PAST TENSE REPLACEMENT AND THE MODAL SYSTEM

T.R. HOFMANN
University of Ottawa

This paper originated as a term paper that the author wrote while a first-year graduate student at M.I.T. and a member of the Mechanical Translation Group, Research Laboratory of Electronics, M.I.T. The version published here is a revised and extended version of that term paper that appeared in 1966 in Report NSF-17 of the Aiken Computation Laboratory, Harvard University. The research was supported in part by grants from the National Science Foundation to M.I.T. and to Harvard University.

Hofmann's observations about the correlations between time adverbs and auxiliary verbs and his proposed rule of "past tense replacement" played a major role in the development of the analysis of English auxiliaries that is presented in McCawley (1971a). In particular, Hofmann's paper provides several of the steps in my argument that Chomsky's celebrated formula for auxiliary verbs (Tense(Modal)(have -en)(be -ing)) is unnecessary.

The distinction Hofmann draws between epistemic and root modals has become standard in transformational studies on modals, although only the term "epistemic" has been generally accepted. He has argued more recently (Hofmann, 1969) that this two-way distinction should be replaced by a three-way distinction - epistemic, intransitive (root), and transitive (root) - where the latter two match Perlmutter's

(1968, 1970) two verbs begin. *Thus, he distinguishes the following senses of* John must eat soup: *(a) 'It must be (true) that John eats soup' = 'It is necessarily true that John eats soup' = 'It is necessary/needed for the world to be complete that John eats soup', (b) 'John's eating soup is necessary/needed (for the action to go on)', (c) 'For John, it is necessary to eat soup' = 'Eating soup is necessary for/needed by John'.*

Two similar syntactic constructions, employing epistemic passives and pseudocopulative verbs, are discussed in the first two sections of this paper. Rosenbaum's analysis of these constructions is presented. In Section 3, the past tense replacement transformation is postulated to account for certain of the perfect infinitives found in these constructions. In Section 4, the modal system is discussed, and certain modal constructions are shown to be similar to the constructions of Sections 1 and 2.

1 In Contemporary English, we find that there are a group of sentences that appear to be passive but for which no corresponding active sentences exist. We may call them (with no philosophical implications intended) "epistemic passives", because passivized verbs of this type tend to qualify or limit the truth value of the predicate of the sentence.

(1) a. *He is known to dislike singing.*

b. **Someone knows him to dislike singing.*

c. *Someone knows that fact.*

(2) a. *Harvard is said to be quite a school.*

b. **Someone says Harvard to be quite a school.*

c. *Someone says this.*

(3) a. *Moses is rumored to have been reincarnated as a butterfly.*

b. **Someone rumors Moses to have been reincarnated as a butterfly.*

c. *Such events have been rumored from time to time.*

When used actively, verbs of this type always allow, and in general require, an abstract noun phrase such as *fact* or *event* as an object [as in the c sentences of (1), (2), and (3)], but seldom do they permit an object that is human.[1]

Contrary to this restriction between these verbs and their underlying objects, there is no restriction at all on

the surface subject of the passivized sentence except that it must suffice as the subject of the complement portion of the sentence, e.g., *dislike singing* of (1a). That is, theorems are proven, but people are usually not proven in the same sense; yet we have *He was proven to have lived in France,* and propositions but not electrons are inferred, yet we have *the electron is inferred to have a negative charge.*

We see, then, (a) that there are normal subject-verb selectional restrictions between the surface subject of the passive and the verb of the complement, and (b) that there seems to be no restriction between the surface subject of the passive and the passivized verb in spite of the fact that (c) these are verbs that have their objects restricted to abstract nominals. This is strong evidence that the underlying form of these sentences is something like:[2]

(4) *Someone believes it, that John dislikes singing.*

which is passivized into [with the embedded sentence extraposed in (b)]:

(5) a. *It, that John dislikes singing, is believed.*

b. *It is believed that John dislikes singing.*

The subject of the embedded sentence is then moved forward and replaces the *it*. With several small changes, including deletion of the present tense morpheme in the predicate of the complement, we have:

(6) *John is believed to dislike singing.*

Let us examine which verbs undergo this course of derivation and which do not. First, we may note that all the verbs that occur in these constructions have a "positive" sense. That is, a "negative" verb like *disprove* or *deny* is not found in such constructions.

