Comments on Abusch's theory of tense*

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In her paper "Sequence of Tense Revisited: Two Semantic Accounts of Tense in Intensional Contexts," Dorit Abusch sets herself two very ambitious goals that have not been attained in previous literature. One of these goals is to give a unified syntactic and semantic treatment of the past tense in English which can cope with the puzzling fact that most, but not all, occurrences of past tense convey a meaning of anteriority. The other goal is to deduce the peculiar meaning of present tense complements in past tense attitude reports from independently motivated principles. As far as I can see, she has succeeded on both counts, thus setting a new standard for subsequent work on the topic. I have little to offer in the way of substantive amendments or criticisms. The following pages primarily report my attempt to provide more concrete formulations for some of the sketchier portions of Abusch's proposal.

1. Preliminaries

To get started, let me fix some basic assumptions about the LF-syntax and semantics of tensed sentences. Abusch appeals to an analogy between tenses and pronouns, which suggests a treatment of the tenses as variables: their LF-representations carry numerical indices, and they have semantic values dependent on a variable assignment which maps indices to time intervals. I assume a two-sorted system in which there are ordinary individual variables (type e) and a separate set of time variables (type i), from which the indices on the tenses are drawn. My notation for the semantic value of an expression α with respect to a variable assignment g is $[[\alpha]]^g$. So we have the following lexical entries for the past and present tense morphemes (henceforth PAST and PRES).

(1) (a) $[[\text{PAST}_i]]^g = g(i)$
(b) $[[\text{PRES}_i]]^g = g(i)$

An obvious objection to (1) is that it makes the two tenses semantically equivalent. We will come back to this.

Verbs take tenses as arguments. An intransitive verb like *cry*, for instance, has at least two arguments, an agent and an event time, which in a sentence like *John cried* are expressed respectively by the subject and the tense. The whole system is an intensional semantics, so I assume that the semantic value of a sentence is a proposition, i.e. a function from worlds to truth values (type <s,t>).[1]

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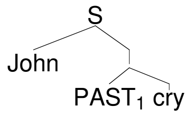
[1]The analysis in (2) and (3) implies that the verb has a world argument, but - unlike the time argument - this is not syntactically realized and remains unsaturated in the composition of a semantic value for the sentence. This is an arbitrary choice of mine, and other treatments of the world-parameter would have been just as good here. (Abusch is inexplicit or inconsistent in this respect: some of the LF-structures in her paper show overt world variables, others don't.)

(2)



(3) $[[\textit{cry}]](t)(x)(w) = 1$ iff x cries at t in w.
(type <i,<e, st>>)

By standard composition principles, we derive that $[[(2)]]^g(w) = 1$ iff John cries in w at g(1). The variable assignment for free variables is supplied by the utterance context: $g_c(1)$ is whichever time the speaker is referring to by her use of PAST_1 in the context c. For instance, this may be a time which has been made salient by a previous utterance.

Something needs to be added to this analysis to account for the fact that the past tense in such a sentence can only refer to an interval preceding the utterance time, whatever the context of use may be. Naive inspection reveals that past tense conveys a meaning of anteriority, and present tense a meaning of simultaneity, relative to the utterance time. (Each context c determines an utterance time t_c.) For instance, when PAST_i occurs free as in (2), it must refer to a time in the past of the utterance. And when it is bound by a quantifier as in (5) below, that quantifier is understood as having only past times in its range. In a setting where tenses are treated like pronouns, this is reminiscent of the semantic import of (natural) gender: Free instances of *she* can only refer to female individuals, and bound instances, as in *Some student raised her hand*, restrict the range of the binding quantifier to females. The contribution of gender in pronouns has been treated as a presupposition[2], and so one might try the same thing for the distinctive features of the tenses. (What follows is not the right way to capture the meanings of the tenses, for well-known reasons, nor is it what Abusch assumes in her paper. We will turn to what she proposes instead in section 3 below.)

To implement this, we make the assignment of the semantic values partial and relativize it to both a variable assignment and a context. The lexical entries (1a,b) are amended to (4a,b). ('<' means '(wholly) precedes', and 'o' means 'overlaps').

(4) (a) $[[\text{PAST}_i]]^{g,c}$ is defined only if $g(i) < t_c$, in which case $[[\text{PAST}_i]]^{g,c} = g(i)$
(b) $[[\text{PRES}_i]]^{g,c}$ is defined only if $g(i)$ o t_c, in which case $[[\text{PRES}_i]]^{g,c} = g(i)$.

An utterance counts as felicitous only if the sentence uttered has a well-defined truth value in the context of utterance. The presuppositions of a sentence thus narrow down the set of possible contexts in which the speaker is allowed to use it, and the hearer may exploit them as a clue in figuring out what the context actually is.[3] Specifically, the

[2]See Cooper (1983) and Heim (1982) for presuppositional treatments of pronoun features.

[3]See Stalnaker (1978) and Lewis (1979b) for this conception of presuppositions and their role in fixing the context.

effect of (4) is that free instances of PAST_i and PRES_i in felicitous utterances will always be intended and understood as referring to times preceding and overlapping the speech time respectively.

A tense may also be a <u>bound</u> variable. Perhaps even <u>all</u> tenses are bound variables, contrary to what I just assumed along with Abusch (and will assume throughout the remainder of these comments), including those in simple sentences like *John cried*. Bäuerle and others[4] have argued that this sentence contains an implicit adverb of quantification meaning 'once,' with an equally implicit restriction to times contained in a contextually salient reference interval, and that this QAdv binds the time argument of the verb. Be that as it may, there are at least some instances of past tense which Abusch explicitly treats as bound, e.g. in her (34), of which (5) is a simplified version.

(5) John was in Paris at some time.

An LF in which the adverbial binds the tense might look as follows.[5]

(6) LF: (at) some time λ_3 [John PAST_3 be in Paris]

This will be interpretable if *some* and *time* have meanings of type <<i,st>,st> and <i,st> respectively:

(7) [[*some*]](P)(Q)(w) = 1 iff ∃t [P(t)(w) = 1 & Q(t)(w) = 1]
[[*time*]](t)(w) = 1 iff t is a time.

If we disregard the presupposition contributed by PAST, we predict something not quite correct, namely that (6) is true iff John is in Paris at some time or other. In fact, (5) says that John is in Paris at some time <u>before the utterance</u>. Let's see if we can derive this somehow from the presupposition.

At this point, we need an assumption of how presuppositions project from the nuclear scope of a quantifier. The basic idea is that a quantified structure presupposes that everything that verifies the restriction fulfills the presuppositions of the nuclear scope.[6] For *some*, this means that [[*some*]](P)(Q)(w) is defined only if Q(t)(w) is defined for all t such that P(t)(w) = 1.

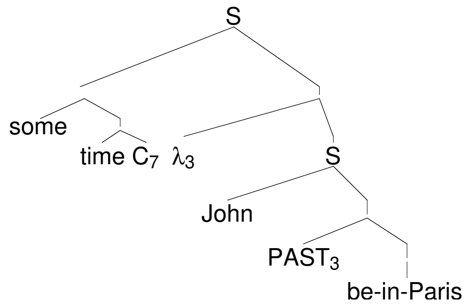
[4] Bäuerle (1979), Kratzer (1978), von Stechow (1992).

[5] I am quite unsure about the details here. The interaction between tense and adverbials doesn't get any explicit attention in Abusch's paper, and what I have read elsewhere about the matter (e.g. Dowty (1979), Stump (1985), and the works cited in note 4) suggests a much more complicated picture. I will go along here with Abusch's view that the relation between tenses and adverbials is just like that between pronouns and their antecedents, taking the risk that this might be quite wrong and that essential parts of Abusch's contribution might fall apart in the process of correcting it.

[6] This generalization, implemented in Karttunen & Peters (1979), has met with much criticism in the literature since then. For a recent assessment, see Beaver (1993). I have not had the time to determine how the present application to tenses would be affected by embedding it in a more sophisticated theory of presupposition projection.

Applying this to the LF in (6), we at first make the unwelcome prediction that $[[(6)]]^{g,c}$ is undefined, because there exist times which are not before t_c. But we can avoid this if we acknowledge that quantifiers quite generally carry implicit restrictions. *Everyone* isn't normally understood to mean 'every person in the whole universe', and so we shouldn't expect *some time* to necessarily mean 'some time in the past, present, or future.' Let's represent implicit quantifier restrictions at LF as free predicate variables which receive values from the context and intersectively modify the overt restricting predicate.[7]

(8)



We then predict that (8) will lack a truth value if there are times not preceding the speech time in the extension of C_7. The net effect of this presupposition is to constrain the restriction variable to a set of past times. This seems descriptively appropriate.

