

# Syntax: Moving Beyond Phrase Structure Rules

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Linguistics 201

Up to this point we have concentrated on the issue of syntactic grammaticality. We have catalogued some of the types of word-strings that English speakers recognize as forming English sentences, and tried to characterize those strings in terms of recursive rules. In this essay we will see some of the ways this project falls short of characterizing the full gamut of grammaticality judgments and investigate the ways linguists have tried to extend the system of rules appropriately. I will concentrate here on ways in which our present rules are not merely incomplete, but are instead of the wrong kind to do what is needed. I'll look at two particular kinds of phenomena that our present rules are not well designed to account for.

The first of these indicates that we need something beyond rules which, like our present phrase structure rules, characterize syntactic knowledge in terms of category, or parts of speech. We decided at the outset that our ability to distinguish grammatical from ungrammatical strings of words could be made on the basis of category. We reached that conclusion by observing that one could make grammaticality judgments about a sentence that has a word in it whose meaning you do not know completely. In fact, all you need to know is enough information about that unknown word to gauge its category. So, for instance, I can tell you that *strum* refers to some part of an automobile and you have all you need to know that (1a) is grammatical and that (1b) isn't.

- (1) a. The strum broke.
- b. Strum the broke.

Knowing that *strum* refers to something concrete, like a part of an automobile, apparently licenses the guess that it belongs to the category Noun, and that is sufficient to know where it can stand among a string of words and form a grammatical English sentence. The precise meaning of the words don't matter, it seems. Only their type of meaning: their category. It's for this reason, then, that our phrase structure rules express which orderings of words are English in terms of category alone.

But sometimes the exact meaning of the words does matter. Consider the following sentences.

- (2) a. \* John slapped.
- b. \* Mary sat that Sally should leave.

- c. \* Sally put the book.
- d. \* Jerry wondered that Sally should leave.
- e. \* Myrtle believed whether John should eat cake.
- f. \* Sam died the man.

Each of these strings fits the description of grammatical arrangements of words that our phrase structure rules give, yet they are clearly ill-formed. The problem with these examples is that the verbs's meanings are not compatible with the rest of the constituents in the sentence. The meanings of verbs requires that a certain assortment of phrases be present in the sentences they stand in. We say that a verb specifies that certain "arguments" are necessary in the sentence it contributes to. Moreover, verbs require of their arguments that they mean certain things and that they be of a certain category. We call these dual, and often related, requirements *selection* and *subcategorization*. Verbs select for arguments that have a certain meaning, and they subcategorize for arguments of a certain categorial sort (NP, PP, etc.) We can envision the situation illustrated by the above examples in the following way. Our grammar constructs sentences by going through the following steps: first a phrase marker is constructed by way of the phrase structure rules and then a rule of Lexical Insertion is applied that inserts in each of the terminal elements of the tree a word of the appropriate sort. The meaning of "appropriate sort" involves both category — the word inserted into a position must be of the category that position is labeled for — and selection and subcategorization — the insertion of a verb into a position must satisfy its selectional and subcategorization requirements. In the cases in (2), then, the selectional requirements of the verb have not been satisfied upon Lexical Insertion. If, by contrast, these verbs had been inserted into the VPs in (3), the result would have been perfectly grammatical.

- (3) a. \* John slapped **Mary**.
- b. \* Mary sat.
- c. \* Sally put the book **on the shelf**.
- d. \* Jerry wondered **whether** Sally should leave.
- e. \* Myrtle believed **that** John should eat cake.
- f. \* Sam died.

So the picture that emerges is that there are two components to our ability to recognize certain strings of words as grammatical or not. On the one hand, there is that information that is independent of the meaning of the words, but sensitive to just the part of speech, or category, of those words. We've described this component of our knowledge with phrase structure rules. And then, in addition

to that, there is a process that fits particular words into the positions that these phrase structure rules reserve. This process, Lexical Insertion, is sensitive to the meaning of the particular words involved. It fits a particular verb into a “V” spot, for instance, in which the selection and subcategorization requirements of that particular verb are satisfied.

The selectional and subcategorization requirements on Lexical Insertion and the phrase structure rules together are capable of characterizing quite a large portion of our grammaticality judgments. But there is a certain class of cases which they cannot. This brings us to our second class of cases that require an extension to the grammar we’ve so-far developed. The following sentences are representative of this class.

- (4) a. Who have you talked to?
- b. Which man have you met?

These sentences are “questions,” they are used when information of a specific kind is sought. More particularly, these are called “*Wh* Questions.” There are several properties of these sentences that our grammar so far fails to allow. In the first example, the preposition *to* must be followed by an NP according to our rules, and yet there is no NP following *to*. In the second example, the selectional and subcategorization requirements of the verb *meet* demand that an NP follow it, and yet again there is no such NP. Further, the NPs *who* and *which man* cannot stand in the positions they are in, according to our phrase structure rules. Informally, then, what makes these sentences exceptional is that in each of them there is no NP where one is expected, and there is an extra NP in a position where one is unexpected.

There are a number of solutions to these problems, but all of them find a way of saying that the NPs *who* and *which man* in these sentences are occupying, in some syntactic sense, the positions following the verb and preposition. I’ll sketch one of those solutions here.

Let us suppose that there is a rule that rearranges the constituents in a phrase marker in such a way that the examples in (4) can be derived from representations where the *who* and *which man* stand in the positions following *meet* and *to*. Let’s call this rule *Wh*-Movement, and formulate it in a preliminary way as follows:

- (5) WH MOVEMENT  
    Move a *wh*-phrase to ??.

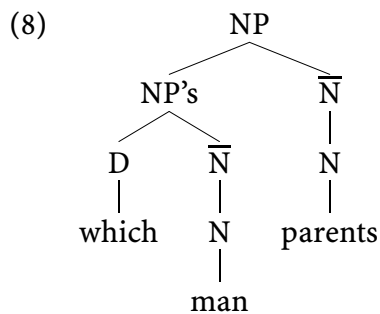
- (6) A *wh*-phrase is:
- i. an interrogative pronoun,<sup>1</sup>
  - ii. An NP with a *which* as its determiner, or
  - iii. An NP with a *wh*-phrase as its leftmost daughter.

We'll have to spend some time figuring out exactly where a *wh*-phrase is moved to, so I've marked this part of the rule with a question mark. From the examples we've seen, it is clearly to some position at the beginning of a sentence.

