The Anaphoric Theory of Tense

James Higginbotham
University of Southern California

In this article I extend the discussion of Sequence of Tense phenomena in English that I have presented in earlier work (particularly Higginbotham 2002a and 1995) so as to include some properties of the English Perfect, and so as to clarify some pieces of the construction that I left open or unarticulated there. I also call attention to some features of what I call here *indexical mismatch* as between adverbials and tenses, a phenomenon that may well extend in a number of directions, both within individual languages and cross-linguistically. In large part, however, my purpose here is critical: I aim to show, despite arguments to the contrary, that anaphoric theories of tense do exactly what needs to be done to explain the dependencies of c-commanded tenses upon c-commanding ones, and that alternatives, notably those of the sort proposed in Ogihara (1995), von Stechow (1995) and Abusch (1994) and (1997), must build back into their respective accounts the anaphoric properties of Sequence of Tense if those accounts are to be part of an empirically adequate system. The semantics that I deploy here will require abandonment, or at least radical modification, of any framework that takes sentential complements in a "notation-free" manner, as in possible-worlds semantics; but that framework wants modification anyway, or so (for familiar reasons) I will assume.

1. Introduction

Anaphoric theories of tense may be elaborated in several ways. As I am using the term, an anaphoric theory will account for the familiar properties of a sentence such as English (1.1) by establishing some basis for coreference between the Tense-bearing element of the main clause (in this case futurate *will*), and that of the complement clause (here the Present, or –Past, inflection on the copula):

(1.1)　　John will say that Mary is happy.

For: (1.1) can be understood to mean, and be intended to be understood to mean, that John, at some future point or other, will make a statement whose content is that Mary is happy as of the time of that very statement. The complement Present is thus relative to the futurate *will*.

　　On the view elaborated in Higginbotham (2002a) (but presented much earlier, for instance in course notes for the Girona Summer School of 1996, and still earlier in lectures a MIT and the University of Oxford) the anaphoric relation in (1.1) is established as follows. First, it is assumed that both the main predicate *say* and the complement predicate *happy* (and indeed all heads) have an Event or

E-position in the sense of Higginbotham (1985), following the point of view elaborated in several essays in Davidson (1980), and in addition that what it is customary following Reichenbach to call "event time" is fixed in each case as the actual time of the events, or alleged events, in question. Second, the tenses are taken, all of them, to express binary relations between times, whether these are given as the times of events or in some other way. Third, a speaker of English who asserts (1.1) is making a prediction about what will happen in the future of her own speech *u*, an event of utterance; and, fourth, that the complement Present, itself expressing the binary relation ≈ of temporal overlap, contains an element that is anaphoric to the event time marker of the main clause.

To complete the first steps of the picture, we assume a function, represented here by 'τ', that delivers the actual time $\tau(e)$ of events *e*, and (as is customary), existential quantification (default existential closure) at clause boundaries with respect to the E-position, with the temporal relations expressed by Tense figuring in the restriction of such quantification. The main clause, as in (1.2) below, thus comes out as in (1.3):

(1.2)   John will say so-and-so.
(1.3) $[\exists e: \tau(e){>}\tau(u)]$ Say(John,so-and-so,*e*)

(for some further elaboration of the interface computation, see Higginbotham 2002a).

What of the complement clause? In isolation, as the second coordinate of the Present Tense would receive the actual time $\tau(u')$ of its own utterance *u′* for its value, we would have simply (1.4):

(1.4) $[\exists e': \tau(e'){\approx}\tau(u')]$ Happy(Mary,*e′*)

Embedded as it is in (1.1), however, this coordinate will receive its value anaphorically, from the first coordinate of the main clause Tense. Its content will therefore be the proposition expressed by (1.5):

(1.5) $[\exists e': \tau(e'){\approx}\tau(e)]$ Happy(Mary,*e′*)

But what is that proposition? Well, for any event *e* it is the proposition that the actual time of *e* overlaps the actual time of some situation *e′* of Mary's being happy. Using Montague's notation '^' for λ-abstraction over possible worlds, what I shall call the *modal profile* of this proposition, its intension in the sense of Montague, is that denoted by (1.6):

(1.6) $^{\wedge}[\exists e': \tau(e'){\approx}\tau(e)]$ Happy(Mary,*e′*)

That modal profile, given the actual world @ so as to fix the function *τ*, and given a future event *e*, will yield Truth for those possible worlds *w* where the actual time of *e* temporally overlaps Mary's being happy in *w*. And it will yield Truth in @, or Truth *simpliciter*, if @ itself is amongst those *w*.

