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Paul Portner
MCC

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The Semantics of Complementizers

Paul Portner

MCC

1. Approaches to the Semantics of Subordination

Several recently fruitful lines of investigation into the semantic relation between subordinate clauses and their matrices have a strong syntactic component. In the area of sequence of tense (SOT) phenomena, Ogihara (1989) proposes a syntactic transformation deleting semantically vacuous occurrences of tenses, while Enç (1987) postulates an account involving both syntactic binding of tense and syntactic movement of clauses. Smith (1978) makes a more traditional Reichenbachian proposal, on which the event time and reference time of different clauses are related according to several principles which have both a syntactic and semantic character. Concerning *for* infinitives, Stowell (1982) argues that a special tense-like element undergoes a movement to C in order to realize the future orientation (discussed by Bresnan (1972)) of the time of the embedded verb's event compared to the matrix verb's.

Here I want to investigate in more detail the specifically semantic nature of the subordination relation. I propose that the semantics associated with the subordination of propositional expressions can be fruitfully studied in a situation semantics framework of the type proposed by Kratzer (1989) in combination with the following general principles:

(1)

- I. The Reichenbachian Model: Expressions are interpreted with respect to an utterance situation, a reference situation, and an evaluation situation.

- II. The Semantics of Subordination: Morphemes which subordinate propositions abstract over the reference situation, and so subordinate clauses denote functions from situations to propositions.
- III. The Semantics of 'Inflection': Inflectional elements establish a relation among reference situation, evaluation situation, and utterance situation.

'Inflection' in (III) includes not only such traditional inhabitants of INFL as tense, mood, and perfect *have*, but also the morpheme *-ing* as it occurs in gerunds and the progressive. In this paper I will focus on complement gerunds, infinitives with the complementizer *for*, the contrast in English between subjunctive and indicative mood, and a neo-Reichenbachian theory of SOT. For a more complete investigation of *-ing*, infinitives, and subjunctives, see Portner (1992).

2. Infinitives, Subjunctives, and Gerunds

The ideas in (I)-(III) can be put to immediate use in analyzing certain infinitives, subjunctives, and gerunds in English. I will use these constructions to provide initial support for the point of view outlined (1); then we will examine the apparently disconfirming case of SOT. Let me first outline the type of situation semantics, based on the system of Kratzer (1989), that I use.

(2)

A Model is a 5-tuple $\langle I, S, <, precedes, counterpart \rangle$, where

I is a set of individuals,

S , a subset of I , is a set of situations,

$<$ is a part-of relation on I ,

'precedes' establishes a temporal ordering on S , and

'counterpart' establishes a counterpart relation on I (Lewis (1968, 1971, 1986)).

Types:

e is a type

t is a type,

If τ and ρ are types, $\langle \tau, \rho \rangle$ is a type.

Domains:

$D_e = I$,

$D_t = \mathbb{P}(S)$,

For any types τ and ρ , $D_{\langle \tau, \rho \rangle} = D_\rho^{D_\tau}$.

- (3) An expression α is interpreted with respect to a model M , an utterance situation u , a reference situation r , and a variable assignment g . $[\alpha]^{M,u,r,g}$ indicates the interpretation in English of α with respect to M , u , r , and g .

Example: $[[\text{Shelby ran}]^{M,u,r,g} = \{s : \text{for some } s' < s, s' \text{ precedes } u \text{ and } s' \text{ is a minimal situation in which Shelby ran}\}.$ ¹

2.1 *For* Infinitives

Bresnan (1972) demonstrates that a class of infinitives, which she calls *for* infinitives, are always futurate with respect to the clause which embeds them:

- (4) Sam hopes for Mary to win.
 (5) It would be good for Kay to leave.

Some clauses which do not contain an overt *for* also show this future orientation. These cases typically do not have an overt subject either and are related--as (6) is to (4)--to examples with an explicit *for*.

- (6) Sam hopes to win.

These future oriented infinitives show up in a variety of contexts:

- (7) Oh to meet her!
 (8) John is to be consulted on all important decisions.
 (9) Sal did it to make you happy.
 (10) He would be a good man to talk to.
 (11) For Diane to win, the other candidates must be exposed.

In general, when *for* infinitives are embedded by a verb or adjective, they are future with respect to the time of the situation associated with the embedder. Otherwise they are future with respect to the utterance situation.

