one found in English, where the embedded present tense is free, and a dependent reading, where the embedded tense is bound by the matrix past tense and therefore interpreted as simultaneous to the matrix past tense. To the extent that I have been able to verify this prediction, it has been confirmed.

Having shown that the standard cases can be handled in the referential theory of tense without special stipulations or SOT rules, let us now consider the sentence that, for Abusch (1988) and Ogihara (1996), necessitates a special SOT treatment. This is sentence (3), repeated here as (22).

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

Recall that this sentence contains a past tense TP that will take place after the DA, and no earlier than any other TP in the sentence, casting doubt on any analysis of past tense that always includes the notion of precedence. However, this sentence also introduces two other kinds of temporal information: temporal adverbs and a modal. Before drawing any conclusions about the significance of this sentence for the question of SOT, it is essential to understand the contribution of these elements.

Partee (1973) claimed that temporal adverbs are antecedents for tenses. For me, the only possible antecedents for TP's are other TP's or the Discourse Anchor. Temporal adverbs are TP-adjuncts which modify, rather than antecede, the TP or something within the TP.[6] Assume that in (22), the temporal expression *a week ago* modifies the matrix TP. The two PP's *in ten days* and *at breakfast* stand in a relation of thematic discontinuity (Brunson 1992). They cumulatively denote a single interval which modifies the TP containing the VP headed by *tell*. Nothing in the temporal adverbials sheds light on why the most deeply embedded TP, denoting an interval apparently later than the DA and simultaneous with its governing TP, shows

[6]Interesting things happen when there is a clash between the tense and the temporal adverb, as in (i), but a consideration of such cases goes beyond the scope of this paper.

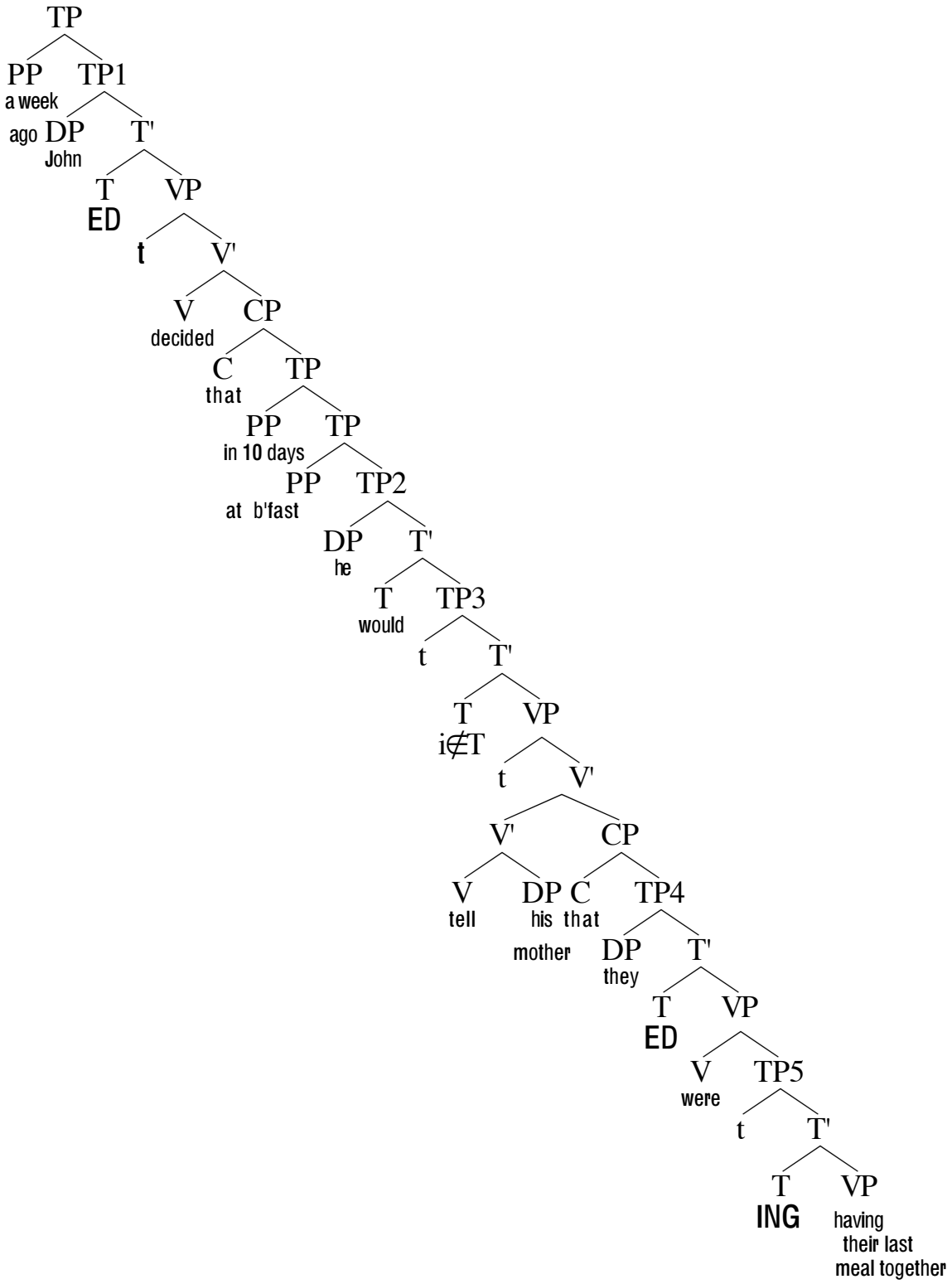
(i) I **was** leaving for Toronto **tomorrow**, but now it looks as though I'll have to stay a few more days.