Next, let's sketch the LF-syntax and semantics of attitude complementation structures. Following Lewis (1979a), Abusch assumes that the contents of attitudes are not in general propositions (functions from worlds to truth values), but rather properties of temporally located individuals, which she construes as functions from triples of an individual, a time, and a world to truth values. Since the individual coordinate of the triple doesn't really play a crucial role for the specific purposes of her paper, I will abstract away from it and pretend that the objects of attitudes are just <u>properties of times</u>, construed here as functions of type <i,st>. For instance, *believe* can be interpreted as expressing the following relation (type <<i,st>,<i,<e,st>>>)[8]:

(9) [[*believe*]](P)(t)(x)(w) = 1 iff P(t')(w') = 1 for all w' and t' compatible with x's beliefs in w at t.

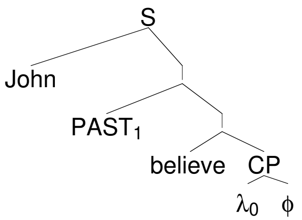
The locution "compatible with x's beliefs in w at t" requires some explication, for which I refer to Abusch and especially to Lewis: the worlds and times "compatible" with a person's beliefs are those at which she might be located for all she can tell. When w' and t' are compatible with x's beliefs in w at t, we also say that t' is a doxastic alternative of t for x, and w' is a doxastic alternative of w for x.

[7] I am following von Fintel (1994), to whom I refer the reader for details.

[8] This is ultimately just a special case of a more complicated entry which provides for additional arguments created by res-movement; see below.

This entry implies that a sentence like (2) above cannot simply be embedded as it is under *believe*, because it has the wrong type of meaning (<s,t> instead of <i,st>). Adapting Chierchia's treatment of de se readings for pronouns, I assume that complement sentences contain an operator (perhaps in the Comp node) that performs functional abstraction of a variable of type i.[9] An LF for a sentence of the form *John believed* ϕ will thus have the following structure:

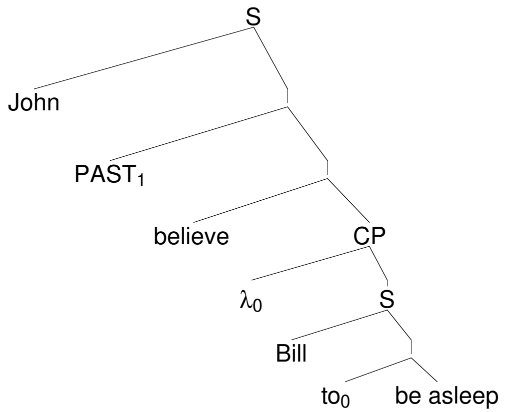
(10)



For a first concrete illustration, I choose an infinitival complement[10].

(11) John believed Bill to be asleep.

(12) LF:



The infinitive marker *to* here is treated like a tense: it is a variable of type i and serves as the event-time argument for *(be) asleep*. It is not a free variable, however, but bound

[9]See Chierchia (1990). Abusch herself is not clear or consistent on whether she intends the abstraction over times in attitude complements to be made explicit at LF in this way. Just like with the world-arguments of propositions (see note 1) she sometimes does and sometimes doesn't. But since she assumes that this abstractor sometimes binds a tense (see below), I am forced to make it explicit. (There are no analogous cases, at least none relevant to Abusch's paper, that would have forced me to do the same for the world-argument.)

[10]Abusch treats infinitival clauses only in passing, but her representation of her (36), for instance, suggests something along the lines of the present analysis for (11).

by the operator in Comp. We will see below that such binding is an option for the finite tenses PAST and PRES as well, but with them, it is not obligatory. We may draw an analogy here to a well-known difference between the empty pronoun PRO and overt pronouns like *he*, *she* etc.: PRO can only be interpreted de se (which in Chierchia's analysis means it must be bound by the operator in Comp), whereas overt pronouns have this choice as well as others.[11] Given the binding relation in (12), the embedded CP denotes the property of being a time at which Bill is asleep. And given the semantics for *believe*, the whole structure (12) then means that John at the time denoted by PAST$_1$ believes himself to be located at a time which has this property. This amounts to a so-called "simultaneous reading", which is indeed the only possible reading for (11).[12]

One more thing before we can move beyond the preliminaries: I set aside a distinguished time variable which is subject to two stipulations: its free occurrences denote the utterance time, and it is the only variable that may be bound by the operator in the Comp of an attitude complement. Let's say this is the zeroest variable of type i. So every assignment g_c that is supplied by a felicitous utterance context c is such that $g_c(0) = t_c$; and every well-formed LF has index 0 on every λ in Comp. As we will see below, this distinguished variable plays the role of Abusch's "local evaluation time".[13]

2. The Upper Limit Constraint

Abusch states the Upper Limit Constraint (ULC) in two formulations on p. 24: "the now of an epistemic alternative is an upper limit for the reference of tenses. [...] the local evaluation time is an upper limit for the reference of tenses." It plays a central role in her theory. For instance, it enters her explanation of why the (a)-sentences in the following pairs cannot be used to describe the same states of affairs as their (b)-variants.

(13) When she was in her twenties,
(a) she thought she was unhappy on her 40th birthday.
(b) she thought she would be unhappy on her 40th birthday.

[11]This observation originates with Morgan (1970). Besides Chierchia (1990), see also Higginbotham (1992).

[12]A problem with this analysis is that binding the tense to λ_0 leaves no room for adverbials. But in fact they can appear: *John believed Bill to be asleep at that time/every time he called/...* Perhaps what's at fault is the analysis of adverbials as binding tenses; see note 6.

[13]We do not literally have evaluation times in the version of intensional semantics that I have used here: it is not a system in which semantic values are generally functions whose arguments are (or include) times, or in which semantic values are assigned to expressions relative to times. (Except insofar as semantic values depend upon a context and thus on an utterance time, but this plays a different role. In unembedded contexts, the evaluation time is the utterance, but elsewhere they may be distinct.)

(14) John said that he had never been in Paris yet,
(a) but that he went there at some time in his life.
(b) but that he would go there at some time in his life.

(15) It wasn't such a terrible experience as she had predicted
(a) that it was.
(b) it to be.

The ULC is also crucial to Abusch's derivation of the double-access reading for present-under-past structures.

I will render the ULC as another presupposition (constraint on definedness of semantic values).

(16) If α_i is a tense, then $[[\alpha_i]]^{g,c}$ is only defined if $g(i) \neg> g(0)$.

('$\neg>$' means 'does not follow'.) There is a vagueness here as to what it means for α_i to be a tense. We could take it to mean that α is one of the morphemes PAST and PRES, in which case we would effectively be amending the lexical entries of each of these items. For instance, we'd be replacing (1a) by (17).

(17) $[[\text{PAST}_i]]^{g,c}$ is defined only if $g(i) < t_c$ and $g(i) \neg> g(0)$,
in which case $[[\text{PAST}_i]]^{g,c} = g(i)$.

Abusch makes it clear, however, that she intends something slightly different (see her discussion on p. 37): A tense for the purposes of the ULC is whatever occupies the syntactic position in which tenses originate, whether this be an actual tense morpheme or a trace that has been left there after movement. Let's assume this position is identifiable by the syntactic category label T. We can then leave the entries for PAST and PRES as we have had them and implement the ULC as follows:

(18) $\left[\!\left[\begin{array}{c} T \\ \alpha \end{array} \right]\!\right]^{g,c}$ is undefined if $[[\alpha]]^{g,c} > g(0)$; where defined, $\left[\!\left[\begin{array}{c} T \\ \alpha \end{array} \right]\!\right]^{g,c} = [[\alpha]]^{g,c}$.

In simple examples with matrix tenses, the effects of the ULC are systematically redundant: As we saw in the previous section, the inherent presuppositions of the tenses already impose more specific requirements on the ordering between event time and utterance time.[14] We need more complex examples to see the ULC at work, specifically, examples where a tense node is inside the scope of a binder for the designated variable 0.

Consider first a past-under-past complementation structure in which the lower past is anaphoric to a de dicto description within its clause[15].

[14] This result will have to be reconsidered in section 3, where we abolish the inherent presuppositions of the tenses and introduce instead the affixes $<$ and $\neg<$ and the TLC. For matrix PAST, the ULC will still be systematically redundant after those revisions. (For PRES, it depends -- see below.)

[15] The English sentence in (19) presumably has other kinds of readings as well, but this is the one I want to consider.