(7) a. **John is disproven to be rich.*

b. **She is denied to live in France.*

But this observation is just a special case of a more general observation, which is, that if and only if a verb occurs in the epistemic passive, it can take a complement, "Z be true" (e.g., *It is true that John is coming*), with the meaning that the truth of the Z is qualified by or results from the main verb of the epistemic passive. Thus, in the sentences below, the epistemic passive (a) is equivalent to saying that the truth of (b) is derived from (c).

(8) a. *John is rumored to be in France*

b. *John is in France.*

c. *a rumor*

(9) a. *Betty is known to chase fellows.*

b. *Betty chases fellows.*

c. *(common) knowledge*

(10) a. *He is inferred to be 5'6" and have large hands.*

b. *He is 5'6" and has large hands.*

c. *inference*

The negative verbs *deny, disprove,* etc., may take a complement of the form "it S be true", but the truth of the S can never be a result of denying or disproving.

The analysis of the epistemic passive construction can now be improved by requiring that the matrix verb (the verb that is passivized) be one that permits *true* in its complement and that it not be negative in the special sense that *disprove, deny* are. This is not sufficient, however, as there are verbs like *contend, vouch,* and *vow,* which will take complements containing *true* and are not negative, yet which can not be epistemically passivized.

(11) a. *He contends that it is true that John went to France.*

b. **John is contended to have gone to France.*

Thus, apparently some ad hoc lexical specification is still needed to block derivations leading to sentences like (11b).

2 Another class of verbs that should be handled by this same set of transformations is a subset of the so-called copulatives, including *appear, seem, turn out.*

(12) a. *It appears (to be) true.*

b. *He appears (to be) willing.*

c. *She seems (to be) anxious.*

In many cases, the *to be* is optional after such pseudo-copulatives. It is apparently from the examples with the *to be* missing that various grammarians have classified these verbs as copulative verbs. Yet they are more easily explained as having a deletable *to be.* Notice the following:

(13) a. *It appears (to be) true.*

b. *He appears (to be) willing.*

c. *He appears to be singing*

d. *He appears to be a man*

e. *He appears to have gone*

(14) a. *He seems (to be) anxious*

b. *He seems to have moved away - there's no one here*

(15) a. *He turned out (to be) crooked*

b. *He turned out to enjoy singing*

It appears that *to be* is deletable before adjectives only,[3] and it is simpler to say it is deletable before adjectives than it is to say that it is insertable before everything else. Furthermore, in (13e), (14b), and (15b), there is no *be* at all, but an ordinary verbal element. This paradigm is much more easily explained, then, if we assume the *be* in all the other cases is the *be* that is associated with adjectives, progressive modification (i.e., *be* followed by a present participle), and predicate nominals, respectively. Thus, we may conclude that these verbs are not really copulative; hence the name "pseudocopulative".

The derivation of these constructions is apparently identical to that of the epistemic passives discussed in Section 1. Starting with [parallel to (5a)]:

(16) *It, that he is stupid, appears.*

extraposition gives

(17) *It appears that he is stupid.*

and precisely parallel to the change between (5b) and (6), we get:

(18) *He appears to be stupid.*[4]

The verb *happen* belongs in this class but has one idiosyncracy - that *to be* deletion is impossible with it. Extraposition is not obligatory with *likely* (e.g., *That he is stupid is quite likely*), unlike the other verbs in this class, and, being an adjective, it takes *be* in front of it.

3 The two constructions under consideration can have "perfect infinitives" in their complements; for example:

(19) a. *He is rumored to have been rich*

b. *He appears to have finished his work*

We shall examine below the conditions under which these perfect infinitives appear in the complements. Let us call

the past tense modification Ed and the perfect modification Perf. Perf is expanded into *have* + En, and Ed and En are the suffixes on the immediately following verbs for the past tense and past participle forms, respectively.

It seems that if and only if the complement sentence contains either Ed or Perf or both, then there will be a Perf in the portion of the complement that remains after the *to*.

To establish this, which may be called the "Ed-replacement transformation", we may argue as follows. First, there must be Ed and there cannot be Perf if a time adverb designates a past time point, e.g., *at 3 p.m. yesterday* or even merely *yesterday*.

(20) a. *He came last Tuesday.*

**He has come last Tuesday.*

b. *He flew to Chicago yesterday.*

**He has flown to Chicago yesterday.*

c. *He incited the revolt last year.*

**He has incited the revolt last year.*

But if these sentences are embedded into one of the passives discussed above, Perf is invariably required.