The definition of *wh*-phrase is designed to allow the following set of phrases to be movable:

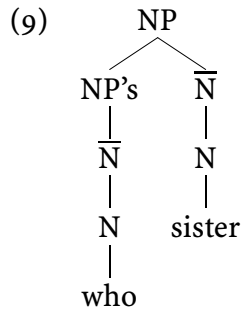
- (7) a. Who did you visit?  
 b. Which person did you visit?  
 c. Which man's parents did you visit?  
 d. Whose sister did you talk to?

The phrase that has moved in (7a), *who*, fits the description in (6i), *who* is an interrogative pronoun. The phrase that has moved in (7b) satisfies the definition in (6ii), since it is an NP that with *which* as its determiner. The phrase that has moved in (7c) also meets that definition, since it is an NP which starts with a *wh*-phrase, as shown in (8).



Because (6iii) says that an NP is a *wh*-phrase if its leftmost daughter is, the NP in (8) is a *wh*-phrase. This is because the possessive NP is a *wh*-phrase, and it is the leftmost daughter. The possessive NP is a *wh*-phrase because it is an NP whose determiner is *which*, and this is another thing that (6ii) says is a *wh*-phrase. The case in (7d) is identical to that in (7c), except that the possessive NP is itself the interrogative pronoun *who*; it gets a parse like that in (9).

<sup>1</sup> These are: *who*, *what*, *when*, *where*, *why* and *how*.



(Our way of spelling *who* plus the possessive *s* obscures what's going on here.)

Now let's turn to the question of where the *wh*-phrase is moved. In the examples we've considered so far, a *wh*-phrase has moved to the very front of a sentence. It is also possible, however, to find *wh*-phrases moving to the beginnings of embedded sentences, as in (10).

- (10) I know who Mary talked to.

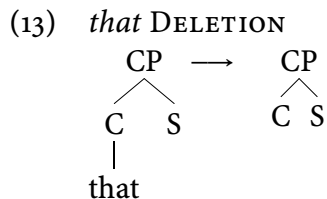
An interesting feature of examples like these is that the complementizers that would normally be possible in these embedded sentences are forced to be absent:

- (11) a. \* I know who that Mary talked to.  
 b. \* I know that who Mary talked to.

Now as it happens, the complementizer *that* is only optional in embedded sentences, to begin with. Both of the sentences in (12) are grammatical.

- (12) a. I know that Mary talked to Sam.  
 b. I know Mary talked to Sam.

There are a variety of ways of describing this fact; one is to posit a rule which deletes *that* in certain contexts. Let's formulate this rule as follows:



So, one way of describing the fact that when a *wh*-phrase has moved to the front of an embedded sentence, no Complementizer can appear, is to say that *wh*-movement forces Complementizer Deletion.

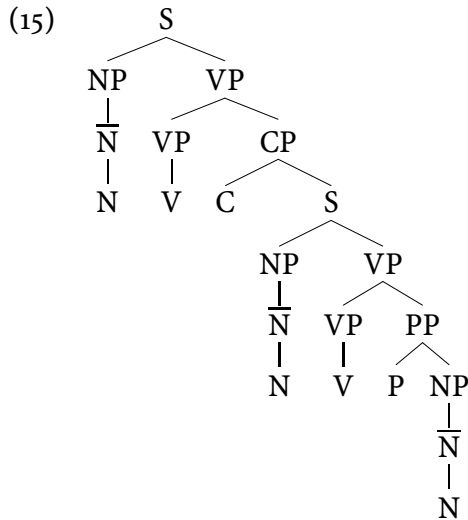
This can be achieved if we think of Complementizer Deletion as leaving an empty spot (the C position into which *that* is inserted), and decide to make *Wh* Movement relocate *wh*-phrases into C position. That is, let's adopt this way of completing the *wh*-Movement rule:

(14) *Wh* MOVEMENT

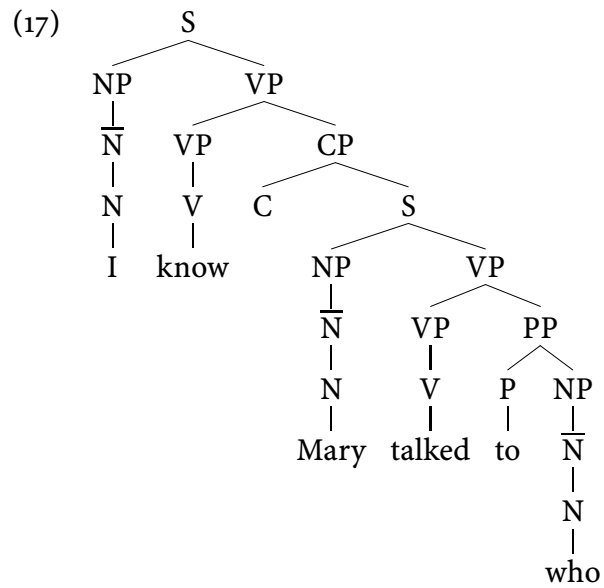
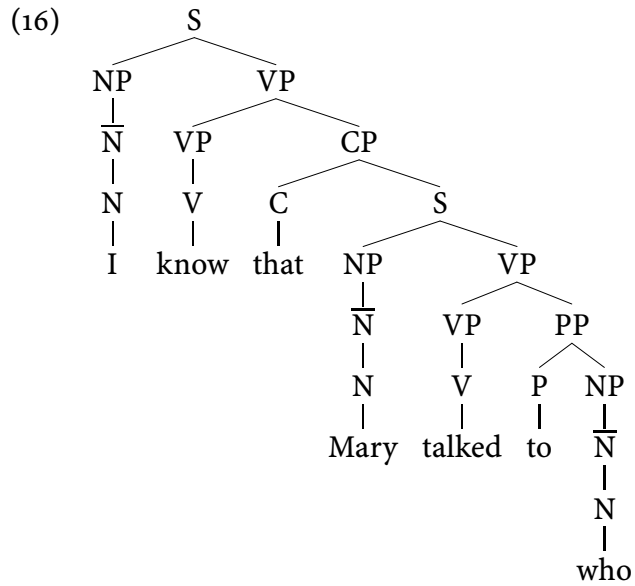
Move a *wh*-phrase into an empty *C*.

For this rule to take place, then, the *C* position will have to be empty (only one thing can fit into one position), and this can be achieved only by way of the Complementizer Deletion rule.