Some further assumptions are certainly required, as for instance the assumption that (1.1) cannot be made true in virtue of some future utterance of John's in some world other than the actual world; the assumption that temporal intervals and their ordering are fixed across worlds; and the like. Anyway, assembling the pieces, we end up with (1.7) as giving, up to the limits of the modal profile of the complement clause, the truth conditions of (1.1):

(1.7) $[\exists e: \tau(e) > \tau(u)]$ Say(John, $^\wedge[\exists e': \tau(e') \approx \tau(e)]$ Happy(Mary,e'),e)

Supposing that any anaphoric theory of Sequence of Tense must say the functional equivalent of what is proposed above for (1.1), we may ask what syntactic mechanisms mediate the anaphoric relation as shown in (1.7), or syntactically through (say) indices as in (1.8):

(1.8) $...[\alpha_i > \beta]...[\gamma \approx \delta_i]...$

where δ, the second coordinate of the complement clause, is anaphoric to α. The syntactic relation depicted in (1.8) is obviously non-local, in the sense that it proceeds from INFL (or T(ense)) to INFL without mediation. Giorgi and Pianesi (2000) and (2001), however, have shown a strong correlation of this relation with properties of the complementizer position C, and have thus shown that mediation through the clause boundary is wanted; a version of their view is adopted in Higginbotham (2002a), involving INFL-to-C movement in complement clauses. This further elaboration, however, does not disrupt the basic contours of the semantics under the anaphoric theory.

2. General Outline

One proposal for English Sequence of Tense , apart from examples involving the Perfect and the Progressive, is as follows (from Higginbotham 2002a):

($\varnothing$)   The actual time of utterance is default in root clauses.

(I)   Tenses are binary, expressing one of the three relations $\approx$,$<$,or $>$.

(II)   Anaphoric +Past is ambiguous (in English) between (a) facilitating anaphora, but having a –Past interpretation (B-past), and (b) expressing $<$ (A-Past). The antecedent of a B-Past must be +Past, and the clause itself must be Stative.

(III)   -Past *in situ* cannot be anaphoric to +Past.

(IV)   Tenses in the C position of a complement clause are always anaphoric; movement of one copy of INFL to C is obligatory in these cases.

It follows that Sequence of Tense is obligatory in complement clauses, but not in relative clauses. The phenomena of English "double access" likewise fall out. There are a number of languages in which the forced double access interpretation, as in the well-known example (2.1), does not occur:

(2.1) John said that Mary is pregnant.

That is to say, in these languages the analogue of (2.1) means merely that John said (in the past) that there was such a thing as Mary's being pregnant at the time of his speaking. English, however, forces an interpretation of (2.1) according to which the content of John's speech is to the effect that Mary is pregnant both at the time of his own utterance and at the time of the reporter's speech.

In the system assumed here, English double access is a joint consequence of (III) and (IV) above. For, the complement clause will contain two copies of INFL, one in C and one *in situ*, and these will conjoin in the restriction of the existential quantification over events, as in (2.2):

(2.2) $[\exists e'\colon \tau(e')\approx\alpha\ \&\ \tau(e')\approx\beta]$ Pregnant(Mary,e')

The element α will be anaphoric to the first coordinate of the Tense of the main clause (by IV), but β, being –Past, will not (by III). Then β will be set at the actual time of the speaker's utterance, thus yielding a content (whether true or not) that locates Mary's alleged pregnancy at both points on the interval between the speaker's utterance and John's, and so by implication throughout that interval.

As for languages that do not show double access, I will assume (until shown otherwise) that condition (III) above is vacated, and that the B-past doesn't exist (at least with an embedded simple past). There are complications arising from the distinction between perfect and imperfect forms, subjunctive, and the like; but the first parameterization of linguistic differences seems likely to occur at the points mentioned. (From this perspective, English is a poor starting-point for cross-linguistic discussion, as it collapses a number of distinctions that are morphologically expressed in other systems; but my intention here is to explore, in English, the proposition (I), the strictly anaphoric approach to sequence of tense, and the extension of (II)-(IV) to the English Perfect.)

In my examples, the propositions ($\varnothing$)-(IV) and their consequences apply between immediately c-commanding and immediately c-commanded clauses. But such a restriction appears to be sufficient, since, as observed for instance in Ogihara's work (Ogihara 1995), the operation of Sequence of Tense is strictly clause-by-clause. As an example, take Hans Kamp's case (2.3):

(2.3)   John said that in two days he would say to his mother that they were
         having their last meal together.

The relevant organization of temporal coordinates, according to the anaphoric theory, is as in (2.4):

(2.4) $\tau(e){<}\tau(u)$ ... $\tau(e'){>}\tau(e)$ ... $\tau(e''){\approx}\tau(e)$ ... .

Note in particular that the intermediate *would* counts as +Past for the purposes of the anaphoric account. The Past form *were* is also a B-Past, in the terminology adopted here.