Stowell (1982) argues that *for* infinitives should be assumed to contain a special tense morpheme which results in the future orientation. I will follow this idea, proposing the following semantics for *for* and its associated special INFL, which I will designate 'F':

- (12) $[[\text{for } p]^{M,u,r,g} = \text{that } f \in D_{\langle e,t \rangle} \text{ such that for any } s \in I, f(s) = \{s' : s' \in S \text{ and } s' \in [p]^{M,u,s,g}\}$
 $[[F(q)]^{M,u,r,g} = \{s : s \text{ has as its initial segment a counterpart-duplicate of } r \text{ and for some } s', s' < s \text{ and } s' \in q\}$

'Has as its initial segment' can be defined in terms of '<' and 'precedes'. A situation *a* is a counterpart-duplicate of another *b* iff *a* is a qualitatively identical counterpart of it.

Let us consider the infinitive in (4).

- (13) $[[\text{for Mary to win}]^{M,u,r,g} = \text{that } h \in D_{\langle e,t \rangle} \text{ such that, for any } s \in I,$
 $h(s) = \{s' : s' \in S \text{ and } s' \text{ has as its initial segment a counterpart-duplicate of } s \text{ and for some } s'', s'' < s' \text{ and Mary wins in } s''\}$

With (14) as the meaning for *hope*, (15) is the interpretation for all of (4).

- (14) $[[\text{hope}]^{M,u,r,g} = \text{that } f \in D_{\langle \langle e,t \rangle, \langle e,t \rangle \rangle} \text{ such that, for any } h \in D_{\langle e,t \rangle}$
 and any $i \in I, f(h)(i) = \{s : \text{HOPE}(i)(s) + h(s) = \text{HOPE}(i)(s)\}$

¹The analysis of tense assumed by the example is unrealistic. In §3, tense is discussed in some detail.

- (15) $[[\text{Sam hopes for Mary to win}]^{M,u,r,g} = \{s : \text{HOPE}(\text{Sam})(s) + \{s' : s' \in S \text{ and } s' \text{ has as its initial segment a counterpart-duplicate of } s \text{ and for some } s'', s'' < s' \text{ and Mary wins in } s''\} = \text{HOPE}(\text{Sam})(s)\}$
 'HOPE(i)(s)' designates the set of situations for which i hopes in s. The meaning for *hope* in (14) is modelled on the approach in Heim (1991). The operation '+' is just set intersection, except that it may have special restrictions placed on it to encode presuppositions. The meaning (15) says that Sam hopes for Mary to win in s if intersecting the set of situations he hopes for in s with the set of situations in which extend into the future from s to situations in which Mary wins just gives back the set of hoped-for situation--i.e. if the hoped-for situations were all already situations in the denotation of the infinitive. This meaning entails that Mary's hoped-for winning follows Sam's hoping.

We have seen that the complementizer *for* can be given an interpretation following principle (II). Additionally, the meaning given to the special inflectional element F postulated by Stowell conforms to (III).

2.2 The English Counterfactual Subjunctive

English has several different types of subjunctive. Here I will only discuss one, the 'counterfactual subjunctive', seen in (16)-(17).

(16) Jill wishes that Bob were here.

(17) If Mary came, Mark would leave.

This kind of subjunctive clause is presupposed false. In a case like (16), where the subjunctive is embedded under an attitude verb, according to general presupposition-projection principles (Karttunen (1973)), this presupposition is converted into a presupposed belief of the attitude holder.

We can give a treatment of counterfactual subjunctive clauses along the lines of (II) and (III). First of all, *that* is analyzed precisely as *for* was:

- (18) $[[\text{that } p]^{M,u,r,g} = \text{that } f \in D_{\langle e,t \rangle} \text{ such that for any } s \in I, f(s) = \{s' : s' \in S \text{ and } s' \in [p]^{M,u,s,g}\}$

Next we have a semantics for the counterfactual subjunctive, which, like F or tense, is an sentential operator.

- (19) $[[c\text{-subj}(p)]^{M,u,r,Cg} = \{s : s \in p\}$

presupposition: For any context C, $C + [c\text{-subj}(p)]^{M,u,r,g}$ is only defined if $\text{DOX}(\text{AG}(r))(r) + [p]^{M,u,r,g} = \emptyset$.

$\text{DOX}(\text{AG}(r))(r)$ is the set of situations compatible with what the agent of r believes in r.² (20) gives the meaning for the embedded clause of (16).