(19) John believed that Bill was happy on his 40th birthday.

(20) LF: John PAST_1 believe λ_0 [his 40th birthday λ_2 [Bill PAST_2 be happy]]

If this has a truth value in the utterance world (w_c) at all, i.e., if all its presuppositions are satisfied, then it is true in w_c iff for all w compatible with John's beliefs in w_c at $g_c(1)$, Bill is happy in w when he turns 40 in w. This ascribes to John a "purely propositional" belief: it tells us something about what kind of world he locates himself in, but nothing about where he locates himself in time. As far as this asserted proposition goes, John might have viewed Bill's 40th birthday as past, present, or future, or he might have been agnostic about the matter.

Let us now calculate the presuppositions. For the matrix tense, we get the usual $g_c(1) < t_c$. What interests us here are the presuppositions that are projected from the embedded tense, especially the one due to the ULC. Since attitude verbs are, in effect, universal quantifiers, the projection rule that applies is another instance of the law we invoked in connection with example (5) above: everything that verifies the restriction must fulfill the presuppositions of the nuclear scope. The restriction in the case is of [[*believe*]] is an implicit one to doxastic alternatives, the nuclear scope is the complement. Concretely, the relevant instance of the projection law is (21)[16]:

(21) [[*believe*]](P)(t)(x)(w) is defined only if P(t')(w') is defined for all w' and t' compatible with what x believes in w at t.

Applied to (20): $[[\lambda_0\ \textit{[his 40th birthday}\ \lambda_2\ \textit{[Bill PAST}_2\ \textit{be happy]]}]]^{g_c,c}(t)(w)$ is defined for all w and t compatible with John's beliefs in w_c at $g_c(1)$. Let "b(w)" abbreviate "Bill's 40th birthday in w". $[[\lambda_0\ \textit{[his 40th birthday}\ \lambda_2\ \textit{[Bill PAST}_2\ \textit{be happy]]}]]^{g_c,c}(t)(w)$ is defined iff $[[\textit{Bill PAST}_2\ \textit{be happy}]]^{g_c[t/0,\ b(w)/2],c}(w)$ is defined.[17] The latter requires (i) that Bill's 40th birthday in w precede t_c (from lexical entry for PAST), and (ii) that Bill's 40th birthday in w not follow t (from ULC). So there are two predicted presuppositions about John's beliefs at $g_c(1)$: (i) that he believed Bill's 40th birthday to precede t_c, and (ii) that he located himself at a time after or overlapping Bill's birthday.

I think that (i) is not a welcome prediction: John's beliefs about the utterance time are totally irrelevant to either the truth or the appropriateness of assertions of (19) on any reading. But I won't belabor this point here, because the lexical presupposition of PAST that is responsible for this dubious prediction is empirically inadequate for less esoteric reasons than this and will be replaced in section 3.

Presupposition (ii), on the other hand, is just what we want: It would be violated if John (at $g_c(1)$) had thought that Bill wasn't 40 yet. In that case, the analysis predicts, (19)

[16] Again, it is beyond the confines of these comments to relate this to a principled account of presupposition projection in attitude contexts; see e.g. Karttunen (1974), Heim (1992).

[17] $g_c[t/0,\ b(w)/2]$ is the variable assignment just like g_c except that it assigns t to 0 and b(w) to 2. (My calculation here implicitly relies on appropriate rules for the projection of denotation gaps under functional abstraction and for definite descriptions.)

would be inappropriate. (What would be appropriate instead is: "John believed that Bill would be happy on his 40th birthday." But we haven't treated *would* so far and thus can't make this positive prediction yet.) Notice that, if this analysis is correct, it isn't relevant whether Bill was 40 by $g_c(1)$ in actual fact, or in the opinion of the speaker of (19). It's John's beliefs about the matter that count. So even if Bill was 41 at $g_c(1)$, and the speaker knows it, (19) is an inappropriate report if John is known to have thought he was 39. (22) sounds incoherent; the right way to express what this is supposed to say is (23).

(22) John thought that Bill was only 39, and he wondered whether he was happy on his 40th birthday.

(23) John thought that Bill was only 39, and he wondered whether he would be happy on his 40th birthday.

Let me summarize a few respects in which this first example may be seen to motivate and support Abusch's proposal and/or its present implementation. First, (19) is one of the cases which Abusch takes to show that the ULC cannot be replaced by or reduced to the assumption that it is impossible to have de re beliefs about future times: (19) is naturally read as attributing to John a belief which doesn't seem to be about any particular time, yet even when read in this way, it somehow conveys more specific information than merely that John believed that Bill had been, was, or would be happy on his 40th birthday. The ULC accounts for this intuition, rendering the extra information as a presupposition.

Second, the example shows that the ULC cannot be stated as a constraint on the reference of tenses (although this is what it sounds like in Abusch's informal statement, quoted above): the tense in LF (20) is not referential, but a bound variable. The implementation of the ULC in (18), together with independently needed laws of presupposition projection, succeeds with bound variable uses as well as referential uses of tense.

Third, the example reveals that grammar imposes no constraints on the relation between the times at which the events described by the matrix and subordinate clauses have occurred in actual fact, or according to the speaker, as is sometimes implied by informal descriptions of the phenomena. What matters instead is the subjective ordering in the mind of the subject of the attitude report. This too is correctly predicted by the ULC as we have implemented it.

As we have noted in passing, if we want to report those beliefs which the ULC prevents us from reporting with sentences like, it helps to stick in a *would*. Let us see if we can predict this by adding an appropriate treatment of that auxiliary.[18] *would*, I take it, is the surface realization of a past tense on an underlying verb stem *woll* that is common to

[18]There is none explicit in Abusch's paper, though what she says puts a number of constraints on what it must be like.

would and *will* (the latter being its present tense form).[19] How does *woll* combine with its infinitival complement? Let's think of it as a raising verb, embedding a full infintival clause with all the semantically significant ingredients of an infinitival complement to *believe* as analyzed in (12) above.[20,21]

(24) John will cry.

(25) LF: PRES_1 woll λ_0 [John INF_0 cry]

Since there is no *to* here, I filled the event argument position with an invisible infinitve morpheme INF, also interpreted as a time variable. Like the *to* in (12), it is obligatorily bound by λ_0. The lexical entry for *woll* is in (26).

(26) [[*woll*]](P)(t)(w) = 1 iff $\exists t'>t$: P(t')(w) = 1

I don't know if we should say that INF_0 here occupies T and thus is subject to the ULC. It won't make any difference, since the requirement imposed by the ULC in this case is trivial, i.e. g(0) ¬> g(0). In more complicated examples such as in (27) or Abusch's (35), however, a finite tense appears inside the scope of *woll* and is coindexed with the INF of *woll*'s complement.

(27) She will marry a man who loves her.
LF: PRES_1 woll λ_0 [a man who PRES_0 love her λ_2[she INF_0 marry t_2]]

The ULC applies to PRES_0 here, but fortunately without undesirable effect. This type of example shows why it was necessary to treat *woll* as forcing a shift of the evaluation time. If the evaluation time for the embedded present in (27) were still at t_c, the ULC would not allow the reading of this sentence where the loving is in the future.[22] (There remains a different problem with this example, viz. that the values of PRES_0 don't overlap

[19]See Ogihara (1989).

[20]I don't know how plausible this is from a syntactic point of view. Notice that if the operator λ_0 is really in Comp (as I proposed above, adapting Chierchia), the complement of *woll* has to be a full CP. It may be more plausible that λ_0 doesn't have to be in Comp.

[21]A problem with binding λ -binding the time argument of the verb under *woll* is that it seems to prevent an adverbial. (Compare note 12.) So this analysis actually doesn't work for (23) above, where *would* cooccurs with *on his 40th birthday*.

[22]If the future is an evaluation time shifter, its complement also should qualify as an intensional context in the sense of Abusch's generalization on p. 46 ("evaluation times are never shifted in extensional contexts"). This in turn makes a prediction which I believe is borne out, namely that *might* and *ought* are permitted in sentences like *He will always be a student that ought to work harder.*

On the other hand, if *woll* did not shift evaluation time, the ULC might have helped us explain why in sentences like *A child was born who would rule the world*, we understand the time of ruling to be before the speech time rather than unordered with respect to it. This intuition remains unaccounted for in all current theories, as pointed out to me by J. Higginbotham (p.c.).

with t_c as required by the presupposition in the lexical entry (4b). We take care of this in section 3.)

Next we consider a past-under-past complementation structure in which the lower past tense doesn't have an antecedent in its own clause.