(21) a. *He is rumored to have come last Tuesday.*

b. *He is reported to have flown to Chicago yesterday.*

c. *He is alleged to have incited the revolt last year.*

The time adverb belongs to the complement verb rather than to the main verb in each of these examples, because the main verb is in the present tense, and indeed these time adverbs cannot be moved to the front of the sentence (topicalized) as time adverbs usually can.

(22) a. *He came yesterday.*

b. *Yesterday, he came.*

(23) a. *He is reported to have come yesterday.*

b. **Yesterday, he is reported to have come.*

Similarly, there are places where Perf is strongly preferred over Ed. Consider the following examples.

(24) a. **He drank a gallon of vodka by now.*

b. **His lordship finished eating now.*

These may be rendered acceptable by using Perf,

(25) a. *He has drunk a gallon of vodka by now.*

b. *His lordship has finished eating now.*

and indeed, we get Perf in the embedded forms:

(26) a. *He is reported to have drunk a gallon of vodka by now.*

b. *His lordship is alleged to have finished eating now.*

Because the Perf in (26) could not have come from Ed, then it must have as a source the Perf in (25).

In the following sentence, both Ed and Perf are required on the main verb.

(27) a. *He had seen her only once before when I met him.*

b. **He saw her only once before when I met him.*

c. **He has seen her only once before when I met him.*

And again we have Perf in the complementized form,

(28) *He is rumored to have seen her only once before when I met him.*

Thus, it seems that the Ed-replacement transformation as stated at the beginning of this section is necessary. But it is not restricted to the cases we examined above; rather, it is used in many different constructions in English. The following examples illustrate this fact (noting that a non-embedded Perf does not occur with *yesterday*). In adverbial participial constructions:

(29) *Having done that yesterday, he proceeded with the second task.*

In Poss-Ing nominalizations:

(30) *His having done that yesterday forced us to find him.*

In *for-to* nominalizations:

(31) *(for him) To have done that yesterday would have been disastrous.*

And in certain cases of modals:

(32) *He may have done it yesterday.*

The construction illustrated in (28) may eventually be shown to derive from Poss-Ing nominalizations, and we will examine the constructions involving modals later, but in any case, this Ed-replacement process is far from trivial and needs adequate explication.

In attempting to formalize the transformation for Ed-replacement, it should first be noticed that it will necessarily introduce Perf into strings that have no Perf, but only Ed. This pristine Perf must replace either the Ed or the Perf, either of which may not be present in a particular string. As it seems more natural not to move a Perf already in a sentence (if there is no Ed), we may have it replace the Perf:

(33) X (Ed) (Perf) $Y \Rightarrow 1\ \emptyset$ Perf 4

and we must explicitly state that either 2 or 3 must occur for the transformation to apply; i.e., that it is not the case that there is no 2 and there is no 3.

There is a slightly better solution, however. If we revise the structural description to

(34) X Ed (Perf) Y

the transformation will not apply in the case of a Perf alone, thus leaving such a string unmodified. In the other two cases, an Ed alone and an Ed followed by a Perf, it will apply, replacing either string with a Perf. It seems more reasonable to attach the Perf to the tense node, replacing Ed, rather than to have it replace Perf (which may or may not be there), because the Ed is necessarily there if the transformation applies. We will see later that there are data that demand this choice. Thus, the Ed-replacement transformation is:

(35) X Ed (Perf) $Y \Rightarrow 1$ Perf $\emptyset$ 4

This formulation (35) gives slightly unintuitive results in its account of the phrase marker associated with the output string. The following sentences will have two tense nodes, one dominating the first verbal element and the other dominating the *have* after it.[5]

(36) a. *He is rumored to have left yesterday*.

b. *He seems to have gone*.

We will return to this problem in Section 5.

4 Turning our attention to the modal system in English, we may recall that by and large, each of the modals have two different semantic uses, e.g., *may* may mean either 'permission granted' or 'possibility of being true', and

must may mark either 'imperative requirement' or 'logical entailment'. Examples of these in order are:

(37) a. *You may go now.*

b. *He may have already gone.*

c. *I must go now.*

d. *He must have already gone.*

In sentences 37a and c, it will be noticed that Perf and Prog, the progressive modification, are not permitted[6] (38a and c) and the underlying subject must be animate (38c):

(38) a. **You may have gone outside to play. (permission sense intended)*

b. **You can be singing. (ability sense intended)*

c. **My car must leave now.*

In (37b and d), however, (i) Perf may be a representative of Ed and (ii) there is no restriction on the subject except that it be compatible with the main verb that follows the modal. Both (i) and (ii) can easily be seen to be parallel to what was found in the epistemic passive constructions already discussed.