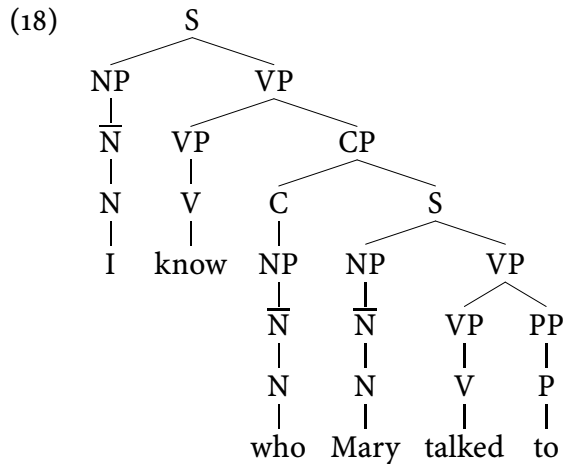
So, let's see how these rules will apply to create the sentences we've been looking at. We'll start with (10), which involves an embedded question. The first step in creating this sentence is to apply our phrase structure rules to build a phrase marker into which the particular words we see in (10) will be inserted. This produces (15).



The next step inserts the appropriate words into the positions marked out for them in this phrase marker. This step, which will yield (16) on the next page, is guided by the subcategorization and selection requirements that the verbs involved bring with them. This step in the construction of a sentence — the step immediately after the words have been inserted into the structure — is sometimes called a sentence's Deep Structure or "D-Structure." The next step uses Complementizer Deletion to empty *C* of *that*, as shown in (17).



And the final step uses *Wh* Movement to bring *who* into the now empty C position:



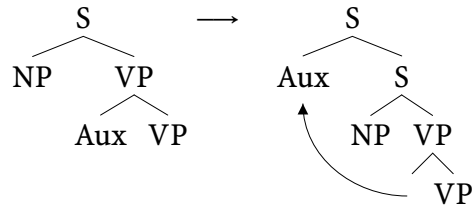
This last step, which represents the sentence in its final form, is sometimes called a Surface Structure, or “S-Structure.” I will call that portion of the construction of a sentence that starts with the D-structure and ends with an S-structure, the “derivation of a sentence.” Thus, the derivation of (10) is made up of the three phrase markers in (16)-(18).

Now let’s see how these rules are employed to produce the sentence in (4a), which illustrates an unembedded question. Unembedded questions like (4a) raise a number of extra complications that the embedded question in (10) doesn’t. To begin with, the question in (4a) has been created not just with *Wh* Movement, but with Subject-Auxiliary Inversion in addition. Subject-Auxiliary Inversion hasn’t applied in the embedded question of (10), however. In fact, this is a very general difference in the syntax of questions in English: Subject-Auxiliary Inversion never applies to an embedded sentence. Recall that we formulated Subject-Auxiliary Inversion in the previous syntax essay to model the word order that is used to indicate Yes-No Questions in English. It’s responsible for “making” the question in (19b) from the declarative sentence in (19a).

- (19) a. Sally has cooked pickles.  
 b. Has Sally cooked pickles?

The rule signals the existence of a question meaning by moving the auxiliary verb (here, *has*) to the front of the sentence. Here’s a way of formulating the Subject/Auxiliary Rule.

(20) SUBJECT AUXILIARY INVERSION



The examples of Yes-No Questions that we looked at were all unembedded. When we look at what Yes-No Questions look like in embedded contexts, they don't show evidence of Subject-Auxiliary Inversion. Instead, embedded Yes-No Questions use a special Complementizer, *whether*. For example, (21a) is the way embedded a Yes-No Question looks, and not (21b), in which Subject-Auxiliary Inversion has applied.

- (21) a. I know whether she has left.  
 b. \*I know has she left.

These observations lead to two points: first, that questions are sometimes formed through a combination of rules, and second, that there is a distinction between embedded and unembedded questions regarding the use of Subject-Auxiliary Inversion. The table below summarized what we've discovered.

	embedded	independent
(22) Yes-No Question	<i>whether</i>	Subject AUX Inversion
Wh Questions	<i>wh</i> Movement	<i>wh</i> Movement + Subject Auxiliary Inversion

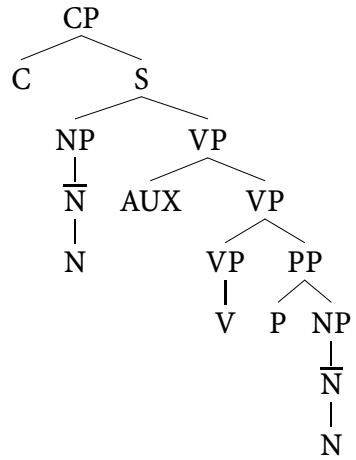
The other complication that unembedded questions raise concerns our decision to formulate the rule of *Wh* Movement so that it moves the *wh*-phrase into an empty C position. This assumption means that unembedded sentences can be CPs, with a C position into which the *wh*-phrase is moved. But unlike embedded sentences, unembedded sentences never begin with a complementizer; sentences like (23) aren't grammatical.

- (23) \*That I left.

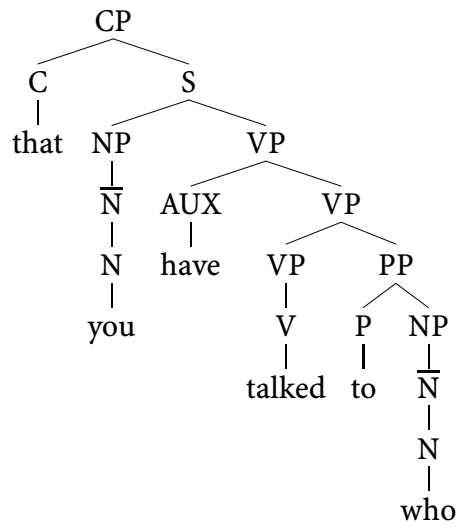
Let's capture this fact by making our Complementizer Deletion rule obligatory in unembedded contexts.

So, now the unembedded Wh Question in (4a) is formed through the following steps.

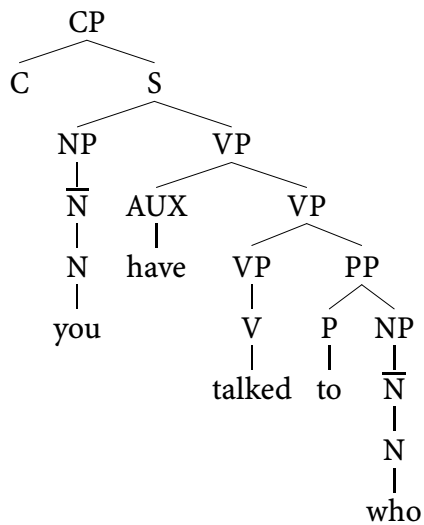
(24) a. Phrase Structure Rules:



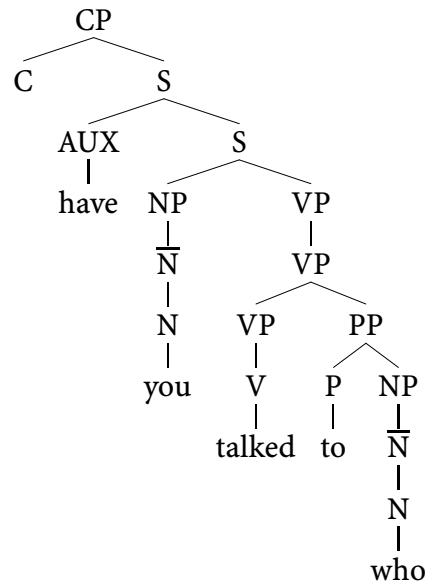
b. Lexical Insertion:



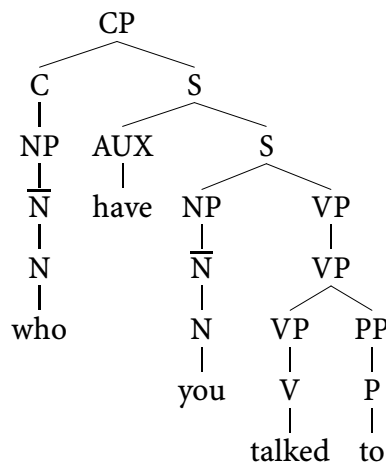
c. *that* Deletion:



d. Subject AUX Inversion:



e. *Wh* Movement:



The way the *Wh* Movement rule is currently formulated allows it to construct questions by putting *wh*-phrases into Comps in any way whatsoever. It places no particular restrictions on which Comps can or must be targeted by the moved *wh*-phrase. This means, for instance, that there is no restriction on how far the *wh*-phrase may be moved. So, it is possible to move a *wh*-phrase over an indefinitely long distance, as the series in (25) indicates.

- (25) a. Who have you talked to?
- b. Who has she said that you talked to?
- c. Who has he claimed that she said that you talked to?
- d. Who have I remembered that he claimed that she said that you talked to?

As we have seen earlier, there is no syntactic reason why a sentence of infinite

length can be constructed by recursively embedding a sentence. And as (25) indicates, a *wh*-phrase (here *who*) can be moved from the end of a sentence built in this fashion to the beginning of that sentence.

Nonetheless, there are some restrictions on which *wh*-phrases can be moved into which Comps. One of these restrictions has to do with the selection requirements of verbs that we discussed above. Certain verbs have a meaning that requires their sentential complements to be questions, whereas other verbs have a meaning that prevents their sentential complements from being a question. The verb *wonder*, for example, can only combine with a CP that means a question, and the verb *think* cannot.

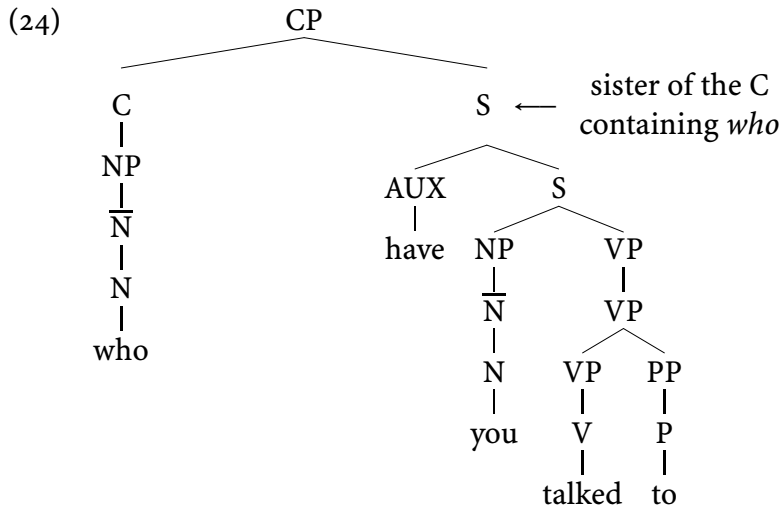
- (26) a. \* I wonder that you talked to Sally.  
b. I wonder who you talked to.  
c. I think that you talked to Sally.  
d. \* I think who you talked to.

Still other verbs — *know* is one — are able to combine with either a question or a declarative complement.

- (27) a. I know that you talked to Sally.  
b. I know who you talked to.

What we see here, then, is that the selectional requirements of verbs can sometimes prevent *Wh* Movement from relocating a *wh*-phrase into Comp (as in (26b)) and sometimes force *Wh* Movement to place a *wh*-phrase into Comp (as in (26a)).

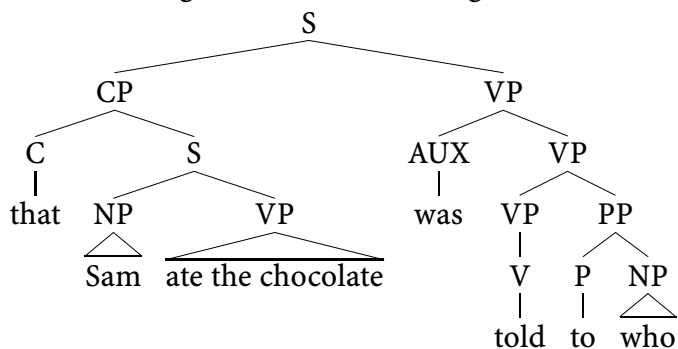
Another restriction has to do with the structural relationship that a *wh*-phrase has to the Comp it moves into. In the cases we have looked at so far, a *wh*-phrase has moved into a Comp that “higher” in the phrase marker. In (4a), for example, the *wh*-phrase has moved into a Comp position that is higher, in a very particular sense, than the position it originates in. If we look again at the S-Structure of this sentence (= (24e)), which I’ve repeated below, we can see that the S out of which the *wh*-phrase has moved is a sister to the Comp in which it lands.



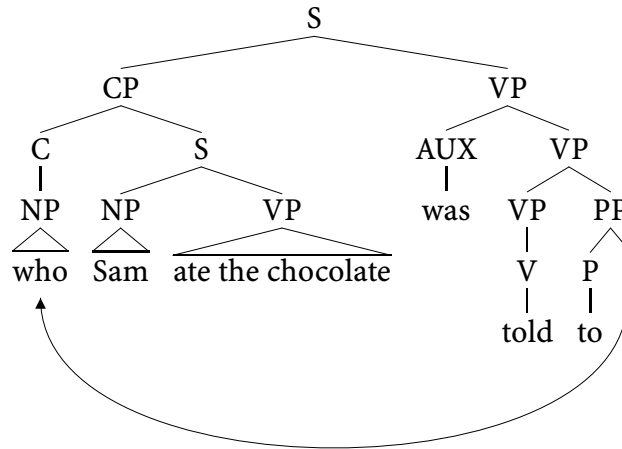
It turns out that this feature of the examples we have seen so far is a requirement. If we try to construct a question by moving a *wh*-phrase into a Comp position that is not sister to an S out of which the *wh*-phrase moves, the result is ungrammatical.