(28) John believed that Bill was asleep.

There seem to be a variety of options for the LF-representation of the embedded tense. For instance, it could be a free variable, either coindexed with the (equally free) matrix tense or indexed differently, or it could be bound by the operator in the Comp of the *that*-clause. Let's look at this last option first.

(29) John PAST_1 believe λ_0 [Bill PAST_0 be asleep]

Comparing this LF with the one in (12) above, it should be clear that whenever (29) has any truth value at all (i.e. if there isn't some presupposition failure), it is the same as (12)'s. So (29) is prima facie a good candidate for the "simultaneous reading" which (28) indeed shares with the infinitival variant (11). Let's check the presuppositions. Apart from the usual $g_c(1) < t_c$ for the matrix clause, what are the presuppositions projected from the complement? The ULC's application there is innocuous, since it only says that $[[_{[T}PAST_{0]}]]^{g,c}$ is undefined when $g(0) > g(0)$, which is impossible. The inherent presupposition of the PAST-morpheme does project to a substantive and actually rather dubious condition[23], but this problem will disappear with the analysis of PAST that gave rise to it. So (anticipating the amendments to be implemented in section 3 below), we can conclude that (29) is indeed a viable LF for (28) under its simultaneous reading.

Another possibility we have mentioned are LFs with a free lower PAST, e.g. (30) or (31):

(30) John PAST_1 believe λ_0 [Bill PAST_1 be asleep]

(31) John PAST_1 believe λ_0 [Bill PAST_2 be asleep]

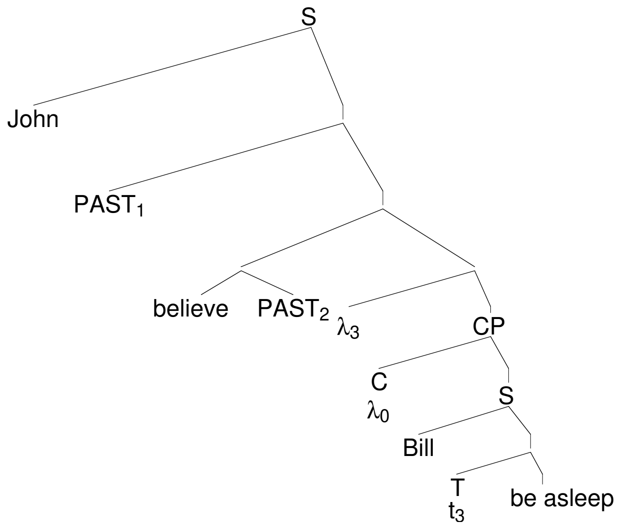
(30) has a meaning which is superficially similar to the simultaneous reading, but not quite the same. From the ULC applied to the embedded tense, we project the presupposition that John at $g_c(1)$ located himself at or after $g_c(1)$, i.e. he knew that $g_c(1)$ wasn't still in his future. The assertion is that he located himself in a world where Bill is asleep at $g_c(1)$. Neither of these are beliefs that I would ever want to attribute to John when I assert (28) on any reading. If John is like the rest of us, he never knows exactly what time it is and often doesn't even know it within a rather broad margin. So probably he didn't know at $g_c(1)$ that it wasn't still a little earlier than $g_c(1)$. And even if he did, I am not talking about or presupposing any such knowledge when I use the sentence in (28).

[23]This presupposition is that every time compatible with what John believes at $g_c(1)$ is before the utterance time. In other words, if I assert (29) today, referring by PAST_1 to some time yesterday, I should be presupposing that John knew at that time that it wasn't today yet. I don't think the English sentence (28) has such a presupposition on any of its readings. It is totally immaterial to its truth if John was seriously mistaken or ignorant about his own location in time.

I am not sure whether we must therefore take care to prevent the generation of this reading in the grammar. Perhaps it is grammatical but unavailable in practice due to its inherent strangeness and the competition from more plausible readings. The issue is a general one in the semantics of attitude reports and I will put it aside here.[24] Analogous considerations apply to LF (31), so we won't consider this as a candidate for any of (28)'s natural readings either.

So how <u>are</u> those readings represented? For the "simultaneous" reading, we are happy with LF (29), but we need something else for the "back-shifted" reading. This is where res-movement and the relational analysis for *believe* comes in. With Abusch and the references she cites, we assume that referential expressions in attitude complements may (perhaps must) raise out of the complement to an argument position of the attitude verb. If this option is exercised for the embedded tense, we obtain LFs more or less as follows.[25]

(32)



[24]As does Abusch. See her remark on p. 8 in connection with her example (13).

[25]I bracket the res-moved constituent with the verb, rather than with the complement as does Abusch. Neither option is really satisfactory: hers requires an ad hoc departure from compositionality (the syntactic constituent consisting of res and complement is not a semantic unit), mine requires a non-standard way of executing movement (one would normally expect the λ to appear on the sister constituent of the moved phrase, not a lower node). But this too is a problem with de re analyses in general, beyond the scope of Abusch 's paper and my comments.

believe here must be of type <i,<<i,<i,st>>,<i,<e,st>>> rather than the simpler type in (9) above, and we need a new lexical entry[26].

(33) $[[$*believe*$]]^c(t_{res})(R)(t)(x)(w)$ is defined only if c supplies a suitable time-concept f_c such that $f_c(w,t) = t_{res}$.
Where defined, $[[$*believe*$]]^c(t_{res})(R)(t)(x)(w) = 1$ iff $R(f_c(w',t'))(t')(w') = 1$ for all w' and t' compatible with x's beliefs in w at t.

By a "time-concept" I mean a function from world-time pairs to times. Think of these as the meanings of descriptions by which a thinker might represent a time to herself. For instance, the description "now" corresponds to the function that maps each <w,t> to t; the description "the last time the lights went out" corresponds to the function that maps each <w,t> to the last t'<t at which the lights went out in w. The qualification "suitable" is meant to exclude descriptions by which one might pick out a time without being sufficiently acquainted with it to have beliefs about it; see Abusch and Lewis.

Due to the presupposition imposed by the ULC, $[[$*Bill t_3 be asleep*$]]^g$ is defined only for those g such that $g(3) \neg> g(0)$. Therefore $[[$*$\lambda_3\ \lambda_0$ [Bill t_3 be asleep]*$]](t')(t)$ is defined only if $t' \neg> t$. Specifically, if our contextually supplied time-concept is f_c, then $[[$*$\lambda_3\ \lambda_0$ [Bill t_3 be asleep]*$]](f_c(w,t))(t)$ is defined only if $f_c(w,t) \neg> t$. By the projection law in (21)[27], this means that the whole LF (32) has a truth value in w only if, for all w', t' compatible with John's beliefs in w at g(1), $f_c(w',t') \neg> t'$. This presupposition effectively constrains the choices for f_c: it must be a time-concept which (together with John's beliefs) implies simultaneity or anteriority. The concepts corresponding to the descriptions "now" and "the last time the lights went out", as described above, will both qualify. But something like "the next time the lights go out" would not, nor would "at the time of Mary's death, be it past, present, or future".

It is interesting to note that the ULC again does not seem to predict exactly the generalization that is usually stated in informal descriptions of the phenomena. (Recall my third point about (19) above.) As it is usually put, the observation to be captured is that the past tense on *was asleep* in (28) cannot refer to a later time than the past tense on *believed*. We might thus have expected that the ULC would imply a constraint on the contextually supplied assignment g_c to the effect that $g_c(2) \neg> g_c(1)$. As it turned out, this was not what we derived. For all that the ULC predicts, it should be possible to use sentence (28) to report a belief, say, that John held yesterday morning and that was about last night -- provided that John somehow managed to represent last night to himself as a time already past.

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[26] I am departing from Abusch in treating the acquaintance relation as supplied by the context rather than existentially quantified; see von Stechow (1982). This may not be essential, but it somewhat simplifies the calculation of the presuppositions below.

[27] Actually, a variant of (21) that accommodates the more complicated type of relational *believe*, namely this: $[[$*believe*$]](t_{res})(R)(t)(x)(w)$ is defined only if $R(f_c(w',t'))(t')(w')$ is defined for all w' and t' compatible with x's beliefs in w at t.

It is difficult to decide if such usages occur. Consider the following text.

(34) When I woke up, I was convinced I had overslept. I wondered what happened at six when the alarm went off. <u>I figured I probably turned it off in my sleep</u>. Then I realized it was only five o'clock.

Should the underlined utterance be analyzed as reporting a de re belief about six o'clock, i.e. should we posit for it the following LF and contextual assignment?