In the preceding examples, I have used only three modals, *may, must,* and *can,* but these parallel syntactic and semantic dualities are quite common throughout the modal system. If extensive examination of the modal system is made, several generalities can be discovered. First, there are two senses in which a modal may be used. The root sense, illustrated by (37a and c), is where there is a restriction of the subject to animate things, and Perf is forbidden and Prog is permitted only under exceptional circumstances. This is illustrated by *may* in the permission sense, *can* in the ability sense, *will* in the habitual-obstinancy sense. These have past tense forms *might, could,* and *would,* which are also generally used for counterfactual subjunctive, consistent with the general rule of using Ed for counter-factual statements.

(39) a1. *May I sit down?*

a2. *She told me I might go, but I didn't.*

b1. *Can you lift it?*

b2. *Could you play that well last year?*

c1. *He will interrupt any lecturer.*

c2. *He would stay up all night when he was a boy.*

Examples (37b and d) illustrated the epistemic sense where the modal seems to say something about the truth value of the sentence rather than to predict something about the subject. Here, the modal does not restrict the subject in any way, and Perf serves as the past tense marker. Contrasting with the senses described above, both *may* and *can* have a meaning of 'possibility' (*can* here is almost exclusively used negatively as *can't,* and *may* prefers the positive), and *will* has a 'future' meaning. The forms *might, could,* and *would* are reserved for the counterfactual subjunctive.

(40) a1. *He may have come yesterday.*

a2. *I wish he might have come yesterday.*

b1. *He can't have come.*

b2. *I wish he couldn't have come.*

c1. *He will have finished it before he comes.*

c2. *I wish he would have finished it before he came.*

The remainder of the modal system isn't quite so patternful; *need, dare,* and emphatic *shall*[7] appear to exist only in the root sense but have no past tense form, while *should, must,* and *ought* have both senses but no past forms as modals.

We may now leave aside the root modals and concentrate on the epistemic modals. We have already noted that Perf could represent Ed and is, of course, the only way to represent past time with an epistemic modal. Similar to this, Prog is used for present time if the lexical verb is not stative. This may be seen to follow necessarily from the fact that Prog is used in simple sentences with nonstative verbs to indicate present time. Thus we have as unambiguous:

(41) a. *He must have sung yesterday.* past time
b. *He must be singing now.* present time
} epistemic
c. *He must sing now.*

but as ambiguous:

(41) d. *He must know that now.* root and epistemic

Although it is clear that these epistemic modal constructions are derived, it is not immediately clear just what the structures of the matrix sentences are. Let us compare the two most plausible alternatives.

We might suppose the underlying matrix to be a

sentential (it S) subject followed by the epistemic modal, which would be considered to be an intransitive verb. This is similar to the matrix proposed for the pseudocopulatives in Section 2. A derivation similar to the pseudocopulative use of *seem* or *appear* would be obligatory with the additional necessity of dropping the *to* complementizer. In such a case, however, we would need to block ad hoc a derivation if an aspect (Prog or Perf) appeared in the matrix.

Alternatively, we might consider the verb of the matrix to be an intransitive *be* and the epistemic modal to be a modal, and no aspects could appear with either root or epistemic modals. This would simplify the base component. The first several rules would have the effect

(42) S → NP Tns ({Modal / Aspect}) Verb ...

There are several indications that the second alternative is correct. First, there are sentences of form:

(43) *It isn't that John wouldn't have come, rather...*

the first part of which must be (unextraposing the embedded sentence),

(44) *It, that John wouldn't have come, is not.*

This is just the negative of a structure "it S be", which seems infrequent at best. Perhaps it is explainable by the dictum that to assert a sentence to be (true) is equivalent to asserting simply the sentence? Such a structure seems to be supported by sentences like (quite acceptable in at least some dialects):

(45) *Lions have been mammals for as long as I can remember.*

Although the interpretation of this sentence is clearly generic (like *Lions are mammals*), it is readily observable that aspects do not occur in generic sentences:

(46) a. **Lions have been mammals for 3700 years.*

b. **Lions are being mammals nowadays.*

We could reconcile these facts if (45) were derived from an underlying

(47) *It, that lions are mammals, has been (true) for as long as I can remember.*

And indeed, what is being asserted by that sentence is that for as long as the speaker could remember, the generic

sentence *Lions are mammals* has been true, i.e., not doubted, and it is presupposed that the listener agrees or should agree that this generic is true. Questioning and sentence negation apply only to the *having been true for as long as he could remember,* which are two tests for identifying nonembedded sentences. It is furthermore a fact that if a presupposition is found in the base structure of a sentence, it is invariably embedded. Thus, there is a strong argument for (47) being the underlying structure of (45). But this implies that the Perf in (45) is epistemic. In the framework of the first alternative, we are forced to accept that Perf can be an intransitive verb. Whereas in the second analysis, Perf is merely an aspect with the intransitive verb *be* as would be expected from (42).

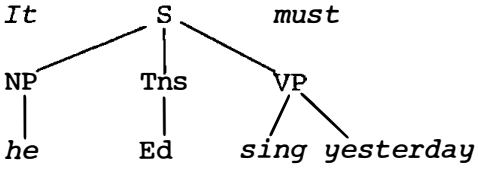
If this second analysis is accepted, what is the course of derivation by which the epistemic object (Modal or Perf) gets situated between the subject and the Tns of the embedded sentence with the remainder of the matrix erased? And what implications does this derivation have on the analysis of the epistemic passives and pseudocopulatives discussed in Sections 1 and 2? These problems will remain unanswered here in the face of a larger problem. Although there is some linguistic evidence for the second alternative, it apparently entails infinitely ambiguous syntactic derivations.[8]

5 Returning to the Ed-replacement transformation (34), we see that it predicted two Tns nodes in the following sentence type:

(48) *He must have sung yesterday.*

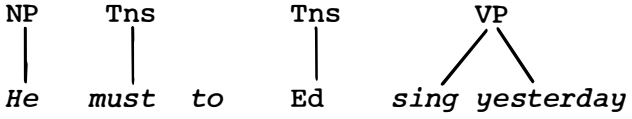
The derivation of this sentence is something like (assuming for the moment that the derivation is that of the first alternative - like *seem* - the same result appears with the second alternative):

(49)



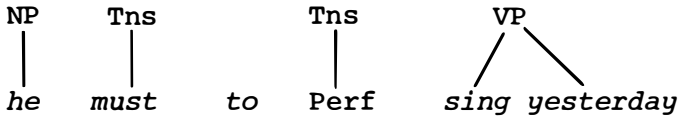
And with extraposition and subject incorporation,

(50)



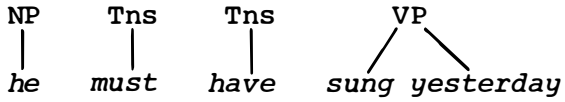
The Ed-replacement transformation converts this to

(51)



And after *to*-deletion and affix-hopping,

(52)

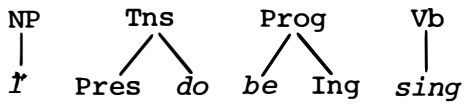


Tns plays several roles in the syntax of English. First and foremost, after *be, have,* or a modal has been attached under it, replacing the periphrastic *do* (by the *do*-replacement transformation), it serves as the node that is brought forward in inversion for questions, etc. Thus, the inversion transformation looks like:

(53) NP Tns ⇒ 2 1

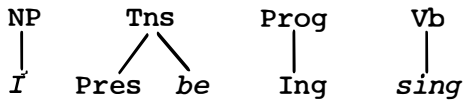
and we may have a derivation,

(54)



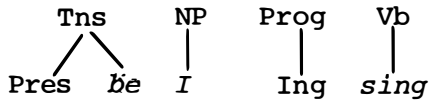
applying the *do*-replacement transformation;

(55)



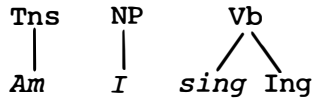
and after inversion;

(56)



which, with the affix-hopping rule, becomes

(57)



As the inversion transformation is stated, it takes the first occurrence of Tns and pulls it to the front of the sentence. Thus there is no effect of having two Tns nodes. Another role Tns plays is in forming short answers. Here the rule is, to form a short answer, take a full answer (i.e., a sentence that satisfies the conditions for being an answer) and delete everything after the Tns and a *not* if one is there.