3. Some general questions

On the view that I have summarized above, or on any comparable view, simple examples such as (3.1) come out as in (3.2):

(3.1)   Mary thinks that John is asleep.
(3.2) $[\exists e\colon \tau(e){\approx}\tau(u)]$ thinks(Mary,^$[\exists e'\colon \tau(e'){\approx}\tau(e)]$ asleep(John,e'),e)

where $\tau(e)$ is the time of *e*, and *u* is the utterance of (3.1).
    Arnim von Stechow, in a couple of places (von Stechow 1995 and 2002), argues that this sort of view (either in the quantificational terms expressed above, or on more purely referential anaphoric accounts) can't be correct. I quote from one of his arguments (having changed the names in his examples to *Mary* and *John*, and having adjusted the quotation so as to fit the formulation (3.2) above):

> We all are wrong about the time most of the time. Mary
> has her thought at 5 o'clock, but she believes it is 6 o'clock.
> ... We can describe the content of her thought as "being
> temporally located at a time which is 6 o'clock and at which
> John is asleep." In other words, the time of John's sleeping
> in the belief worlds is 6 o'clock. Thus [the time of thinking is]
> 5 o'clock and [the time of sleeping is] 6 o'clock. So, obviously,
> $[\tau(e')]{\neq}[\tau(e)]$. Or Mary might not have had any particular
> time in mind. She just thought: "John is asleep right now."
> The content of the thinking may be described as "being at a
> time at which John is asleep." This formulation makes it
> obvious once more that the time of sleeping $[\tau(e')]$ has nothing
> to do with the time of thinking $[\tau(e)]$.

(von Stechow 1995:4). I don't think this argument tells against the anaphoric theory; in fact, as I will elaborate below, it even gets matters backwards, in the sense that the subjective element of time is exactly what *is* revealed in the anaphoric account (3.2) of (3.1). First, however, I reconstruct the argument more explicitly.
    On the first of the stories just rehearsed, we have the speaker saying (3.3):

(3.3)   Mary thinks at 5 o'clock that John is asleep at 6 o'clock.

On the anaphoric theory, we obtain (3.4):

(3.4) $[\exists e: \tau(e)\approx\tau(u)]\ \tau(u)=5$ o'clock & thinks(Mary,^$[\exists e': \tau(e')\approx\tau(e)]$
         (6 o'clock(e') & asleep(John,e')),e)

Since $\tau(u)$ is by hypothesis 5 o'clock, only that time will truly cash out the existential quantifier in the speaker's statement about what Mary thinks. In the system within which I take von Stechow to be working, and assuming that the temporal designator *5 o'clock* is rigid, there follows (3.5):

(3.5)   Thinks(Mary,^$[\exists e': \tau(e')\approx5$ o'clock] (6 o'clock(e') & asleep(John,e')),e)

where e is the situation of Mary's thinking. But the proposition believed, on this consequence, would appear to be indistinguishable from that believed in thinking that 5 o'clock is 6 o'clock, something of which Mary is certainly not guilty. The conclusion, in what I have offered as a sympathetic reconstruction of von Stechow's line of thought, would be that, since Mary is merely mistaken about the time, and her beliefs are not absurd, there must be something wrong with the anaphoric theory.

But now, why suppose that we can replace the *actual time t* (i.e., the actual time $\tau(e)$ of Mary's thinking) in (3.6) with the descriptive designator *5 o'clock*?

(3.6) $t\approx\tau(u)$ & $\tau(u)=5$ o'clock & thinks(Mary,^$[\exists e': \tau(e')\approx t]$ 6 o'clock(e'),e)

Mary's thought was about a *thing*, the actual time of her thinking, and that thought is not the same as one involving a descriptive reference (or even a name primitively referring) to that time. So the last step of the argument fails.

It remains correct to remark that Mary's belief about John, under the scenario envisaged, cannot be true (or, that there are no counterfactual situations compatible with her beliefs). The modal profile of her thought, namely that denoted by the expression (3.7), could yield truth only in a possible world in which 5 o'clock was 6 o'clock; and there are no such worlds.

(3.7)   ^$[\exists e': \tau(e')\approx5$ o'clock] [6 o'clock(e') & asleep(John,e')]

Under the idealization that would view belief and the like as "personal modalities," in the sense due originally to Jaakko Hintikka, such consequences are a common occurrence; but that just shows the limits of the idealization.

In von Stechow's second example, Mary is simply thinking, "John is asleep now." Elsewhere he notes, properly, that the *now* must be "subjective:" it is *her* Present, not *the* Present, that she cares about. I will discuss below the case for taking Mary's thought to have as a constituent the (time of the) event of her thinking it, something that comes out in the speaker's report (3.1).

Broadly speaking, the distinction between the anaphoric account, as I present it here, and that advocated by von Stechow (1995) is that tense anaphors, for him, are permitted in simple extensional contexts, as in (3.8) below, but not elsewhere; whereas I assume a system in which they are available alike in all contexts, with the difference that they become obligatory in all complements.