²If we consider a wider range of cases, $\text{DOX}(\text{AG}(r))(r)$ is a special case--the kind of 'default context' that arises when r is a context in which the agent of r has a propositional attitude. Let CONTEXT be a function from situations to default contexts. When r is this kind of situation, $\text{CONTEXT}(r) = \text{DOX}(\text{AG}(r))(r)$. If r is an utterance situation, $\text{CONTEXT}(r) = \text{the conversational context}$. If r is a verb of saying, $\text{CONTEXT}(r) = \text{the context that makes true everything in the described}$

- (20) $[\text{that Bob were here}]^{M,u,r,g} = \text{that function } f \in D_{\langle e,t \rangle} \text{ such that, for any } s \in I, f(s) = \{s' : s' \in S \text{ and } s' \text{ is a situation in which Bob is here}\}$
presupposition: For any context C and situation r , $C+[\text{that Bob were here}]^{M,u,r,g}(r)$ is only defined if $\text{DOX}(\text{AG}(r))(r)+\{s : \text{Bob is here is } s\} = \emptyset$.

Now (21) is the meaning for (16). The presupposition results from simply projecting the *that* clause's presupposition to the matrix S .

- (21) $\{s : \text{WISH}(\text{JILL})(s)+\{s' : s' \in S \text{ and } s' \text{ is a situation in which Bob is here}\} = \text{WISH}(\text{JILL})(s)\}$
presupposition: $[\text{Jill wishes that Bob were here}]^{M,u,r,g}$ is only defined if for every $s \in C$ (the conversational context), $\text{DOX}(\text{Jill})(s)+\{s' : s' \in S \text{ and } s' \text{ is a situation in which Bob is here}\} = \emptyset$.

$\text{DOX}(\text{J})(s)$ represents the set of situations compatible with everything Jill believes in s . Therefore (21) says that (16) is true if Jill hopes that Bill is here, with the presupposition that she believes that he is not. We were able to arrive at this meaning by giving the mood morpheme a semantics that is sensitive to both the evaluation situation and the reference situation and by treating the complementizer *that* in the same manner as *for*.

2.3 Gerunds

I have argued previously (Portner (1991, 1992)) that certain complement gerunds like those in (22)-(23) should be analyzed as propositional expressions which provide a situation argument for their embedding verb.

- (22) Sue enjoyed painting a portrait of Phil.
 (23) Sue regretted painting a portrait of Phil.

Within our situation semantics, these can be analyzed with LF's like (24):

- (24) $[\text{S } [\text{NP}_1 \text{ PRO painting a portrait of Phil}] [\text{S Sue enjoyed } t_1]]$

Like other NP's, the gerund undergoes QR and leaves behind a coindexed trace. The intuitively correct interpretation of this LF is that (22) is true iff, for some situation s in the denotation of *PRO painting a portrait of Phil*, Sue enjoyed s . Thus it may receive a translation as in (25).

- (25) $\text{ing}(\exists x[\text{portrait-of-Phil}(x) \ \& \ \text{paint}(s, x)])(y) \ \& \ \text{PAST}(\text{enjoy}(s, y))$

The first conjunct in (25) says that y is a (contextually specified) situation in

$[\text{ing}(\exists x[\text{portrait-of-Phil}(x) \ \& \ \text{paint}(s, x)])]^{M,u,r,g}$. Formally,

- (26) $[\alpha[x]]^{M,u,r,g} = \{s : g(x) \in [\alpha]^{M,u,r,g}\}$

The second conjunct says that this situation was enjoyed by Sue.

conversation. This variety of cases deserves further study, but is beyond our topic here.

There is a difference between (22) and (23), however, which will lead to support for principles (I)-(III). Note that (23) strongly prefers that Sue regret a situation in which she completed a portrait of Phil, while (22) is compatible with her enjoying the potentially incomplete process of painting his portrait. In other words, the gerund in (22) is interpreted imperfectively, while that in (23) is perfective. While at first this appears to be an idiosyncratic difference, in fact it follows from the semantics of *regret* and *enjoy*. *Enjoy* denotes an attitude towards an event which temporally overlaps the enjoyment, while *regret* denotes an attitude which is typically towards a past event. (One can regret an in-progress event, and if one imagines such a case, I believe that (23) becomes imperfective.)

(27) shows a few verbs which pattern with *enjoy* and *regret*, respectively:

(27) enjoy-class

I hated climbing that mountain.