(35) I PAST$_1$ figure PAST$_2$ λ_3 λ_0 [I probably t_3 turn it off in my sleep]
$g_c(1) = 5$ o'clock, $g_c(2) = 6$ o'clock.

If this is the right analysis of this example, it supports the present analysis. It shows that where the ULC's prediction diverges from the commonly offered descriptive generalization, it is the latter that's inaccurate: Semantics does not constrain the objective location of the referent of the lower tense, but its subjective location in the mind of the subject.

But perhaps this is not properly analyzed as a de re report at all. The alternative is to posit a covert de dicto description, something like "when the alarm rang", that is inside the complement clause and binds its tense. One might maintain, in fact, (as Abusch does earlier in the paper) that it is impossible in principle for a time concept that picks out a future time to be "suitable" in the sense of (33). If that assumption is made, it independently excludes the analysis in (35) and makes it generally impossible (as far as I can see) to construct any de re examples that would be ruled out by the traditional descriptive generalization but predicted okay by the present analysis.

In our last illustration of the ULC, we replicate part of Abusch's explanation of the double-access effect in sentences with a present tense in the complement of a past attitude verb.

(36) John thought Mary is pregnant.

We are confronted with the same types of potential LFs as for the previous example: In (37), the lower tense is bound from Comp, in (38), it is free and res-moved. (We disregard the possibility of leaving it free but in situ, for the same reason for which we disregarded (30), (31) above.)

(37) John PAST$_1$ think λ_0 [Mary PRES$_0$ be pregnant]

(38) John PAST$_1$ think PRES$_2$ λ_3 λ_0 [Mary t_3 be pregnant]

(37) expresses a "simultaneous" reading, but with a funny presupposition, namely that John located himself at a time overlapping t_c. (This is projected from the lexical presupposition of PRES.) The English sentence has no such reading, and once again it is not clear to me whether we could rely on its inherent strangeness alone to exclude it. Abusch rules it out independently by the part of her theory that we will get to in section 3, so I won't worry about it now.

(38) is the LF that Abusch assumes (36) to have as its only grammatical LF, and she claims that it correctly expresses the so-called "double-access" reading as it has been

described in the literature. Let's calculate. The presuppositions we derive are the following four:

(i) $g_c(1) < t_c$

(ii) $g_c(2) \text{ o } t_c$

(iii) For all w, t compatible with John's beliefs in w_c at $g_c(1)$: $f_c(w,t) \neg\!> t$.

(iv) $f_c(w_c,g_c(1)) = g_c(2)$

The first two come from the lexical content of the past and present tenses, the third is contributed by the ULC applying to the trace t_3, and the fourth comes from the de re analysis, see entry (33). These presuppositions jointly constrain the values that the context can furnish for the two tenses $g_c(1)$ and $g_c(2)$ and for the time-concept f_c.

Presupposition (iii) tells us that the latter has to be a time-concept that implies non-futurity for John. So if John said to himself something like "she will be pregnant a year from now" or "she will be pregnant when such and such happens", these are not beliefs that (38) could be used to report. If he told himself, on the other hand, "she is pregnant today," or "she is pregnant while the cause for her right now visible big belly lasts," or "she was pregnant a year ago," these beliefs should in principle be reportable by (38), at least as far as presupposition (iii) is concerned.

But presuppositions (ii) and (iv) together put an additional constraint on the time concept: they imply that $f_c(w_c,g_c(1)) \text{ o } t_c$. So if John in w_c at $g_c(1)$ said to himself "she is pregnant today," we can report this belief by (38) only if the "today"-concept applied to $<w_c,g_c(1)>$ yields a value that overlaps t_c. The "today"-concept, of course, is the function that maps each $<w,t>$ to the day around t; so it maps $<w_c,g_c(1)>$ to the day around $g_c(1)$. That day overlaps t_c just in case t_c and $g_c(1)$ are on the same day. So here is what we predict: After John says to himself "she's pregnant today," we can report this belief by means of (38) any time later on the same day, but no longer on the next.

Similarly if what John said to himself in w_c at $g_c(1)$ was: "she is pregnant while the cause for her right now visible big belly lasts." The "while-the-cause...-lasts"-concept maps each $<w,t>$ to the maximal interval during which the cause for Mary's big belly visible in w at t lasts in w at t. (It is a partial function, of course, not defined for $<w,t>$ where Mary doesn't have any big belly, etcetera.) If Mary has a big belly in w at t because she's pregnant, this is the duration of the same pregnancy in w. If she has a big belly in w at t because she has a some disease, it's the duration of that disease in w. By the presupposition derived from (ii) & (iv), we can report the belief that John thus expressed to himself by using (38) at any time t_c that still overlaps the value of the "while-the-cause...-lasts"-concept for $<w_c,g_c(1)>$; i.e. at any time before the end of the state that actually caused Mary's big belly in w_c at $g_c(1)$. Thereafter, we'd have to use a different sentence to report that belief.

Now suppose John in w_c at $g_c(1)$ said to himself: "she was pregnant a year ago." Could we ever report that belief by means of (38)? The "a-year-ago"-concept maps each

$<w,t>$ to the time that is one year before t. So presuppositions (ii) & (iv) require that t_c overlap the time one year before $g_c(1)$. But by presupposition (i), t_c must be after $g_c(1)$, so it cannot possibly overlap any time before it. So we predict that (38) can never be used to report this belief.[28]

These predictions are just what we want. They do justice to everything that has been observed in the literature on the meaning and appropriateness conditions of present-under-past reports. (See especially the very thorough discussion in Ogihara (1989).)

A final remark on my reconstruction of the ULC: Abusch suggests that the ULC need not be stipulated, but follows somehow from a branching-time conception of modal space. This would be very appealing indeed, but I have been unable to substantiate it. Part of the problem, I guess, is that I don't know what it would even mean to interpret attitude predicates and modals in a branching times model.

3. What distinguishes PAST from PRES?

According to the naive semantics in (4a,b), values for PAST must always precede t_c, values for PRES must overlap it. Both generalizations are well known to be incorrect in several respects.

For one thing, they make wrong predictions for embeddings of PAST and PRES under future:

(39) He will think that he is sick.

(40) He will think that he was sick.

(41) I will use an iron that is hot.

(42) I will charge you whatever time it took.[29]

[28] I have confined my discussion here to a few concrete examples of time-concepts, all of which imply a definite temporal ordering. What about concepts that per se are neutral about temporal ordering, e.g. the "on-Bill's-40th-birthday"-concept. Would that be a possible value for f_c? For it to satisfy (iii), as well as (ii) & (iv), it would have to be presupposed that John falsely believed Bill to be past 40 whereas in fact he is just turning 40 today. Suppose this is all indeed presupposed; then the prediction is that this concept should qualify. I take it this is undesirable: it does not seem possible to use (38) on Bill's 40th birthday to report an earlier belief of John's which he expressed to himself by saying "Mary was pregnant on Bill's 40th birthday." Abusch considers this problem (albeit rather abstractly) in the following passage, and her response is to deem such temporally neutral time-concepts as simply not "suitable" in the sense of (33).

"... the counterpart relation invoked by de re construal ... require[s] that the actual and the belief worlds be temporally isomorphic. The believing time $g_c(1)$ is a counterpart of the believer's now t, and $g_c(2)$ is a counterpart of $f_c(w,t)$. With a reasonable acquaintance relation, when $g_c(2)$ overlaps the believing time $g_c(1)$ in the actual world w_c, its counterpart $f_c(w,t)$ should overlap the believer's now t in a belief world w." (Quoted from pp. 37-38, with trivial substitutions to make it fit the notation I have used here.)

[29] This sentence was uttered by my roofer more than two weeks ago. Unfortunately, as of this writing he still hasn't started the job we were talking about.

The embedded tenses here apparently indicate anteriority and simultaneity with respect to the local evaluation time, not with respect to the utterance time.

Suppose we were led by these examples to replace the presuppositions '$g(i) < t_c$' and '$g(i)$ o t_c' in our current entries of the tenses by '$g(i) < g(0)$' and '$g(i)$ o $g(0)$'. For matrix tenses, where evaluation time coincides with utterance time, this would retain the previous predictions, and it would also work for (39) - (42). But it is still not right: First, it fails to exclude simultaneous readings for present under past, as in (37). Second, it fails to account for the most embedded PAST in examples like the following.[30]

(43) He decided a week ago that in ten days he would say to his mother that they <u>were</u> having their last meal together.

(44) He said he would buy a fish that <u>was</u> still alive.