(3.8) Mary found a unicorn that was walking.

Indeed, features of the anaphoric account (as advanced here, or in some work by Tim Stowell, Karen Zagona, and others) must eventually be incorporated into von Stechow's own view, because by itself that view does not provide a means for assessing the truth value of what someone is said to have said, believed, realized, etc. Thus take (3.9) (from von Stechow 2002):

(3.9) Mary thought that it was raining.

On von Stechow's view, the complement clause in (3.9) gives us only a relation obtained by λ-abstraction over worlds and times: $\lambda w \lambda t(\text{rain}_w(t))$ (or, in the system proposed here, where the times are times of situations: $\lambda w \lambda t[\exists e_w: e_w \text{ at } t] \text{rain}_w(e_w)$). But we now must ask what it is for Mary's thought to be *true*; for I might contradict it, as in (3.10):

(3.10) Mary thought that it was raining, but it wasn't.

(or endorse it, by saying, "and it was indeed raining," or qualify it, etc.). In the case of (3.1) the comparable question has an immediate answer: for Mary's belief that John is asleep to be true is for the actual world and time $(@,t_0)$ to fall within the relation expressed by the complement. But because Sequence of Tense is obligatory in complement clauses, in the case of (3.10) we must allow for a two-way (but not a three-way) ambiguity; that is, we must allow that, on one construal, Mary's thought is true iff $\text{rain}(t)$ at $@$ at the time of Mary's so thinking, and on another that it is true iff $\text{rain}(t)$ at $@$ at some time prior to Mary's so thinking; but also we must say somehow that there is no construal such that it is true iff $\text{rain}(t)$ at $@$ at some time prior to the reporter's speech. Likewise, consider (3.11):

(3.11) Mary said that it will rain.

Supposing that (3.11) is true, we must bring out the fact that Mary spoke truly if and only if $\text{rain}(t)$ at $@$ for some time t following the time of the *reporter's* speech (whereas with 'would' for 'will' it would be some time after *Mary's* speech); and so on, through all the cases. In short, the conditions on tense anaphora, whatever they are, must be reproduced *in toto* in a full account of tense in indirect discourse and the like.

The last observation does not imply that the difference between von Stechow's outline and the view advanced here is notational merely; rather, the conclusion should be that there was no compelling reason for von Stechow's detour through properties and relations in the first place; and, as I remarked above, that there are limitations on the view of belief and the like as personal modalities.

Similar remarks apply to accounts of the type advanced by Dorit Abusch, chiefly Abusch (1994). Her work obtains the proper conclusion for (3.9) and the

like through a proposed semantic condition, the "Upper Limit Constraint," which restricts the times of evaluation of the complement to those less than or equal to the time of the reporter's speech. However, in those languages for which (3.9) admits only what I called above the A-Past interpretation, the constraint would have to be further modified, or another constraint added, to the effect that the upper limit is not the time of the reporter's speech, but the time of the speech reported. Similarly for languages where, unlike English, the double access interpretations are not realized, or they are realized only for certain morphological forms, such as the Imperfect. The suggestion in this article, in effect, is that the linguistic parameters governing sequence of tense are all of them syntactic, parts of the binding theory of implicit arguments, and that the semantics is mostly routine once the syntax is solved for.

There are material points as well. The constraint proposed by Abusch would rule out (3.12), as noted with approval in von Stechow (1995:19):

(3.12) Mary expects to marry a man who loved her.

at least on the interpretation in which Mary's expectation is: she will marry (at some future time), a man (some man or other) who loved her (at some time prior to that). I don't agree with the judgement that this sort of interpretation is not possible. It becomes salient with proper time-delineations, as in (3.13):

(3.13) Mary expects within the next six months to marry a man who fell in love
          with her only a little while before that.

Of course, the matter is not one of simple counterexample, as the properties of infinitives must be brought into the picture: if the complement is tensed, as in (3.14) below, we expect, and I believe we get, fully acceptable results, as the anaphoric theory would predict.

(3.14) Mary expects that she will marry a man who fell in love with her only a
          little while before.

In this section I have argued that the anaphoric penetration of complement clause Tense by main clause Tense is not threatened by the kinds of semantic considerations advanced in the literature. I will return only in closing to the question how to make clear the "subjective" aspect of the time in complement clauses to predicates such as *say*, *know*, or *think*. Before doing so I sketch, rather briefly, some issues with the English Perfect, and with indexicals, which may help to emphasize how the semantics of complements must be sensitive, not only to their modal profiles, but also to the notation in which these are expressed.

4. Adding the Perfect

To this point I have considered only simple verbal forms, abstracting away from the Perfect and Progressive heads (*pace* example 2.3, which does not raise any of the peculiar issues connected with the Progressive). Here I will consider, incompletely but perhaps sufficiently to impart a conception of, the application of the general account to the Perfect.

Does the English Perfect have temporal properties? Jespersen (1924:270), urged that it characterizes "present results of past events," and not the past events themselves. (He further noted that English was what he called a "conservative" language in this regard, as most Germanic and Romance languages had to a large degree mutated the Perfect somehow so as to become part of a system of Tense.) To the extent that Jespersen's view of English holds up, the temporal properties of the Perfect would have to be derived from its aspectual meaning. Parsons (1990) makes Jespersen's account, or part of it anyway, explicit in contemporary logical or truth-conditional, terms. I will not summarize these discussions, but turn directly to their implementation in the system proposed here.

I assume that Perfect morphology plus Tense combine in English in the standard way: there is a head **Perf** within the scope of +Past or –Past INFL, and the auxiliary *have* raises to Tense, whereas the Verb moves to the Head position of **Perf**, marked by *–en*. **Perf** has two argument positions, and is satisfied by a pair (e',e) of situations just in case e' is a result (in some sense or senses to be determined) of e. The Tense, which c-commands **Perf**, applies therefore to its first argument position, marked by e'. In simple sentences existential closure applies to both E-positions.

As Jespersen remarked, his basic view has the consequence that the Present Perfect is just what it seems to be, as in his famous example (4.1):

(4.1)   Now I have eaten enough.

where the Present predicate *now* must apply to the Present result, not the Past activity. Taking it step by step, we would have (projections of) the sentential ingredients *eat enough(x,e₁)* and **Perf(e₂,e₃)**, sisters in the syntactic structure, combining through conjunction (that is, through θ-identification of e_1 with e_3) to produce (4.2); and would have these combining again with the raised subject, and with the –Past head in Tense as in (4.3), to produce (4.4):

(4.2)   **Perf**(e_2,e_1) & eat enough(x,e_1)
(4.3)   **-**Past($\tau(u)$,$\tau(e_4)$)
(4.4)   **-**Past($\tau(e_2)$,$\tau(u)$) & **Perf**(e_2,e_1) & eat enough(I,e_1)

We assume that the sentence is by default existentially closed, as proposed in Davidson (1980). Where the adverb *now* is predicated of the higher position marked by e_2, and the feature –Past is interpreted as expressing the relation ≈ of temporal overlap, the result is (4.5):

(4.5) $[\exists e_2: \tau(e_2)\approx\tau(u)]$ $[\exists e_1]$ (Now(e_2) & **Perf**(e_2,e_1) & eat enough(I,e_1))

We next distinguish *Results* from *Resultants* (in the sense of Parsons 1990). The latter are identified as states that commence when an event *e* is over, and continue forever. The meaning is, as it were, "been there, done that," salient for instance in (4.6):

(4.6)   I have been to Japan.

For a Perfect of Result (not Resultant) consider (4.7):

(4.7)   I have spilled my coffee!

The announcement (4.7) is only in order as long as there is spilled coffee around; likewise, (4.1) is fine when just setting down one's knife and fork after dinner, and for some time afterwards, but not upon waking up the next morning (unless one has just resolved to go on hunger strike). And so on in like cases, as both Result and Resultant states commence immediately after the events of which they are the Results or Resultants.
        It is perhaps worth noting that the Perfect head, even when happening to favor in context a Result interpretation, can always be understood as expressing a Resultant, as in (4.8) for instance:

(4.8)   I have done many foolish things in my life---I have spilled my coffee, I
         have lost my wallet, etc.

For notation, I will retain **Perf** as expressing the Resultant Perfect, and use **RPerf** for the Result Perfect.
        The question now is what happens when the Perfect is added to the Sequence of Tense mix. To fix ideas, I consider in some detail the cases where the superordinate Tense is the simple Past, and the complement Tense varies, including the possibility of the Perfect, as in (4.9)-(4.12)

(4.9)   John said [that Mary has been happy].
(4.10)   John said [that Mary had been happy].
(4.11)   John said [that Mary will have been happy].
(4.12)   John said [that Mary would have been happy].

In each case the embedded predicate may be represented by *happy(Mary,e)*, and the matrix subject and tense by *[$\exists e: \tau(e)<\tau(u)$] Say(John,...,e)* where the dotted material is to be filled in by a representation of the content of the complement clause.
        The account of the simple cases given above implies that (4.9), with Nonpast under Past, has only a double access interpretation, as the lower copy of INFL cannot be anaphoric. The predicate *happy* has no notable Results (being a stative), and plausibly admits only the fundamental reading, expressed by the

head **Perf**. But the peculiar property of Resultant states---that they continue forever---actually makes double access redundant. To see the effect of double access, therefore, we turn to (4.13), under the Result interpretation:

(4.13) John said that I have spilled my coffee.