Mary loved reading *A Bloodsmoor Romance*.

regret-class

I celebrated climbing that mountain.

Mary recalled reading *A Bloodsmoor Romance*.

The *enjoy*-class verbs seem to only have an imperfective meaning for their complements, while the *regret*-class verbs strongly prefer for the gerunds to get a perfective meaning.

The intuition concerning the differences between the two classes that I will pursue is the following: the evaluation situation of the matrix verb in these examples provides a kind of point of view on the gerunds' evaluation situations. When the two overlap, there is an internal perspective on the gerund's situation, resulting in an imperfective reading, while when the gerund's evaluation situation precedes the matrix's, there is an external perspective on it and consequent perfectivity. This can be formalized by identifying the gerund's reference situation with the matrix's evaluation situation through the operation of a subordinating operator, in accordance with (II). Then *-ing* will relate the reference situation to the evaluation situation in the way indicated, providing an internal or external perspective on the painting event in (22)-(23), in accordance with (III).

The first thing we need is an analysis of imperfectivity which can make use of the reference situation. Because it is the most well know, I will use a modified version of Dowty's (1979) theory:

(28) $[[\text{ing}(\Phi)]^{M,u,r,g}] = \{s : \text{for all } s' \text{ such that } s' \text{ is identical to } s \text{ up until the time of } r \text{ and } s' \text{ is an inertia continuation of } s \text{ after the time of } r, s' \in [\Phi]^{M,u,r,g}\}$

Let us consider the gerunds in (22)-(23). When *r* overlaps *s*, *s* need not be a complete portrait-painting; *s* merely needs to be a situation which, if the the part of it that precedes *r* had gone to its normal completion, would have been a complete portrait painting. On the other hand, if *r* follows *s*, all of *s* is the part of *s* that precedes *r*, so *s* will have to be a complete portrait painting on its own. This meaning for *-ing* accords with principle (III).

We need for the *r* of (28) to be the enjoying situation in (22) and the regretting situation in (23). From what we've seen in §§2.1-2.2, this is a job for a

complementizer. I will assume that, being subordinate propositional expressions, there is a syntactically unmarked subordination operation which can operate on gerunds. (Perhaps Rosenbaum's (1967) view that POSS/ACC...-ing is analogous to *for...to* can be modernized so that a POSS or ACC morpheme plays the role of a complementizer, but this is not crucial here.) Because in the LF proposed in (24), the gerund is no longer the argument of the matrix verb, this subordinator must both abstract over the reference situation and supply the current evaluation situation as the resulting function's argument. This can be combined with (26) into one step:

$$(29) \quad [\alpha[x]]^{M,u,r,g} = \{s : g(x) \in [\alpha]^{M,u,s,g}\}$$

Now consider this updated version of (25):

$$(30) \quad \text{ing}(\exists x[\text{portrait-of-Phil}(x) \ \& \ \text{paint}(s, x)]][y] \ \& \ \text{PAST}(\text{enjoy}(s, y)))$$

The meaning of the first conjunct is given in (31):

$$(31) \quad [\text{ing}(\exists x[\text{portrait-of-Phil}(x) \ \& \ \text{paint}(s, x)]][y)]^{M,u,r,g} = \\ \{s : g(y) \in [\text{ing}(\exists x[\text{portrait-of-Phil}(x) \ \& \ \text{paint}(s, x)])]^{M,u,s,g}\} = \\ \{s : \text{for all } s' \text{ which are identical to } g(y) \text{ up until the time of } s \text{ and} \\ \text{which are inertia continuation of } s \text{ thereafter, } s' \text{ is a situation in} \\ \text{which Sue paints a portrait of Phil}\}$$

The translation (30) will then be true in s if s is in the set given in (31) and Sue enjoys $g(y)$ in s . Since it is a fact about enjoyment that the enjoying situation must overlap the painting situation, s can be in (31) if $g(y)$ is just an incomplete portrait-painting. Instead, if, as would be the case with *regret*, s followed the painting situation, s could only be in (31) if $g(y)$ were a complete painting of a portrait.

The interpretation of gerunds that I have just argued for conforms to the principles set out in §1. Since we are not dealing for complementizers or ordinary elements in INFL, gerunds provide an argument that those principles hold for subordination in general, and are not just about the semantics of the categories C and I.