(45) He decided to jump before they <u>fired</u>.

The event time of the underlined past tense verb in each of these examples isn't ordered before either the utterance time or the evaluation time for any other part of the sentence. So whether this PAST is left in situ or scoped to any higher position, the presupposition we are entertaining will be violated.

Examples of this last type have led many recent writers to conclude that there are at least some occurrences of past tense that are devoid of any inherent meaning of anteriority.[31] Stowell's work in progress[32] explicitly advocates the most radical generalization of this view, namely that no occurrence of either tense ever carries any inherent information about temporal location. Abusch's position seems to be similar, at least as regards the past tense: I read her as proposing that PAST has no inherent semantic content beyond its being a variable. (And I would read her as assuming the same about PRES, if it weren't for one problem with that assumption that I will point out below.) What primarily distinguishes PAST and PRES and accounts for the impression that they express contrasting information about temporal ordering is that they are subject to different syntactic constraints on their distribution at LF. Because of this, the choice of one tense over the other effectively disambiguates the surrounding sentence, thus creating the illusion of additional semantic content in the tenses themselves.[33]

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[30](43) is from Abusch (1988), (44) from Ogihara (1989), and (45) from A. Santisteban (p.c.).

[31]See, e.g., Baker (1989), Ogihara (1989), Abusch (1988).

[32]Stowell (1993).

[33]In certain passages of Abusch's paper, she seems to clearly distance herself from the position I have just attributed to her. For instance, on p. 26 she says that "a SQT past need not be semantically vacuous: in (55) the past tense gives information about the location of the temporal parameter of the embedding operator," and on p. 27, "the semantics of past tense is a constraint on a set of such transmitted temporal relations". Such statements suggest that she would object to my saying that PAST never "carries any inherent information about temporal location," or even that "PAST and PRES are semantically equivalent". However, I suspect that the disagreement here is not so much about what analysis is right, as it is about how best to <u>describe</u> the right analysis. Nobody can deny that substituting one tense for the other in a given surface sentence will change its meaning, and in <u>this</u> sense, I agree that the tenses are obviously not synonymous or vacuous.

Perhaps it is helpful to draw an analogy with the contrast between reflexive and non-reflexive pronouns. Minimal pairs such as *John said that Bill likes him* and *John said that Bill likes himself* evidently differ in meaning. But this is not at all evidence against an analysis which treats pronominals and reflexives as semantically equivalent (as variables) and distinguishes them only in the syntax (where they are subject to different Binding Conditions).

Abusch's own formulation of her proposal is stated on p. 27 (for PAST) and p. 33 (for PRES):

"(i) All operators with intensional arguments ... introduce a relation variable relating their local temporal parameter to their local evaluation time. ...

(ii) Such relations ... are transmitted by a feature passing mechanism to the intensional arguments.

(iii) The semantics of past tense is a constraint on a set of such transmitted temporal relations, along with the local relation: at least one of these must be the temporal precedence relation."

"What about the semantics of the present tense? ... each of the relations should be a temporal relation which entails "$\neg<$", the negation of the temporal precedence relation."

The mechanisms invoked here are not defined very explicitly. I am especially unclear about the semantic interpretation of the relation variables: As free variables, they should be receiving their values in some way like free pronouns or other context-dependent items, but there is no concrete indication of how this works. I will therefore attempt to implement what I perceive to be Abusch's essential idea in a way that looks quite different and doesn't involve these relation variables. I am accordingly unsure, of course, if I have really gotten the point of her approach. And I am also unsure whether the problems I will encounter in this section are of my own creation or inherent to Abusch's proposal.

Suppose that there are two predicate modifiers, zero affixes, which I will represent as $<$ and $\neg<$ (mnemonic for 'past' and 'non-past'). Their semantic contribution is, informally speaking, to restrict the predicate's event-time argument to times before the evaluation time (for $<$) or to times not before the evaluation time (for $\neg<$). For instance, if the unaffixed verb *cry* has the meaning in (3) (repeated from above), $<$-*cry* and $\neg<$-*cry* have the meanings in (46) and (47).

(3) $[[cry]](t)(x)(w) = 1$ iff x cries at t in w.

(46) $[[<\text{-}cry]]^g(t)$ is defined only if $t < g(0)$.
Where defined, $[[<\text{-}cry]]^g(t)(x)(w) = 1$ iff x cries at t in w.

(47) $[[\neg\!<\!\textit{-cry}]]^g(t)$ is defined only if $t \neg< g(0)$.
Where defined, $[[\neg\!<\!\textit{-cry}]]^g(t)(x)(w) = 1$ iff x cries at t in w.

The general definition is roughly this[34]:

(48) Let f be a function of some type $<\tau_1,<.....<\tau_n,t>..>$, where $\tau_i = i$ for some $i \leq n$. Then $[[<-]]^g(f)$ is that partial function f' of the same type such that, for any a_1, ... a_n of types τ_1, ... τ_n, $f'(a_1)...(a_i)$ is defined only if $a_i < g(0)$, and where defined, $f'(a_1)...(a_n) = f(a_1)...(a_n)$.

And analogously for ¬<.

The <-affix carries the meaning that we had earlier attributed to the PAST morpheme. The latter, we now assume, is just a variable, as in the original entry (1a), with no more semantic content than that. Similarly, let me assume (at least for the time being) that PRES has just the entry in (1b), and it is the affix ¬< that actually carries what appeared to be its meaning.

Now if the distribution of these two covert affixes were contrained in such a way that < appears on a verb iff its event time argument is PAST, and ¬< iff it is PRES, then we'd be making the very same predictions as if we had stuck the meanings of < and ¬< into the tenses themselves. We want to make these predictions in most, but not all, cases, and so we want to assume that the cooccurrence restrictions between PAST and < (and between PRES and ¬<) are tight, but not quite that tight.

Suppose that the affixes < and ¬< may be freely affixed to any verb or other predicate at LF, but every predicate must receive one or the other affix[35]. Every surface predicate is thus in principle 2-ways ambiguous. Many potential disambiguations, however, are excluded by an LF-wellformedness constraint which connects the distribution of < and ¬< with the distribution of the tenses PAST and PRES. This constraint (which I dub the "Tense Licensing Condition" or "TLC") is my attempt to render the essence of what Abusch proposes in the passages I quoted above. In schematic form, it says the following:

(49) (i) Every occurrence of PAST must be "in the domain of" some predicate that is <-affixed.

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[34]This formulation presumes that the event-time argument of any predicate can be uniquely identified by being the only argument of type i. There is a problem here when there is an additional argument of type i, as with relational *believe* (entry (33)).

[35]The latter stipulation could probably be done without, i.e., I can imagine a version of the analysis where it is permitted to leave predicates unaffixed as a third option. This would require a slightly different formulation of the TLC below, however, in which the set of environments where PRES is banned would no longer be the exact complement of the set of those where PAST is okay. Abusch's discussion of present tense at the top of p. 33 indicates that she assumes complementary distribution, therefore I chose the variant in the text.

(ii) No occurrence of PRES may be "in the domain of" any predicate that is <-affixed.

"In the domain of" is meant to be a hitherto undefined term of art, and our main task now is to replace it by a descriptively adequate and theoretically appealing concrete definition.

In the paradigm applications of the TLC to past tenses, we see two types of configurations that should definitely count as special cases of "in the domain of". The first is a very local configuration: a PAST is always licensed when it is the event-time argument of a <-affixed verb. In the second type of case, PAST is contained somewhere inside a clausal complement to a <-affixed verb. Here are some examples, with the PAST to be licensed and its licensing predicate indicated by underlining.

(50) John $\underline{\text{PAST}_1}$ $\underline{\text{<-cry}}$

(51) he PAST_1 $\underline{\text{<-decide}}$
[λ_0 PRO to_0 ¬<-tell ...
[λ_0 they $\underline{\text{PAST}_0}$ ¬<-be having ...]]

(52) he PAST_1 $\underline{\text{<-say}}$
[λ_0 PAST_0 ¬<-woll
[λ_0 [a fish that $\underline{\text{PAST}_0}$ ¬<-be alive] λ_2 [he INF_0 ¬<-buy t_2]]]

To appreciate the point of the latter two examples, consider that affixing < to any of the verbs closer to the most embedded PAST would add a presupposition inconsistent with the intended reading. All these lower verbs must thus be affixed with ¬< , and the closest <-affixed verb is the matrix verb in whose complement that PAST to be licensed is embedded (rather deeply in (52)). These are examples of irreducibly non-local licensing of a PAST.