For example, consider a situation in which *Wh* Movement were to move a *wh*-phrase into an embedded CP from a position in the higher, unembedded, sentence. That might happen, say, if we were to construct a sentence whose subject was a CP, and whose object was a *wh*-phrase. and then tried to move that *wh*-phrase into the CP. Such a case is illustrated in (28).

(28) a. After building the tree and inserting the words (i.e., D-structure):

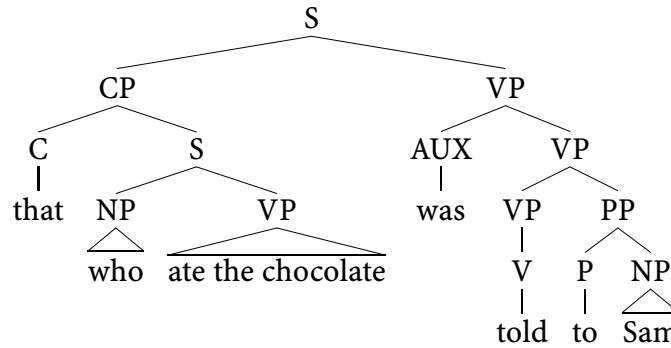


b. After deleting *that* and *Wh* Movement (i.e., S-structure):

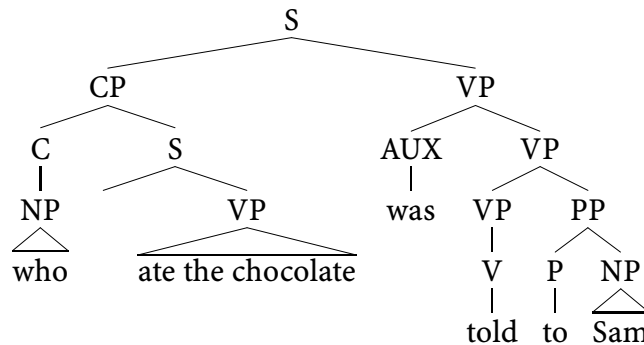


The resulting sentence, *Who Sam ate the chocolate was told to?*, is ungrammatical precisely because *who* has moved onto a Comp which is not a sister to an S out of which *who* moved. If we construct a parallel sentence, but one in which the *who* that ends up in Comp has moved from the S that is a sister to that Comp, the result is fine. Thus, for example, the sentence *Who ate the chocolate was told to Sam*, which is constructed along the lines shown below, is perfectly grammatical.

(29) a. After building the tree and inserting the words (i.e., D-structure):



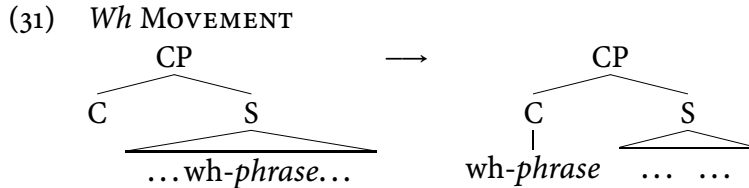
b. After deleting *that* & *Wh* Movement (i.e., S-structure):



If we build this constraint into the Wh Movement rule, then the rule needs to be changed to something like:

- (30) *Wh* MOVEMENT  
 Move a *wh*-phrase to a C whose sister is an S containing that *wh*-phrase.

Or, to put it graphically:

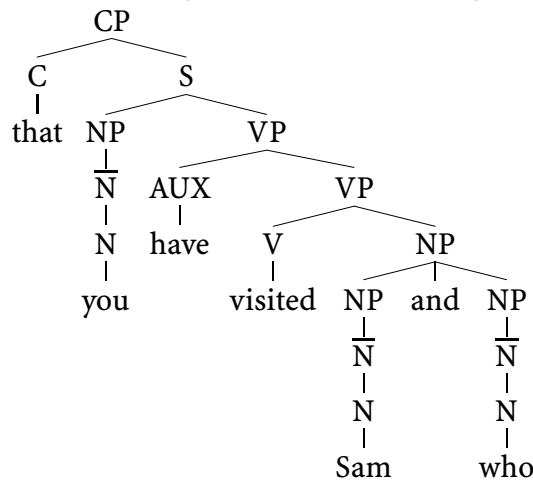


Finally, there are a set of constraints on *Wh* Movement that are sensitive to the particular configurations that the *wh*-phrase and the Comp it is to be moved into find themselves. Many of these constraints were discovered in the middle of the 1960's by John Ross, one of the founders of modern linguistics. These constraints make reference to particular syntactic constructions.

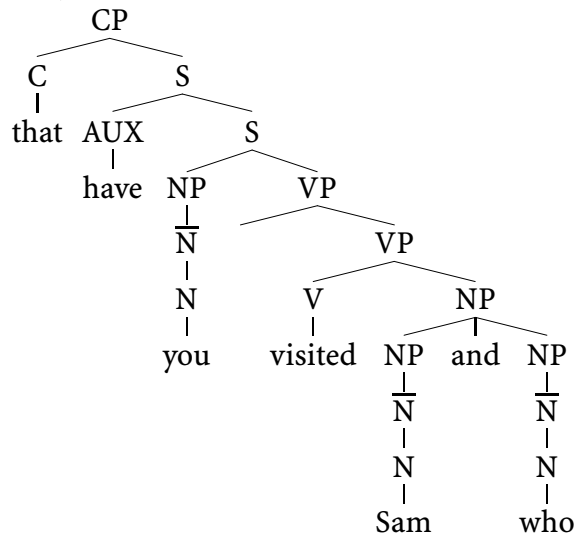
One of these involves coordinations, which, it turns out, *wh*-phrases cannot be moved out of. For example, the question in (32) should be able to be manufactured by *Wh* Movement along the lines sketched in (33).

- (32) \*Who have you visited Sam and?