3. Sequence of Tense

SOT presents a challenge to the simple picture of the nature of subordination presented above. The difficulty comes from the fact that dependent tenses--those whose value fall under a SOT rule--seem not to relate the evaluation situation and reference situation of their own clause. In (32), for instance,

$$(32) \quad \text{Cynthia said that Tracy was eating dinner.}$$

the dependent embedded tense does not indicate that the time of the eating precedes that of the saying. There are two main modern approaches to this phenomenon. The first is to consider the embedded tense to not have semantic importance at all (Ogihara (1989)), while the second is to say that it does have its normal semantics but that it indicates a temporal relation between situations that is partially derived from the higher tense (Smith (1978), Enç (1987)). In what follows I will develop the latter line of approach. After first showing the difficulties with the traditional Reichenbachian theories, I will argue that by modifying Enç's views to bring them in accordance with (I)-(III) above--in effect, by combining them with the Reichenbachian perspective--we can begin to solve several of the problems that her account has.

3.1 Two Previous Approaches to Sequence of Tense Phenomena

In this section I will outline the traditional Reichenbachian theory of SOT (Reichenbach (1947), Smith (1978)) and Enç's somewhat different theory. Then, in subsequent sections I hope to indicate how, by combining these in accordance with (I)-(III), an improved overall theory may be obtained. If this attempt is successful, it will strengthen the general view of subordination that has been outlined above.

Reichenbach's original principle to predict SOT phenomena had the core idea 'maintenance of the reference point'. Every clause in a sentence should have the same reference time, while tenses establish the relation among reference time, event time, and utterance time. This idea works well for examples like (32), but is ultimately untenable, as shown by the following example of Ogihara's.

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

(34) Meaning for Tenses:

past	R precedes S	R=reference time
will/would	R precedes E	E=event time
no will/would	R=E	S=speech time

Example (32) is correctly analyzed, since the two clauses will share a past reference time simultaneous with their event time. However, according to the meanings in (34), (33) is predicted to entail that the time of the final meal together is the same as the time of John's decision and prior to his telling. In fact, the final meal is simultaneous with John's telling.

Smith had already noted that the correct SOT of tense principle cannot be maintenance of the reference point, but rather should involve requiring the reference point of an embedded clause to match the event time of the superordinate clause. Still, as Ogihara demonstrates, her revised semantics still precludes a correct treatment of (33). The challenge presented by (33) is quite straightforward: the event time of the most deeply embedded clause is not past with respect to S or R, wherever R might be inherited from.

Ogihara also has a conceptual argument against Smith's approach. He claims that her proposal that an embedded clause's reference time may be the embedding verb's event time, what she calls the 'Sharing Principle', destroys the intuitive appeal of the Reichenbachian approach. However, (II) above postulates it as a general account of the nature of subordination and it is the idea which I hope ultimately to vindicate.

Now let us look briefly at Enç's (1987) approach to SOT. She presents a view of tenses as anaphoric elements which simply refer to an interval. Tenses may either be bound to another tense or "anchored by" a Comp. When one tense is bound to another, the two denote the same interval. This is the case in (32) and other SOT cases:

(35) C₀ Cynthia PAST₁ say that Tracy PAST₁ be eating dinner.

In contrast, when a tense is anchored by a Comp, the Comp itself must either be bound to a higher tense or, if it is the matrix Comp, carry the special index 0, which

indicates the speech time. In such a situation, a past tense must denote an interval which precedes the interval denoted by the Comp's index. For example:

(36) C_0 Cynthia PAST₁ that₁ Tracy PAST₂ be eating dinner.
Here PAST₁ is anchored to C_0 (as it was in (35) as well) and PAST₂ is anchored to that₁. It follows that PAST₂ precedes PAST₁ and that PAST₁ precedes the speech time. This is also a reading of the sentence.

The following configuration is impossible however:

(37) C_0 John PRES₁ believe that Mary PAST₁ be pregnant.
Nothing so far rules it out. Enç proposes that when a tense is bound to another, it inherits its governing Comp. Given this, the interval '1' has to both precede and be identical to the speech interval, a contradiction.

After this straightforward explanation of these basic cases, Enç goes on to discuss examples of present tense under past like (38).

(38) John believed that Mary is pregnant.
These cases introduce considerable complication into her system, but I will not discuss them in detail now since much progress has been made in understanding them since the time of Enç's work. In the next section Abusch's (1991) analysis of present under past will provide much of the inspiration for revising Enç's theory. However, I will point out the Enç's proposal involves double indexing--binding the embedded present tense to both the matrix Comp and the local tense.