Here is a simple definition that subsumes these two types of configurations:

(53) 1st try: "in the domain of" = contained in an argument of

'Contained' is not supposed to mean 'properly contained': When a tense is itself an argument of a predicate, this is to count as a special case of its being contained in one.

With the TLC read in the sense specified by definition (53), our analysis makes correct predictions for quite a few cases. The three sample LFs (50) - (52) are licensed, as desired, and receive appropriate interpretations.

As a general result, we derive that unembedded PAST always conveys anteriority w.r.t. the utterance time: Clause (i) of the TLC implies that on an unembedded verb, PAST can show up only if the verb is <-affixed. So the overt presence of PAST forces the presence of covert <-, which in turn contributes the presupposition that the event time precedes the evaluation time, i.e. the utterance time.

For unembedded PRES, we at first get a weaker prediction than desired: By clause (ii) of the TLC, the verb must have the prefix ¬<, which contributes the presupposition that the event is not before the utterance time. But we can rely on the ULC to exclude event times after t_c, and so we predict, in effect, that the meaning conveyed by unembedded PRES is always one of overlap.

We also derive good predictions about certain examples where the TLC is violated on the surface. Consider the following case of a present superficially embedded under a past:

(54) John was looking for a man who lives next door.

The matrix PAST forces a <-affix on the matrix verb, because that is the only way to license it under clause (i) of the TLC. This in turn implies, by clause (ii), that no argument of the matrix verb may contain any occurrence of PRES. Now if the object NP *a man who lives next door* were an argument of the verb at LF, the present tense on *live* would be in violation of this. But if we move it (by QR), we get a well-formed LF:

(55) a man who PRES$_1$ ¬<-live next door λ_2 [John PAST$_3$ <-be looking for t_2]

In (55), the arguments of *<-be looking for* are just *John*, PAST$_3$, and the trace t_2; the QRed NP, though somehow related via the λ_2 to an argument, is not itself an argument of this (or any other) predicate. So the TLC here forces wide scope, and thus a transparent reading, for the object NP, and this is arguably the only reading that is available for this English sentence (see Abusch 1988).

Another respect in which the present analysis works nicely concerns the simultaneous reading in (28) and absence thereof in (36).

(28) John believed that Bill was asleep.

(36) John thought Mary is pregnant.

The former was represented as (29) in section 2, but now we have to put in the affixes, so (29) should really have been (56).

(56) John PAST$_1$ <-believe λ_0 [Bill PAST$_0$ ¬<-be asleep]

We were satisfied with the meaning we derived for (29), except for an unwelcome presupposition created by the lexical presupposition of the lower PAST$_0$ that ordered its values before t_c. This is gone now. (And the new presuppositions from the affixes are harmless, as you can easily verify.) And of course (56) is also well-formed by the TLC, a plain case of non-local licensing.

As for (36), an issue left dangling in section 2 was what prevents an LF-representation like (57), with the PRES in situ and bound to Comp (this is (37) with the affixes put in).

(57) John PAST$_1$ <-think λ_0 [Mary PRES$_0$ ¬<-be pregnant]

The "funny" presupposition that came with (37) in section 2 is no longer generated, since neither PRES nor ¬< currently have a semantic analysis that mentions t_c. In fact, (57) now expresses a plain simultaneous reading with no substantive presupposition projected from the complement clause at all. So we better not generate it. And we don't: PRES$_0$ is contained in the clausal argument of the <-affixed verb *<-think*, in violation of clause (ii) of the TLC.

A question that arises at this point is whether (57) could be rescued from the TLC by moving the whole *that*-clause to a non-argument position, as in (58) (with t_2 here a trace of type <i,st>).

(58) λ_0[Mary PRES$_0$ ¬<-be pregnant] λ_2 [John PAST$_1$ <-think t_2]

If this LF is generated, we are in trouble, because its meaning is exactly the same as (57)'s. (Since the evaluation-time shifter λ_0 has moved along with the rest, the movement produces no change in the presuppositions projected from the complement.) I can think of various ways in which such movement could be ruled out (or forced to be undone by reconstruction at LF): e.g. we might just not allow such higher type variables as t_2, or we might have an economy principle that disallows any movement that is neither forced by the syntax nor produces any new readings.[36] Let's trust that something or other will rule (58) out. (We will return to the res-movement LFs for (28) and (36) shortly.)

Notwithstanding the successes listed so far, (53) seems to be too simple-minded. Abusch draws attention to two types of examples that indicate the need for a narrower characterization of the "in-the-domain-of"-configuration.

The first type of problematic case is seen in the following potential LF for the surface sentence (59).[37]

(59) John met the man who lived next door.

(60) LF: John PAST$_1$ <-meet [the man who PAST$_2$ ¬<-live next door]

Notice the choice of a non-past affix on the embedded predicate. This is permitted by my present version of the TLC: the embedded PAST$_2$ need not rely on its local predicate for licensing. Being contained in an argument of *<-meet*, it has the option of being licensed by the latter. The problem is that (60) expresses an unattested reading. Suppose it is uttered in a context c that assigns to PAST$_1$ a time before t_c, but to PAST$_2$ the utterance time t_c itself. Uttered in c, (60) is true iff John at $g_c(1)$ met the man who lives next door at t_c. In other words, I should be able to use this sentence now to say that John met the man who <u>now</u> lives next door. But the judgment is clearly that (59) is not the right sentence for this message (I'd be obliged to use a present in the relative clause instead). We might hope that this context c is ruled out by some other assumption in our theory, but unfortunately it isn't. It actually fulfills all the

[36]Fox (1994) gives persuasive arguments for and a precise formulation of such a principle.

[37]Abusch has almost the same example, but with an indefinite object ('... met <u>a</u> woman who ...', her (54)). Given the semantic type of indefinites, however, it is quite plausible that independent considerations (type-mismatch) force the object out of the verb's argument position at LF, so an LF with the potential non-local licensing configuration in (60) is unavailable to begin with. One might argue the same even for the definite NP (see below), but it is harder in this case, which is why I altered the example.

presuppositions of (60): Since nothing in this LF shifts the evaluation time[38], it is throughout identified with the utterance time, and so the presuppositions we get are (i) $g_c(1) < t_c$(from $<$ on *meet*), (ii) $g_c(1) \neg> t_c$ (from ULC for matrix T), (iii) $g_c(2) \neg< t_c$ (from $\neg<$ on *live*), and (iv) $g_c(2) \neg> t_c$ (from ULC for embedded T). (iii) and (iv) together not only are consistent with the intuitively objectionable assignment $g_c(2) = t_c$, they actually force $g_c(2)$ o t_c!

Since we haven't been able to exclude the combination of LF (60) with a context like c by semantic means, it seems we must exclude this LF in the syntax. Abusch's remedy (transposed into the terms of my own implementation) in effect amounts to a narrower definition of the configuration required for non-local licensing under the TLC: According to her, a PAST is licensed by a <-affixed predicate when it is properly contained in one of its "<u>intensional</u>" arguments, but not in an "extensional" one. Paradigm examples of intensional arguments are the clausal arguments of attitude verbs (such as *decide* and *say* in the good cases of non-local licensing in (51) and (52)) and the NP-objects of verbs like *look for* when not scoped out.[39] The object of an ordinary transitive verb like *meet* in (59), by contrast, counts as an extensional argument. To implement Abusch's descriptive generalization, it seems we have to replace (53) by something like (61).

(61) 2nd try: α is "in the domain of" β iff
either (a) α is the event-time argument of β,
or (b) α is contained in an intensional argument of β.

(The disjunction that separates local from non-local licensing seems unavoidable, unless we declare the event time argument an "intensional" argument.[40])

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[38]As Abusch discusses (p. 46), one might try to blame the problem on this assumption, and try to fix it by giving to the past tense an analysis under which it shifts the evaluation time backwards (analogous to the way that the future *woll*, as analyzed in the previous section, shifts it forward). Contexts like c would then be ruled out by the ULC. She argues against this on the basis of observations about *might* and *ought*.

[39]Reasoning superficially, one might think at this point that Abusch predicts a minimal contrast between (59) and (i) below, in that the lower PAST referring to t_c, which we saw was impossible in (59), should be permitted in (i).

(i) John looked for the man who lived next door.

This prediction, of course, is not borne out. But it is also not made. A verb that is intensional would ipso facto not fit into a well-formed and interpretable LF exactly analogous to (60). The details remain to be spelled out, but it is clear that in our implementation of Abusch's theory we would have posit a more elaborate complement structure, including an operator that shifts evaluation time. (This goes to show how hard it is to construct the sort of minimal pair that would let us test directly whether it is really the intensional/extensional distinction that is the relevant factor in non-local tense licensing.)