up in the past tense. In fact, if anything the temporal adverbials are causing the problem, rather than solving it.

Let us now consider the temporal contribution of *would*, which in this sentence is behaving as the past tense form of the modal *will*. There are two main schools of thought on *will*: one holding that it encodes a tense, namely the future (Hornstein 1990), and the other holding that *will* is simply a modal like other modals, and that the future is simply a particular instantiation of irrealis time (Comrie 1985). I adopt the latter view, and assume that in general, future tenses are best treated as irrealis. An analysis of (22) thus requires an understanding of how irrealis time is represented in English.

I propose to define realis time as the set T of moments and intervals that can be coindexed with the DA. Since the coindexing relations are simultaneity and precedence, T is the set of moments and intervals simultaneous with or prior to the DA. Irrealis time is defined as the complement of T, namely that set of moments and intervals that cannot be coindexed with the DA, and that therefore are neither simultaneous with nor prior to the DA. In Cowper (1996) I argue that irrealis, not realis, is the marked property, and that certain tense morphemes, specifically the two subjunctive tenses, are marked as irrealis. This marking states that their denotata do not belong to the set T. Irrealis is signified, where necessary, as $i \notin T$. Modals also introduce the irrealis property, although in a slightly different way than do subjunctive tenses. Modals are themselves indicative tense heads, and as such head TP's with the binding properties of indicatives. However, I claim that a modal takes another TP as its complement, and that this TP bears the irrealis feature. The structure of sentence (22) is thus as in (24).

(24)



There are 5 TP's in this sentence whose time reference must be established. TP1 is headed by ED and is coindexed so as to precede the DA. TP2, headed by *would*, is free, and is also coindexed so as to precede the DA. As with simpler sentences like (1c), this gives a reading in which the two TP's are simultaneous. Note that TP2 is not the telling event; rather it is the interval during which the intention or probability of telling holds.

TP3 is the irrealis TP selected by *would*, whose VP is the telling event. Since it is specified as irrealis, it cannot be simply coindexed with the DA, or with another TP coindexed with the DA, without causing a contradiction. On the other hand, there has to be some relation between irrealis TP's and the DA in order for the sentence to be interpreted. This problem is not confined to modals, but cuts across the entire language. Consider the data in (25).

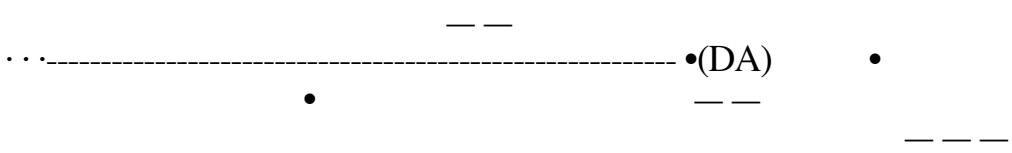
(25) a. Yesterday the patriarch ordered that in one week his daughter **be told** that she **was** no longer welcome in his house.
b. Yesterday the president ordered his assistant **to** wait a week, and then inform the Congress that their approval **was** not required.

The verb *order*, like the modals, selects an irrealis complement, which can be subjunctive, as in (25a), or infinitival, as in (25b). In both of the sentences in (25), the boldfaced past tense denotes an interval that precedes neither the DA nor any other moment or interval in the sentence. As in (22), these problematic past tenses are embedded in irrealis TP's.

What all three sentences have in common, crucial to the resolution of the problematic past tenses, is that the irrealis TP's are selected by elements that are themselves marked as past.

I now turn to the question of how irrealis moments and intervals are incorporated into the temporal representation of a sentence. Realis time, the set of moments and intervals simultaneous with or preceding the DA, can be thought of as a linear structure terminating at the DA. Irrealis moments and intervals are clearly not on this line. Some are in the future, iconically to the right of the DA, and others are in the counterfactual present or past, iconically above or below the line, as schematized in (26).[7]

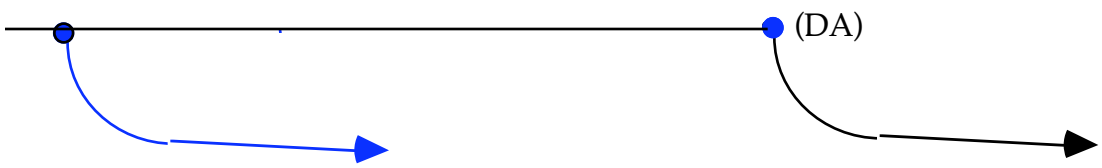
(26)



I adopt the general idea, although not the details, of Enç's claim that tenses must be anchored. The problem with the picture in (26) is that the irrealis moments and intervals are not anchored; no sequence of links attaches them to the DA. Another inadequacy of (26) is that there seems to be no structure to irrealis time; the irrealis moments and intervals seem not to bear any particular temporal relation to each other.