(39) C_0 John PAST₁ believe that₁ Mary PRES_{<0,1>} be pregnant.
The time of the supposed pregnancy must both be identical with the speech time and include the belief time. As I mentioned, obtaining the correct semantic result requires further complications, but this first attempt of Enç's to indicate the relation of the embedded present to both the matrix and embedded complementizers will be quite useful to us shortly.

Enç's proposal does not consider examples involving *will* or *would*, and Ogihara argues that there is no straightforward way to make it do so. It has the same basic problem as the Reichenbachian proposals--since every past tense must denote an event time prior to some other time mentioned in the sentence, examples like (33) above will pose extreme difficulties. However, in what comes next, I hope to show that by combining Enç's indexing system, the Reichenbachian viewpoint, and some ideas of Abusch (1991), we can make progress in overcoming this problem.

3.2 Attitudes *De Re*

Abusch (1991) argues convincingly that present under past examples like (37), exceptions to straightforward approaches to SOT, should be analyzed as denoting a *de re* attitude towards an interval. Within the present framework, this can be cast instead as an attitude towards a situation, and in fact Kratzer (1991) has already made such a move. Example (37) would then be paraphrasable as "John believed of some situation which overlaps the speech time that it is a situation of Mary being pregnant." It would be parallel to, for instance,

(40) Ralph thinks that Ortcutt is a spy.
which, as Quine (1956) notes, is not incompatible with (41).

(41) Ralph thinks that Ortcutt is not a spy.

Ralph can have incompatible beliefs about the person denoted by *Ortcutt* because he has formed these beliefs on two separate occasions. Following Abusch's analysis, which uses the analysis of *de re* belief discussed in Lewis (1979) and Cresswell and von Stechow (1982), our case (37) will be true in the following circumstances:

- (42) $[[\text{John believed that Mary is pregnant}]^{M,u,r,g} = \{s :$
 (i) John stands in the belief relation in s to the set of centered situations $\{ \langle x_{\text{self}}, s' \rangle : \text{there is a unique } s'' \text{ such that } R(x_{\text{self}}, s', s'') \text{ and Mary is pregnant in } s'' \}$, and
 (ii) there is a unique s''' such that s''' overlaps NOW and $R(\text{John}, s, s''')$]}

Here R provides some contextually specified relation of acquaintance. Informally, (37) is true in s iff (i) John believes himself in s to occupy a situation in which he is acquainted by R to a situation of Mary being pregnant and (ii) he is in fact related by R to a unique situation which overlaps the present. Now that we don't have to stipulate that the supposed pregnancy overlaps John's belief situation s , since he must be acquainted with it in s , implying that it stretches back in time at least as far as s .

I think this is correct as far as it goes, but it leaves open two questions.

First, how is this interpretation compositionally derived from the LF Abusch proposes, (43)?

- (43) $[_S \text{ John PAST } [_{VP} \text{ believe } [_{S^*} \text{ PRES } [_S \lambda t [\text{Mary be pregnant}]]]]]]$

This question can be answered in a general way fairly quickly. Since *believe* is operating on both PRES and the abstract S , it seems the interpretation of S^* should be a pair whose members are the interpretations of these two things. Just such a meaning is the kind of thing proposed by Cresswell and von Stechow for *de re* interpretation in general. CP's typically denote tuples consisting of a group of focuses for the clause and its presupposition; an attitude verb makes a *de re* statement about the focuses to the effect that they jointly satisfy the presupposition.

The second question is: what is the status of s''' overlaps NOW, since the present tense is not invariably speech time oriented, as seen in (44)?

- (44) John will say that Mary is pregnant.

By framing this question in terms of the framework discussed in §§1-2, progress can be made. Abusch does not discuss the place or role of the complementizer in (43). A more accurate LF for (37) might be (45).

- (45) $[_{IP} \text{ John PAST } [_{VP} \text{ believe } [_{CP^*} \text{ PRES } [_{CP} \text{ that } [\text{Mary be pregnant}]]]]]]$

Recall that the complementizer serves to shift the embedded clause's reference situation to the embedding clause's evaluation situation. If PRES is adjoining higher than the *that*, giving it wider scope than the Comp, we predict that the reference situation for PRES is the utterance situation; thus it can simply indicate that the time of the supposed pregnancy overlaps the utterance time. If we have the following meanings for tenses, which obey (III) of §1, it will be possible to characterize this reasoning formally.