[40]Abusch doesn't give a definition of the intensional/extensional argument distinction, and I can't think of one that would yield this result.

My personal inclination at this point would be to resist this complication of the TLC and explore some alternative ways to rule out the LF in (60). There might be a reason nothing to do the syntax and semantics of tense why the object NP in a sentence like (59) cannot occupy the actual argument-position of the verb at LF, but must be raised to a non-argument position.[41] This would solve our problem, because after such raising, the PAST in the relative clause could only be licensed by an additional <-affix on its own local verb, which in turn would yield a presupposition incompatible with reference to the utterance time. As we will see right below, however, the point may be mute, because Abusch provides another rather different reason why we can't stick with the simple definition in (53) anyway.

The second type of problem for (53) arises in connection with res-movement. Let us hark back once more to the discussion of the present-under-past sentence (36).

(36) John thought Mary is pregnant.

We saw in section 2 how this received the desired double access reading through an LF-representation involving res-movement of the present tense. Let us check if that nice result holds up after the innovations of this section. The res-movement LF now cannot be quite as in (38) anymore, since we have to add the affixes. On the matrix verb, we must of course have $<$ to license the matrix tense, which leaves these two contenders:

(62) John PAST_1 <-think PRES_2 $\lambda_3\ \lambda_0$ [Mary t_3 <-be pregnant]

(63) John PAST_1 <-think PRES_2 $\lambda_3\ \lambda_0$ [Mary t_3 $\neg$<-be pregnant]

Both, unfortunately, would be excluded by the TLC in conjunction with definition (53). The problem is that res-movement doesn't carry PRES_0 high enough to escape the "domain" of *<-think*, it actually makes it one of its arguments.[42] So we have another reason to prefer (61). As Abusch stresses, the res-argument is an extensional argument (by usual criteria of extensionality, e.g. substitution salva veritate of coextensionals). (And it is also not the event-time argument singled out by clause (a) of (61).)

This is not the end of the story, however. For now we generate both (62) and (63), and what is worse, neither gets the meaning we desire. To see why not, recall the four

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[41]Stowell (1993) suggests something like this, though he doesn't commit himself on what forces the raising. In an intensional semantics, definite descriptions cannot be of type e. If they are <s,e> and verbs like *meet* select for e, in situ interpretation requires a slightly more complicated composition operation than simple functional application. Such an operation is standardly made available, but one might consider banning it, thus forcing a higher type for definites (e.g. a Russellian meaning) and movement. A completely different rationale for obligatory LF-movement of definites is suggested by Diesing & Jelinek (forthcoming).

[42]The situation would be a bit different if I had stuck to Abusch's own structures for res-movement (see note 25), but not any more favorable for definition (53), as far as I can see.

presuppositions that we derived for the old LF (38) on the old semantics for the tenses in (4):

(i) $g_c(1) < t_c$

(ii) $g_c(2) \circ t_c$

(iii) For all w, t compatible with John's beliefs in w_c at $g_c(1)$: $f_c(w,t) \neg> t$.

(iv) $f_c(w_c,g_c(1)) = g_c(2)$

(iii) and (iv) are still with us (they came form the ULC and entry for relational *believe* respectively, which we haven't changed). But (i) and (ii) were due to the now defunct lexical presuppositions of PAST and PRES, and so we can't take them for granted anymore. (i) is unproblematic: we still derive this same presupposition from a new source, namely the <-affix which now appears on *think* in (62) and (63). But (ii) is truly lost: PRES_0 is now a mere variable with no inherent ordering information anymore. And what we get in the way of new presuppositions from the affixes on the embedded predicate is no useful substitute:

(v) for LF (62):
For all w, t compatible with John's beliefs in w_c at $g_c(1)$: $f_c(w,t) < t$.

(vi) for LF (63):
For all w, t compatible with John's beliefs in w_c at $g_c(1)$: $f_c(w,t) \neg< t$.

Presupposition (ii) was absolutely crucial to the deduction of the double access meaning, and we must have it back. The only way I see to rescue the situation is to put some inherent presuppositional content into the entry for PRES_i after all.[43] Not the presupposition $g(i) \circ t_c$, since we had clear counterexamples to this in (39) and (41), but the variant we briefly entertained next:

(64) $[[\text{PRES}_i]]^g$ is defined iff $g(i) \circ g(0)$; where defined, $[[\text{PRES}_i]]^g = g(i)$.

Unlike the analogous presupposition for PAST_i ($g(i) < g(0)$), this actually never met with any counterexamples, so we can reinstate it without adverse descriptive consequences. Theoretically, that is not a satisfying move, however: Not only does it destroy the pretty symmetry of PAST and PRES -- what makes me more uneasy is that present-under-past sentences appear to be the only examples which provide positive evidence for it. As far as I can see, the presupposition contributed by (64) is totally redundant everywhere else, in particular with unembedded present tense. Does the child have to encounter double-access sentences to learn the meaning of present tense in English?

With (64) replacing (1b), we derive presupposition (ii) for both LFs (62) and (63). For (62), we now actually get a conflict between (v) and the remaining presuppositions: (v) requires f_c to be a time-concept which imply pastness to John, but as we saw in section 2, such concepts (e.g. the "a-year-ago"-concept which we used as an illustration there)

[43] This is why I hesitated at the beginning of this section about making not just PAST, but also PRES, mere variables, and about attributing this analysis to Abusch.

won't jointly satisfy (i), (ii), and (iv). So LF (62) is ruled out as presuppositionally incoherent, and we are left with (63), which has the desired reading. (The added presupposition (vi) is harmless: it just requires the time-concept to have a property which the intuitively appropriate choices, like our ""while-the-cause-lasts"-concept, turned out to have anyway.)

I conclude with a problem which the current version of the TLC, based on definition (61), creates for the analysis of the past-under-past example (28).

(28) John believed that Bill was asleep.

If res-movement applies to the embedded PAST in this sentence, we obtain LF (65) or (66) (analogous to (62) and (63) above).

(65) John PAST_1 <-think PAST_2 $\lambda_3\ \lambda_0$ [Bill t_3 <-be asleep]

(66) John PAST_1 <-think PAST_2 $\lambda_3\ \lambda_0$ [Bill t_3 ¬<-be asleep]

My problem here is: how does PAST_2 comply with the TLC? We just saw with the analogous example involving res-moved PRES that the res-moved position should <u>not</u> count as "in the domain of" the matrix verb *<-think*. But then the res-moved PAST_2 in (65) or (66) is apparently not in the domain of <u>any</u> <-affixed predicate, and so it should violate the TLC. This prediction is undesirable: At least LF (65) ought to be generated, because this is Abusch's (only) representation for the "back-shifted" reading of (28). (66), we can do without: it expresses the simultaneous reading, for which we have already found an alternative well-formed LF in (56).

As far as I see, the question of how to license PAST_2 in a configuration like (65) is not addressed explicitly in Abusch's paper. But it is answered implicitly by the annotated LF she displays for the analogous example with a present (i.e., her version of our (63)).[44] She evidently intends that (putting it in my own terms) res-movement doesn't remove a tense from the "domain" of its host verb (i.e. the one in whose argument position it originates and on which it is spelled out). PAST_2 in (65) and (66), for instance, still should count as "in the domain of" *<-be asleep* and *¬<-be asleep* respectively. Therefore (66) is ruled out, but (65) is okay by the TLC. (And by the same token, (63) is okay and (62) is ill-formed, apart from its semantic incoherence.) So the definition for "in the domain of" most faithful to her intentions has to be yet a little more complicated than (61).

(67) 3rd try: α is "in the domain of" β iff
α or <u>the trace of α</u> is the event-time argument of β,
or α is contained in an intensional argument of β.

My impression (at least for the time being) is that this version works. It doesn't look like it picks out a natural class of relations, though. And it implies something that almost

[44] I am alluding to the fact that in her (62), the relation variable R_{is} remains in the set for PRS_3, even after the latter has been the res-moved and thus no longer is the event-time argument of *be pregnant*.

sounds paradoxical, namely that a res-moved tense gets to land high enough to escape the domain of the matrix verb, yet not so high as to escape the domain of the embedded verb. The paradoxical appearance is probably a symptom of an infelicitous match between Abusch's ideas and the technical tools that I have chosen to implement them. Indeed I suspect that in this last section of my comments, I may have gone especially far astray in my reading of the paper, and I look forward to being set straight.

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