The picture in (27) suggests a way of addressing both of these problems.

(27)



In this picture, irrealis temporal structures are linked to the realis structures and are themselves organized into time lines. If these links can be made explicit and

[7]Note that the diagram in (26) has no theoretical status; it is just a convenient way of visualizing intervals and moments.

their properties examined, then perhaps a solution can be found to the problematic past tenses in (22) and (25).

I shall refer to the point at which an irrealis structure is linked to realis time as a temporal nexus. A temporal nexus arises because of the lexical properties of some element in the sentence. For example, the complementizer *if* determines a nexus, as do verbs such as *order,* which take subjunctive complements. Modals also have this property.

Irrealis time can be thought of as existing on a separate dimension, or more properly on any number of separate dimensions, from realis time. A nexus is the point at which an irrealis dimension intersects with realis time. If Enç is right in claiming that all tenses must be anchored, then any tense denoting a moment or interval of irrealis time will have to be anchored through its nexus.

The curved lines in (27) represent irrealis temporal structures, and each nexus is shown by a dot. Only the nexus is relevant for anchoring free TP's that are located in an irrealis domain. In other words, free TP's in an irrealis domain are tense-marked as though they were simultaneous with the nexus. In effect, in the realis dimension they are simultaneous with the nexus since the only link between the irrealis dimension and the realis dimension is the nexus. Since the nexus is in realis time, it bears one of only two relations to the DA: it is either simultaneous with the DA or it precedes the DA.

With all this in mind, let us return to the problematic sentence, (22). Te matrix TP is coindexed so as to precede the DA, and the TP headed by *would* is free and also coindexed so as to precede the DA. The modal *would* determines a temporal nexus, linking realis time with the irrealis events governed by *would*. The TP immediately governed by *would* is unmarked for tense, and its temporal interpretation is determined by the temporal PP's *in ten days* and *at breakfast*.

We come finally to the problematic past tense in the complement of *tell*. If ED in this clause is free, then under the nexus approach to irrealis time, it should be tense-marked as though it were simultaneous with the nexus. The nexus in this case, the modal *would*, is past with respect to the DA, and the embedded free tense should therefore also be marked as past.

Under this view, there should be strong restrictions on the occurrence of the English finite present tense in an irrealis context. Recall that in English, the finite present tense morpheme cannot be bound. Therefore, if an irrealis context has a past nexus, a present tense inside it should not have a purely irrealis reading. Since it is tense-marked as though it were simultaneous with the nexus, it should exhibit the dual-access properties exhibited by any present-under-past construction. Consider the sentences in (28) and (29).

(28) a. Mary said she would tell the workers that they were no longer needed.
b. Mary said she would tell the workers that they are no longer needed.

(29) a. As a practical joke, Mary said she would tell the workers that they were no longer needed.
b. ??As a practical joke, Mary said she would tell the workers that they are no longer needed.

The difference between (28a) and (28b) is that in (28b), the most deeply embedded clause is interpreted as holding, not only at the time of Mary's telling, but also at the DA. This follows from the presence of a free present tense, which is coindexed so as to be simultaneous with the DA. Since the dual-access reading is

always *de re* rather than *de dicto* (Abusch 1990), the strangeness of (29b) follows immediately.

Now consider what happens when the element determining the nexus is present, rather than past. This is shown in (30).

(30) a. Mary says she will tell the workers that they are no longer needed.
b. As a practical joke, Mary says she will tell the workers that they are no longer needed.

Why is (30b) acceptable, while (29b) is strange? The difference is that in (30), the nexus is simultaneous with the DA. A free present tense in the irrealis domain in (30) can receive an irrealis interpretation because there is no conflict between the tense of the nexus and the free present tense. (30) is therefore ambiguous between a *de dicto* and a *de re* reading of the most embedded clause, and the addition of the adjunct PP in (30) simply eliminates the *de re* reading. (28b) has only a *de re* reading of the most embedded clause, and the addition of the adjunct PP therefore makes the sentence anomalous.

We have seen that a properly constructed referential theory of tense has no need for an SOT rule. It can also be shown that tense neutralization rules, such as Comrie (1985) proposed for Bahinemo, can be dispensed with. The cross-linguistic difference traditionally attributed to a ±SOT parameter follow from differences in the lexically-determined binding properties of the tense morphemes in the languages involved. This result lends further support to the idea that grammar is universal and that crosslinguistic differences are to be entirely accounted for by lexical differences.

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