- (46) $[[\text{PAST}(p)]^{M,u,r,g} = \{s : s \in p \text{ and } s \text{ precedes } r \}$
 $[[\text{PRES}(p)]^{M,u,r,g} = \{s : s \in p \text{ and } s \text{ overlaps } r \}$

THE SEMANTICS OF COMPLEMENTIZERS

409

$$[\text{FUT}(p)]^{M,u,r,g} = \{s : s \in p \text{ and } s \text{ follows } r\}$$

The LF (45) will make (37) true if John stood in the believe relation to $\langle [\text{PRES}(T)]^{M,u,r,g}, [\text{that}(\text{pregnant}(m))]^{M,u,r,g} \rangle$.³ That it, (37) is true if John believed himself to occupy a situation where he was acquainted by R with a situation of Mary's being pregnant and if in fact he was acquainted by R with a present situation.

This recasting of Abusch's proposal falls into trouble with cases like (47).

(47) John said that Bill thought that Mary is pregnant.

Here if PRES is merely scoped past the second *that*, it will still be in a past context induced by the first *that*, yet if it is scoped past both complementizers we will fail predict that Bill has a *de re* attitude towards some present situation. In any case, a scope-based account of present under past seems untenable (contrary to Enç and Ogihara as well) due to examples like (48).

(48) John said Bill believed the claim that Mary is pregnant.

In (48), the PRES would have to be moved out of a complex NP, violating some principle of bounding theory.

The lesson of example (37) is that the PRES is in some way dependent on two different positions for its interpretation. It must pick out a situation at the level of the nearest Comp, so that the CP be properly used for *de re* interpretation, but the temporal statement it makes about the situation the attitude is towards seems to require wide scope. Here is where I believe Enç's double indexing representation is the right kind of approach.

(49) $[\text{CP}_0 \text{C}_0 \text{John PAST}_1 \text{believe} [\text{CP}_1 \text{that}_1 \text{Mary PRES}_{\langle 0,1 \rangle} \text{be pregnant}]]$

PRES contributes to the semantics at the levels of both CP₁ and CP₀. Only CP₀, however, receives the presupposition of presentness.

(50) CP₁ denotes the pair $\langle [q]^{M,u,r,g}, [\text{that}(\text{pregnant}(m))]^{M,u,r,g} \rangle$.

(51) CP₀ denotes the pair $\langle [\text{PRES}(T)]^{M,u,r,g}, [\lambda q[\text{PAST}(\text{believe}(j, \langle q, \text{that}(\text{pregnant}(m)) \rangle))]^{M,u,r,g} \rangle$

Let's assume that a top-level presupposition is a presupposition of the assertion. Following Cresswell and von Stechow's analysis, then, (51) is intended to be true if the speaker asserts of some set of present situations that John believed of one of them that it was a situation of Mary being pregnant.

3.3 Basic Cases

With this treatment of the indexing of tenses, Enç's system outlined above can be used for all the basic cases. (52) gives the LF for a simple SOT case.

(52) C₀ Cynthia PAST₁ say that Tracy PAST_{\langle 0,1 \rangle} be eating dinner.

³T denotes S, the set of all situations. It serves as a dummy argument for PRES. Kratzer (1992) has suggested that propositional attitudes always denote *de re* attitudes towards situations which satisfy their complements' presuppositions. If this is right, this T should be replaced by a presupposition skeleton (Rooth (1985)) for *that Mary is pregnant*.

- (53) CP_0 denotes the pair [\langle PAST(T), PAST(say(c, that(eating-dinner(t)))) \rangle] M,u,r,g .

Here, a tense T_1 which is bound by another tense T_2 receives as its first index that of the governing Comp of T_2 . Since PAST $_{\langle 0,1 \rangle}$ has a second index which corresponds to no Comp, it only contributes to the matrix Comp's presupposition. Thus (52) asserts of some past situation that it is a past situation of Cynthia saying that Tracy is eating dinner. The embedded PAST is effectively removed from its surface clause.

The indexing shown in (54) gives another version of a SOT reading.

- (54) C_0 Cynthia PAST $_1$ say that $_1$ Tracy PAST $_{\langle 1,1 \rangle}$ be eating dinner.
 (55) CP_0 denotes [\langle PAST(say(c, \langle PAST(T), that(eating-dinner(t)))) \rangle] M,u,r,g .

Here Cynthia said of some past situation that it is a situation of Tracy eating dinner. This interpretation is also compatible with the eating preceding the saying.

Note that, because it shares its second index with that $_1$, here PAST $_{\langle 1,1 \rangle}$ contributes to the presupposition of *that Tracy was eating dinner*. This aspect of the meaning could perhaps most easily be derived by moving the tense to the governing coindexed C. If this is correct, and we will see below a further reason to suppose that it is, the correct LF's for (49) and (54) would be (56) and (57).

- (56) [CP_0 C_0 John PAST $_1$ believe [CP_1 [C_1 PRES $_{\langle 0,1 \rangle}$ that $_1$] Mary be pregnant]]
 (57) [CP_0 C_0 Cynthia PAST $_1$ say [CP_1 [C_1 PAST $_{\langle 1,1 \rangle}$ that $_1$] Tracy be eating dinner]]

With these LF's, it is a straightforward matter to derive the interpretations of the embedded clauses shown by (51) and (55). Dependent tenses, which don't move to any C under this approach, don't contribute to the assertion of their own clause. They only add to the presuppositions of some higher clause. One may see this as a kind of semantic version of Ogihara's deletion operation.

Finally we can look at the crucial test case, a simplified version of (33).

- (58) C_0 John PAST $_1$ decide that $_1$ he PAST $_{\langle 0,1 \rangle}$ FUT say that they PAST $_{\langle 0,1 \rangle}$ be having their last meal.
 (59) CP_0 denotes the triple \langle [PAST(T)] M,u,r,g , [PAST(T)] M,u,r,g , [λp [PAST(decide(j, \langle p, FUT(say(j, having-their-last-meal(them)))) \rangle)] M,u,r,g \rangle .

Example (58) is intended to be true if the speaker asserts of a set of past situations A and a past situation s that John decided in s concerning some situation s' in A that s' should be followed by a situation in which he says that they are having their last meal together. In arriving at this meaning, note I have had to assume that only the first PAST $_{\langle 0,1 \rangle}$ may contribute to the presupposition of *that he would say that they were having their last meal*. This assumption would follow, however, from the idea that that tense first moves to the C node it is coindexed with--that is, if the correct LF were (60).

- (60) C_0 John PAST $_1$ decide [C_1 PAST $_{\langle 0,1 \rangle}$ that $_1$] he FUT say that they PAST $_{\langle 0,1 \rangle}$ be having their last meal.

Postulating such a movement leads to the suggestion that a tense's first index determines its focus-projection properties while the second indicates syntactic dependence.

4. Discussion

In the last section I have sketched an argument that, by using Enç's indexing system as a guide to how the presuppositions of tenses are associated with CP's, we can improve her theory so that it is able to analyze examples with *will* and *would*. We have thus converted the SOT problem into a presupposition-projection problem. This means, unfortunately, that I am not able to give here a fully compositional version of the ideas concerning SOT, because doing so would require developing a full theory of presupposition. I believe that it is possible to formalize the analysis by using the structured-meanings framework of Cresswell and von Stechow (1982), von Stechow (1989), and Krifka (1991) augmented with an indexing system; it is less clear whether the more constrained theory of Alternative Semantics (Rooth (1985)) can be utilized. In any case, this task will have to be left for another paper.

Another point that the present analysis brings up concerns the syntax-semantics interface. Enç's tense-indexing system, which makes use of syntactic notions like government and binding, to a large extent gives the right operator-focus relations in this domain. I also suggested some further improvement may be possible by relating some of the apparent presupposition-projection facts to head movement. As the compositional semantics of SOT is worked on, it seems that it will also be worthwhile to further investigate the syntactic restrictions on focus-background structures.

In the present context, however, the most important fact concerning §3 is that the changes made in Enç's theory drew on the principles (I)-(III) given at the beginning of the paper. In conjunction with the arguments of §2, we therefore have a wide variety of constructions which support the idea that those principles give general account of the nature of subordination. The fact that the SOT cases at first seem quite at odds with (II) and (III) makes an argument of the kind given by §3, if successful, even stronger. Furthermore, it vindicates the Reichenbachian model, whose original motivation was in large measure to describe SOT, but which had seemed to be discredited as an analysis of it.

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THE SEMANTICS OF COMPLEMENTIZERS

413

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