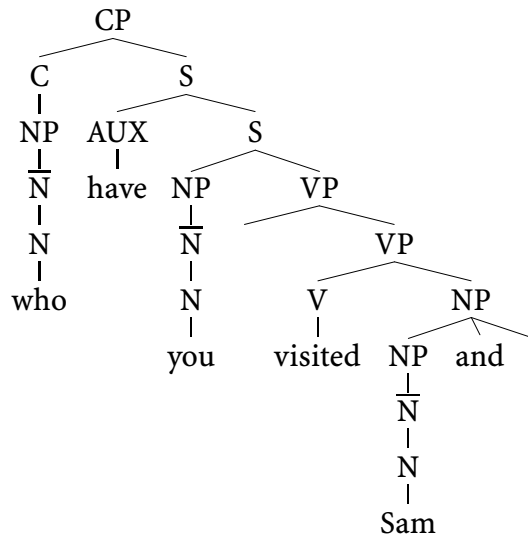
- (33) a. After building the tree and inserting the words (D-structure):



b. Subj AUX Inversion:

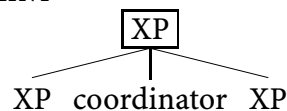


c. *that* Deletion & *Wh* Movement (S-structure):



And yet (32) is ungrammatical. It's the application of *Wh* Movement in the last step of the derivation that is responsible for its badness. In general, it looks like *Wh* Movement can never move a *wh*-phrase out of a coordinated structure. John Ross called this the "Coordinate Structure Constraint," and it can be formulated as in (34).

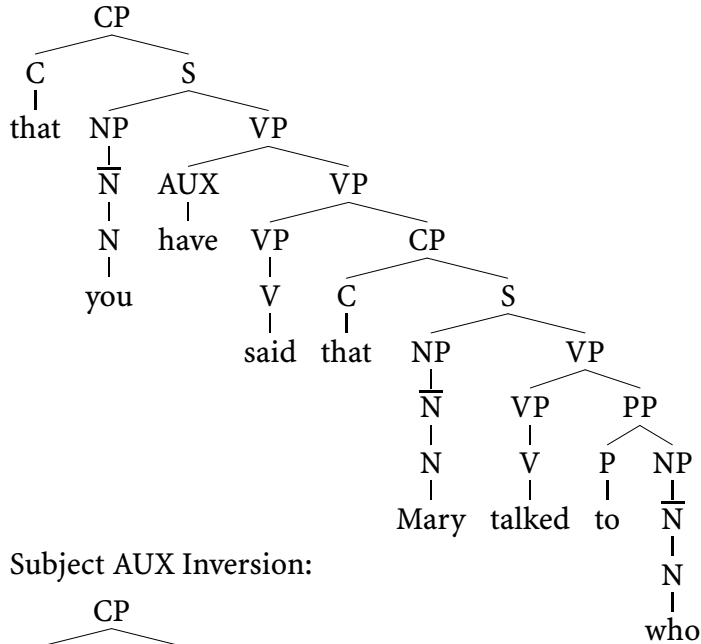
- (34) COORDINATE STRUCTURE CONSTRAINT  
Nothing may move out of XP in:



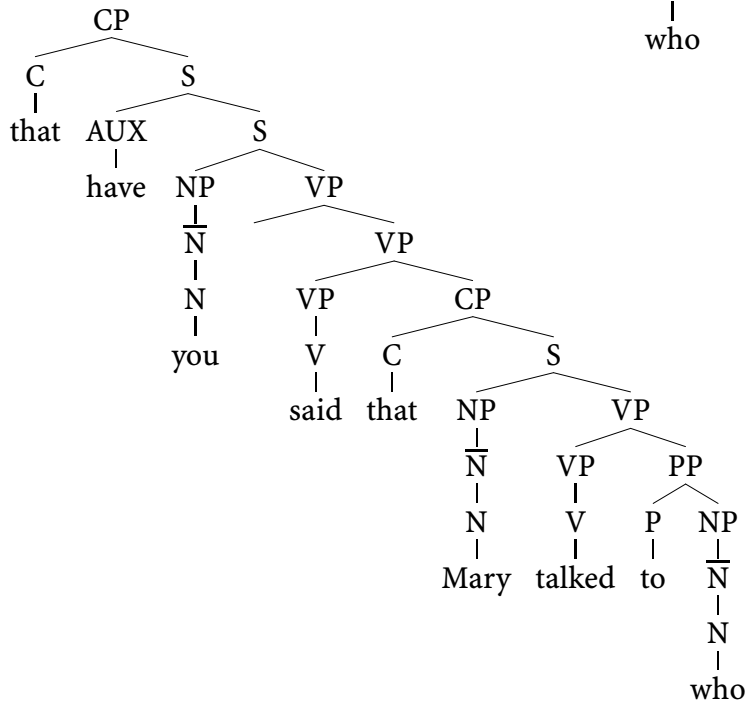
Another configuration in which *Wh* Movement is blocked involves the subject position. To see this, consider first the grammatical question in (35), formed in the way sketched in (36).

(35) Who have you said that Mary talked to?

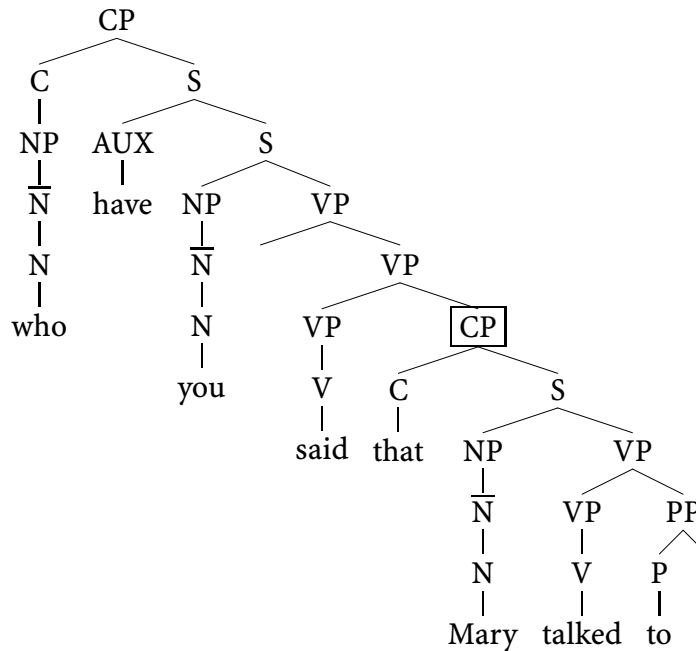
(36) a. After building the tree & inserting the words (D-structure):



b. Subject AUX Inversion:



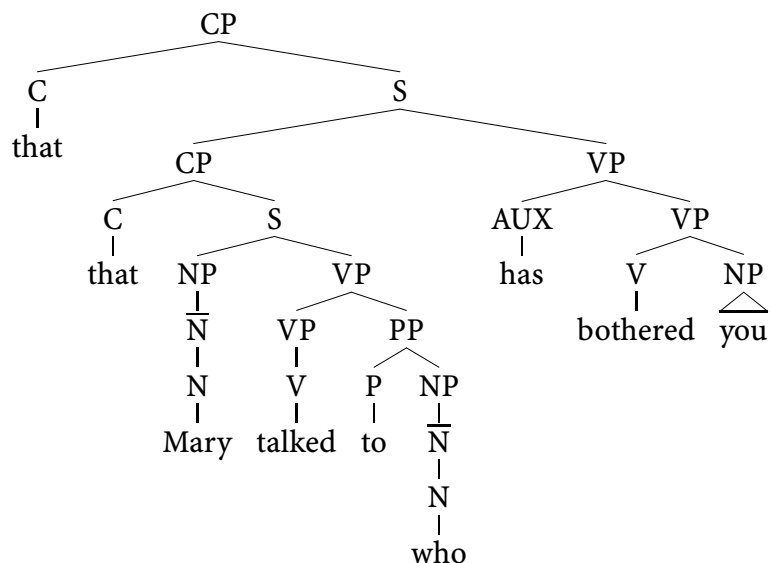
c. *that* Deletion & *Wh* Movement (S-structure):



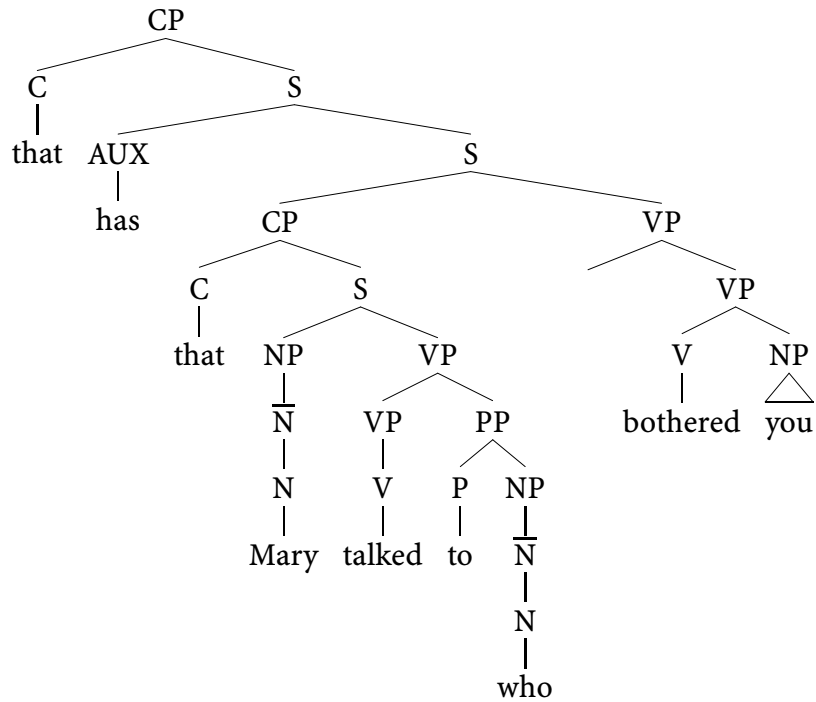
Notice how in the last step of the derivation, *Wh* Movement has moved *who* out of an embedded CP (I've put a box around it). So, in principle, as we've seen in earlier examples, there is nothing wrong with moving a *wh*-phrase out of an embedded CP. However, if the CP is embedded as a subject, a *wh*-phrase cannot move out of it. The example in (37) is ungrammatical precisely because this is what's happened in the final step of its derivation (in (38c)).

(37) \*Who has that Mary talked to bothered you?

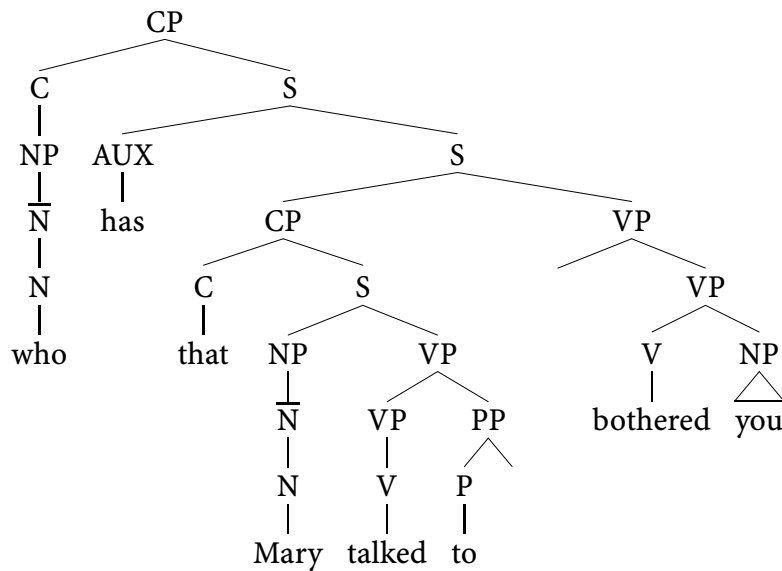
(38) a. D-structure:



b. Subject AUX Inversion:



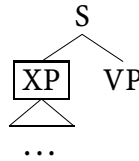
c. *that* Deletion & *Wh* Movement (S-structure):



We can formulate a constraint like that in (39) to account for asymmetries of this sort.

(39) SUBJECT CONDITION

Nothing may move out of XP in:



That is, nothing may move from inside a phrase that stands in subject position.

I've used an example to illustrate this constraint which puts a CP in subject position. But, as the formulation of the Subject Condition implies, it doesn't really matter what kind of phrase it is that stands in subject position; it will still not be possible to move something out of it. So, for example, as (40a) shows, when an NP is in subject position a *wh*-phrase cannot escape it (though when that same NP is in object position, as in (40b), it is possible to move a *wh*-phrase out of it).