(58) a. *Does he sing well?* *Yes, he does.*

b. *Is he smart?* *No, he isn't.*

c. *Has he gone?* *Yes, he has.*

d. *Can she go?* *Yes, she can.*

Notice however, that in addition to the short answers to

(59) *Did he come?*

(60) a. *Yes, he did.*

b. *No, he didn't.*

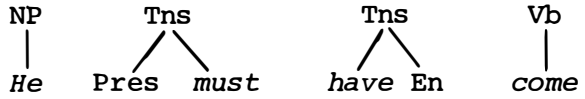
there is another class of short answers to (57) that contains epistemic modals.

(61) *He must have.*

He might have.

By our formulation of the Ed-replacement transformation, the sentences from which these must have been derived contain two Tns nodes:

(62)



and deleting everything after the second Tns gives us precisely the form of these short answers.

Looking at tag questions with metamodals, we find two different patterns in my dialect:

(63) a. *I shouldn't have come, should I?*

b. *I shouldn't have come, should I have?*

The first type may be explained by saying that inversion takes place in the tag and everything else of the second sentence is deleted or that the NP and the Tns are copied in inverted order. The second type of tag is clearly derived from a second sentence that first had everything after the (second) Tns deleted and then inversion took place. Similar confusion reigns in *so* tags.

(64) a. *He must have gone to Chicago, and so must she.*

b. *He must have gone to Chicago, and so must she have.*

Thus, we find surprising support for transformation (35), which was thought to be counterintuitive.

6 To summarize, a class of passive constructions was

examined and an analysis was presented for them that is essentially that of P. Rosenbaum (1967). This analysis was extended to certain so-called copulative verbs. An Ed-replacement transformation was formulated and was found not only to describe the facts of these complements, but also to predict certain seeming irregularities in short answers and tag questions. It was also shown how analysis of the epistemic constructions and the Ed-replacement transformation motivates a syntactic analysis of the modal verbs in English into two natural and pervasive classes that have various common characteristics. Certain problems are raised about their derivation.

NOTES

[1]There are some lexical exceptions to this; for example, the verb *rumor* cannot be used except as a passive. There is a homophonous verb *know,* which takes human objects and which means 'to be acquainted with' (e.g., *I know her*).

[2]Rosenbaum (1967) gives a satisfactory derivation, utilizing *for-to* complementation rather than the *that* complementation, which is used here for ease in reading. Furthermore, all the transformations used in his derivation can be independently motivated.

[3]Notice that (13b,c) distinguishes an adjective from a participle of a verb. Also, for example,

It appears broken.

**It appears typed.*

[4]This derivation permits the explication of the otherwise unexplained *to me,* etc., in

He appears quite intelligent to me.

being derived from something like

It appears to me that he is quite intelligent.

[5]I am assuming a grammar where the modals and aspects are developed from the VP and there is an expansion rule of the form

S ⇒ NP Tns VP

Modals *have* and *be* are drawn out of the VP and attached under Tns. See Section 5 for more explication.

[6]Actually, there are counterexamples where Prog occurs with such a root modal, e.g., *You must be singing when my mother arrives*. But these are cases of the Prog that can appear only with a *when*-clause. Note the nonoccurrence of:

**Have you ever been taking a bath?*

**Be singing*!

in spite of the unimpeachably grammatical:

Have you ever been taking a bath when the doorbell rang?

Be singing when she comes in!

[7]I am describing here general American, in which *will* is used as the future auxiliary in all three persons and *shall* is restricted to the sense of 'request for orders' (*Shall I open the window?*) and the 'promissory emphatic' use as in *I shall return*.

[8]Even though they are syntactically ambiguous, they need not be semantically ambiguous, which, as our intuition tells us, is the case. An analogous problem to this (indeed, the essential problem here) is where *John came* is derived from (as was already noted, these do not occur without negation in common speech):

it is that John came.

it is that it is that John came.

it is that it is that it is that John came.

⋮

each of which is generatable from the base. (The present problem lies in that there is no natural way to state the epistemic transformation in the second analysis without deriving *John may have come* from *it may be (that it is)*^{n} *that John came* where $n \geq 0$ is the number of embeddings or the syntactic ambiguity.) The reader is referred to Russell's theory of types.