Here we have the possibility of temporal relations as in (4.14)

(4.14) $\tau(e){<}\tau(u)$ ... [...$\tau(e'){\approx}\tau(e)$ & $\tau(e'){\approx}\tau(u)$...]

where e' is the Result of the alleged event of coffee-spilling. In (4.14) the second component of the complement clause, referring to the time of the speaker's report, is not redundant. Hence, for me as speaker of (4.13) to speak truly, where John said to me, "You have spilled your coffee!" it must be that John intended a result state of a sort that surrounds my time of speech as a reporter. Of course, John might have been speaking falsely---maybe I spilled only tea, or I didn't spill anything at all. No matter: the warrant for my assertion lies in what can be presumed about John's intention. I conclude, therefore, that double access persists with the Present Perfect as it does for the simple Present.

      Turning now to the Past Perfect as in (4.10), we have the possibility of an A-Past or a B-Past, together with the Resultant or Result interpretations of the Perfect. The A-Past together with a Resultant interpretation is compulsory in (4.15) (because of the adverb):

(4.15) John said [that Mary had once been happy].

The temporal relations for (4.15) as shown in (4.16) are appropriate, implying that the content of John's alleged speech placed the onset of the Resultant state prior to that speech:

(4.16) $\tau(e){<}\tau(u)$ ... [...$\tau(e'){<}\tau(e)$ & $\tau(e'){<}\tau(u)$...]

Again we have redundancy. The first embedded temporal location of e', a Resultant state, implies the second, because Resultants continue forever. But Result interpretations of the construction are in order as well, where there is no implication that the Result state survives to the present. B-Past interpretations are then easily obtained, as for instance when one is telling a story in the middle of which one goes on as in (4.17):

(4.17) ...then John noticed that I had spilled my coffee... ,

the time for evaluation of the second coordinate of the superordinate Past having been reset from the time of speech to some past time as determined by the narrative. In this case too, I think, we can observe that the story line (4.17) is appropriate only if, at the rest past time, the coffee is implicated to be in a spilled (not mopped-up) state.

Example (4.11), or (4.18) below, embed a Future Perfect under Past:

(4.18) John said [that Mary will have spilled her coffee].

As in the simple cases reviewed above, the Nonpast *will* precludes anaphora. Both the Result and Resultant interpretations of the Perfect are available. Naturally, in the normal course of events, if Mary will have spilled her coffee then she will spill her coffee, and conversely; for, any Result state of a coffee-spilling lies in the future immediately after the spilling. Perhaps for this reason, (4.18) is a somewhat strange assertion in the absence of other temporal indicators such as that provided in (4.19):

(4.19) John said that Mary will have graduated by then.

But if (4.18) is evaluated in a model with (or on a supposition of) bounded time, then (4.20) could be true:

(4.20) Mary will spill her coffee, but she never will have spilled her coffee.

This consequence of the aspectual account of the English Perfect as suggested in Parsons seems to me exactly right; and in this case too reported speech would be natural enough, I believe:

(4.21) John said (truly) [that Mary would spill her coffee, but she would never have spilled it].

The last of our representative cases (4.12), repeated here, includes all of Future, Perfect, and Past:

(4.12) John said that Mary would have been happy.

(We are not interested here in the (generally favored) counterfactual interpretations, as in *John said that Mary would have been happy had she moved to Transylvania,* which are compatible with a variety of temporal setups.) The purely temporal interpretation of *would have been* is salient for instance in (4.22):

(4.22) John said that Mary would have graduated by 1999 (but unfortunately she hadn't).

The temporal relations are as shown in (4.23):

(4.23) $\tau(e) < \tau(u) \ ... \ [... \tau(e') > \tau(e) ...]$

where the onset of the resultant state e' follows John's utterance (if 4.22 is true).
        Consideration of these examples, then, does support the view that the English Perfect is purely aspectual, with tense applying just to the Result or

Resultant state, and with the principles governing Sequence of Tense carrying over unchanged. To complete the evidential picture would require further examination of the cases where the superordinate Verb is future, and where, in both Past and Future, it is itself in construction with the Perfect. I believe that these cases check out as well, but will not go through them here (but see Higginbotham 2006 for some details). It will be worthwhile, however, to remark here a particular matter, as follows.

When the superordinate is in the present perfect, it hosts Sequence of Tense just as the past does. So, for instance, (4.24) can be made true in virtue of John's Present-tense, past assertion, "Mary is ill," and also in virtue of his past, Past-tense assertion, "Mary was ill;" and in both cases the subject's speech precedes that of the reporter:

(4.24) John has said that Mary was ill.

(see in this connection Iatridou, Anagostopoulou, and Izvorski 2001, and Ogihara 1995). It follows, given the assumptions above, that the complement Tense is anaphoric, not to the element that actually receives the superordinate Tense (the Result or Resultant that is said to overlap the time of speech), but rather to the time of the event of saying itself. Thus we have the interpretations, four in all, shown in (4.25):

(4.25) $[\exists e': \tau(e') \approx \tau(u)]$ $[\exists e: (\mathbf{R})\mathbf{Perf}(e',e)]$ Say$\{$John,$^\wedge[\exists e'': \tau(e'') </\approx \tau(e)]$
ill(Mary,e''),$e\}$

This fact will require adjustment in the general account, as the rules of Sequence of Tense must be amended for the case where the anaphora does not proceed, either immediately or with mediation through other heads, from INFL to INFL.

5. Rigidity and Indexical Mismatch

Examples like (5.1) show the semantic effects of Sequence of Tense: as the complement V *leave* is not stative, the assertion is to the effect that John made a past Past-tense utterance (an A-Past, in the terminology used here).

(5.1) John said yesterday that Mary left.

An indexical temporal adverbial construed with the complement clause, however, does not shift its reference because of this. So in (5.2) *yesterday*, no matter how construed, necessarily refers to the day before the speaker's speech; and in the (for me) somewhat awkward, but as to its meaning perfectly clear, (5.3), both occurrences of *yesterday* refer to that day.

(5.2) John said [that Mary left yesterday].
(5.3) John said yesterday that Mary left yesterday.

The semantic contrast between (5.3) and, say, (5.4) could not be greater:

(5.4) John said yesterday that Mary left the day before.

It is a widely appreciated thesis, exemplified by the above examples, that indexical expressions in complement clauses behave just as they would in isolation. This is the "no monsters" thesis discussed in Kaplan (1977), or, equivalently, the "semantic innocence" thesis of Donald Davidson. Without going too far into details, I may note that for Davidson the thesis is an immediate consequence of his "paratactic" account of clausal embedding. For Kaplan, however, it takes the form of a general postulate; that is to say, nothing in the formal system prevents the introduction of "monsters," so that any principle restricting their occurrence, or forbidding them altogether, must come from elsewhere. In other work (Higginbotham 2002b) I offered, elaborating an early discussion by Tyler Burge, an account of semantic innocence that differs from Davidson's, but also makes the thesis effectively analytic to the form of the semantic theory. The tenses themselves might be offered as counterexamples to semantic innocence; but it is part of the anaphoric theory of tense that this is only an appearance, induced by tense anaphora.

Indexical temporal expressions are rigid designators; but they also impart what I shall call a *perspective* on their referents. This perspective, following semantic innocence, is always that of the speaker. But those whom the speaker is reporting (including her own past or future self) have their perspectives too. In several recent discussions (Pancheva 2004, Giorgi 2005, Wurmbrand 2001, and Byun 2006), examples have been offered that appear to show that these perspectives can, as I shall put it, *clash* with the embedded tense, in different ways in English, Korean, Italian, and German. I don't know of any thorough survey of these phenomena even in English, let alone across languages; but I shall remark some of their extent, drawing in part on the work cited.

Consider first of all (5.5):

(5.5) John will say tomorrow that Mary is leaving that day.

with *that day* anaphoric to *tomorrow*. What John is predicted to be saying tomorrow is, "Mary is leaving today," or words to that effect. But (5.6) is bizarre:

(5.6) *John will say tomorrow that Mary is leaving tomorrow.

Of course we can have (5.7):

(5.7) John will say that Mary is leaving tomorrow.

But John is then predicted to be saying the Futurate Progressive, "Mary is leaving tomorrow," or words to that effect, *today*. Moreover, if we add material so as to restore the relative temporal ordering, as in 'John will say tomorrow that Mary is leaving tomorrow night', then the situation improves somewhat.

There are similar examples with the Past (the judgements are weaker here, however). Thus (5.3) is for me and some others I have asked relatively unacceptable even if clear, though not so unacceptable as (5.6). But (5.8), with *that day* anaphoric to *yesterday* is perfectly acceptable, and semantically identical to (5.3)

(5.8) John said yesterday that Mary left that day.

Hyuna Byun (2006) observes that in Korean (where the embedded Present, unlike the English, can be anaphoric) one cannot have the analogue of (5.9):

(5.9) *John said that Mary is (=shifted 'was') in Seattle yesterday.

(This datum is also supported by Min-Joo Kim p.c.)

The examples suggest that, rigidity of reference apart, certain *clashes of temporal perspective* are not permitted in complement clauses. To put it another way, temporal content must be measured in part through the notation that expresses it. As a perhaps extreme example, consider (5.10):

(5.10) John will say in two days that Mary was happy the previous day/*tomorrow.

To these facts, let me add that the cases above are in the context of ordinary embedding (they are not cases of free indirect discourse), and that the embedded adverbials are all understood (and can only be understood) as deriving their reference from the speaker's perspective. The examples also go through with a variety of indexicals, as *last/next year*, etc.

The whole arrangement, however, cannot be explained by positing any simple conflict between the tense the subject would use and the indexical employed. Thus (5.11) is of course fine:

(5.11) John said two days ago that Mary would be happy yesterday.

even though the speaker's yesterday was John's tomorrow when he spoke.

The phenomena just illustrated must be seen as syntactic. They do point to the conclusion that the notation of reports of saying and belief is critical for the identity of the contents of those reports, and cannot be abstracted away from. It will not do, therefore, to stick with conceptions of propositional content as stemming just from the modal profile of complement expressions; rather, the notation itself, as in section **3** above, must be taken into account.

6. Subjective Time

In this last section I briefly take up the point remarked above, that a number of examples, including von Stechow's illustrations, require a subjective treatment of time.

In other work (Higginbotham 1995 and 2003) I have discussed some aspects of temporal subjectivity; that is, of judgements that something belongs, not necessarily to *the* Past, Present, or Future, but to the *thinker's* Past, Present, or Future. To deploy once again the famous example of A.N. Prior, suppose I am just leaving the dentist's office after a painful operation. I think to myself, "I am so glad *that's* over!" Supposing the date to be 30 September 2005, my statement is hardly equivalent to, "I'm so glad *that's* over as of 30 September 2005." Not only is the date irrelevant to my feeling of relief, but also mentioning it gives the wrong impression. What I care about is that the operation is over as of the time of my thinking that, that it lies in *my* Past. The point is brought out in the semantics as in (6.1):

(6.1) $[\exists e\colon \tau(e){\approx}\tau(u)]$ Glad(I,^$[\exists e'\colon \tau(e'){\approx}\tau(e)]$ Over(Operation,e'),e)

Here my thinking is itself a constituent of the thought. Insertion of a date for $\tau(e)$ would be misleading.

Similar considerations, I think, apply also to the "*de se*" interpretations of embedded elements. In these, as in (6.2), the subject is given to herself as the subject of the thought, or desire:

(6.2)   Mary wants [PRO to visit Paris]

Because she is given to herself in this way, it is not possible for Mary to have misidentified the subject of her thought; not possible, that is, that it should seem to her that she wants to visit Paris, whereas in fact she wants someone else to visit Paris. Such misidentification is possible in (6.3):

(6.3)   Mary wants herself to visit Paris (because she wants the top graduate to
         visit Paris, and doesn't realize that she herself is the top graduate).

The cases of the *de se*, on the one hand, and tense anaphora, on the other, have in common the formal feature that they are paradigmatically realized by empty elements: PRO in the case of the *de se* (as noted some time back by John Perry, Gennaro Chierchia, and others), and implicit arguments in INFL in the case of the tenses. No referential formative can take their place with equivalent (or equivalently restricted) meaning. In the temporal case, even when a time is mentioned, it is merely a modifier of the implicit argument, and does not replace it.

This last point also gives a bit of a handle on von Stechow's case, say as in (6.4):

(6.4) Mary thought at 5 o'clock that it was 6 o'clock.

which of course must be distinguished from (6.5):

(6.5) Mary thought at 5 o'clock that 5 o'clock was 6 o'clock.

The indexicality of tense is not extinguished in (6.5): on the contrary, it comes out as in (6.6):

(6.6) $[\exists e: \tau(e){\approx}\tau(u)]\ \tau(u){=}5$ o'clock & thinks(Mary,$^{\wedge}[\exists e': \tau(e'){\approx}\tau(e)]$ (5=6,e'),e)

That is, she thought that the situation of 5 o'clock's being 6 o'clock held at the time of her thinking that. The thought is self-contradictory. But the thought reported in (6.4), even though necessarily false, is not self-contradictory.

At this point, one may worry that the conditions that I propose must be satisfied to have the kinds of thoughts that we routinely have about time, or about ourselves, are not too restrictive: for it follows from the above discussion that only creatures with propositional attitudes can have first-personal thoughts about themselves, or about their own Past, Present, or Future. They could indeed have thoughts of which they, or the time of their thinking, were constituents; but they could not cross-reference these elements with superordinate presentations of themselves, or the time. Thus (if dogs don't have propositional attitudes) the dog could want $^{\wedge}[\exists e]$ Get Bone(α,e), where α is the dog itself; but it couldn't want $^{\wedge}[\exists e]$ Get Bone(subject of e',e), where e' is the wanting. It could think $^{\wedge}$Bone(x,t), that the object x is a bone at t, where t is the time of the thinking; but it couldn't think $^{\wedge}$Bone(x,t) & $t{\approx}\tau(e)$, where e is the situation of its thinking that. With human beings, on the other hand, such cross-reference is taken for granted. To paraphrase Immanuel Kant, our epistemic powers reflect the "I think" that accompanies all our representations.

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