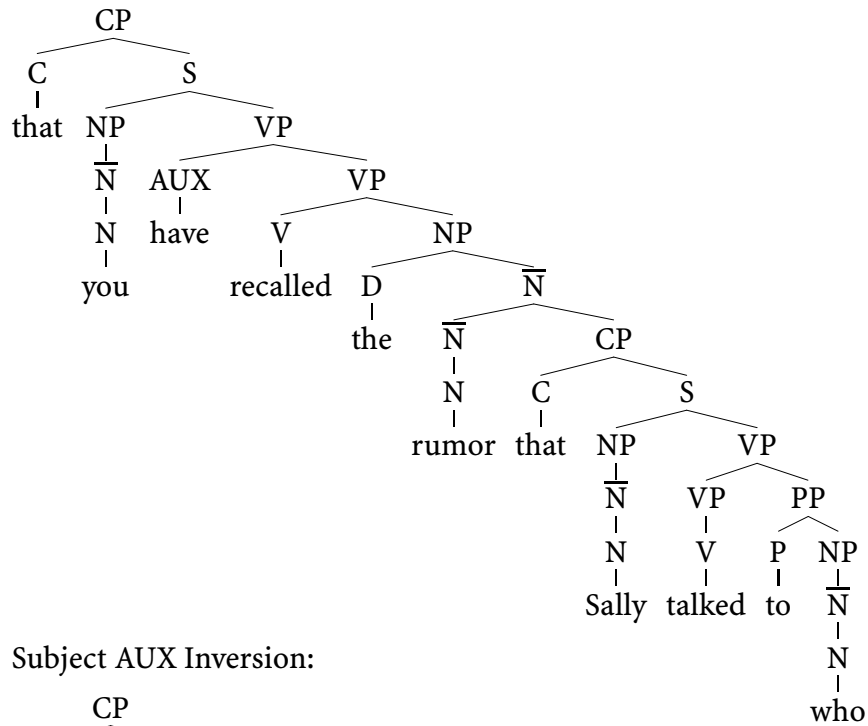
- (40) a. \* Who has [<sub>NP</sub> a story about – ] bothered you?  
 b. Who have you recalled [<sub>NP</sub> a story about – ]?

Another constraint on *Wh* Movement is responsible for the contrast in (41).

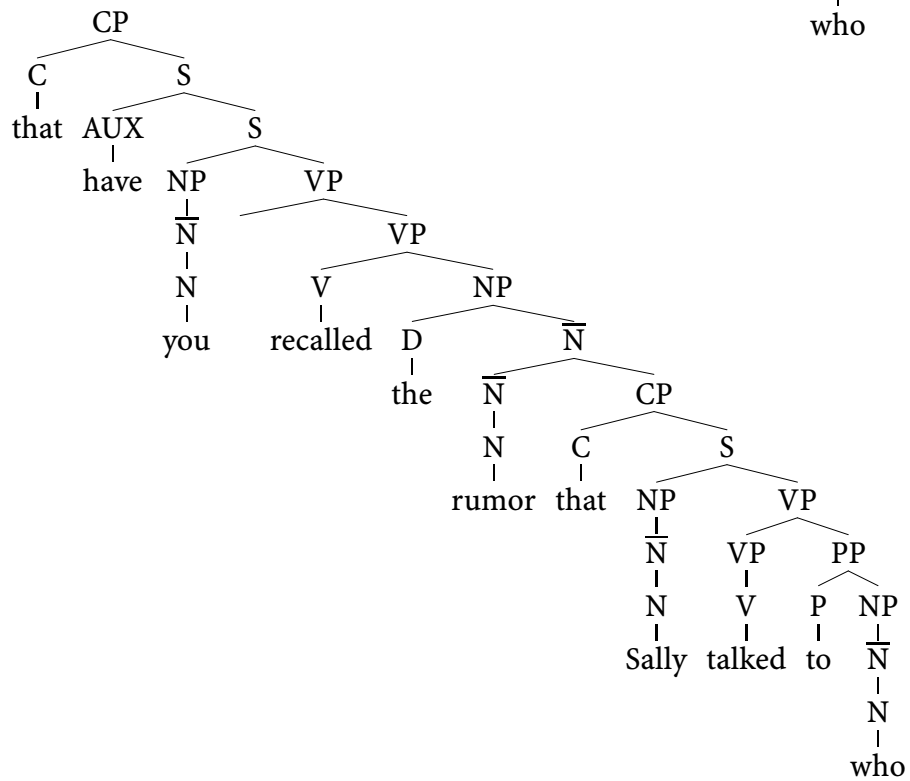
- (41) a. Who have you recalled that Sally talked to?  
 b. \* Who have you recalled the rumor that Sally talked to?

In (41a), *who* has been moved out of a complement CP. This grammatical sentence has a derivation exactly like that shown in (36). By contrast, *who* in (41b) has moved out of a CP that is buried within a noun phrase. This sentence would be constructed by way of the derivation indicated in (42).

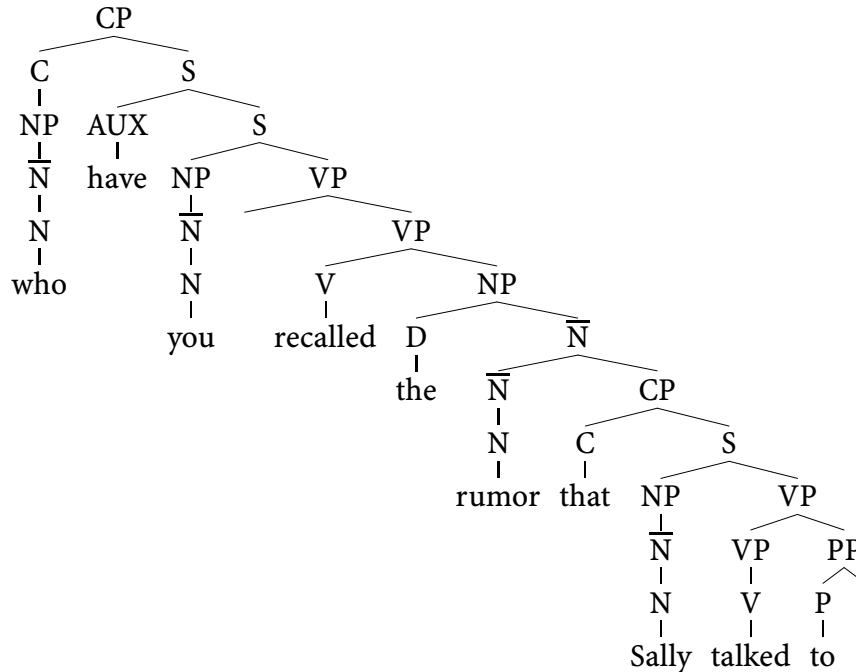
(42) a. D-structure:



b. Subject AUX Inversion:



c. *that* Deletion & *Wh* Movement (S-structure):



John Ross showed that this is what distinguishes (41a) from (41b). He listed a wide-range of examples like these, and indeed, it appears that *Wh* Movement cannot get a *wh*-phrase out of CP if that CP is embedded within an NP. He called this the “Complex Noun Phrase Constraint,” and it can be formulated as in (43).

- (43) COMPLEX NOUN PHRASE CONSTRAINT  
Nothing may move out of a CP that is embedded within an NP.

Or, to put it in graphical terms:

- (44) COMPLEX NOUN PHRASE CONSTRAINT  
Nothing may move out of CP in:

