Syntax (3): Transformations

Let's begin by considering a sentence like (1), the structure of which we have already analyzed in terms of a PS grammar.

(1)   [S' [S she will buy something]]

Next, recall the explanation we provided for why an example like (2) is ungrammatical.

(2)   *[S' [S she will buy]]

The problem with (2) has nothing to do with the theory of phrase structure; the structure needed for a sentence like (2) is presumably the same as the one needed for good sentences like *she will leave*, for example. Rather, the ungrammaticality of (2) is due to the fact that the predicate *buy* has two thematic-roles, both of which must be assigned according to the Thematic-Role Criterion, but there is only one argument in the sentence.

The sentences in (3a) and (3b) are formed by embedding the sentences in (1) and (2) as the object of a verb like *know*. The same contrast arises, not surprising since the Thematic-Role Criterion is still not satisfied in (3b). More surprising, however, is (3c), which is grammatical despite the fact that the relevant S seems to be identical to the bad examples in (3b) and in (2).

(3)   a.   John knows [S' [S she will buy something]]
        b.   *John knows [S' [S she will buy]]
        c.   John knows [S' what [S she will buy]]

There is a difference between (3a) and (3b), on one hand, and (3c), on the other, which turns out to be crucial: the embedded sentences in the former are declarative whereas in the latter the embedded sentence is an "indirect question" (embedded questions, which are never direct requests for answers/information, are called "indirect" questions). We will assume that whether a sentence (S') denotes a question or not is coded as a feature C: C either has the feature [+Q] or the feature [-Q].

We can see the same thing in "direct" questions, which always involve the root (= the very top S' node of the "tree"), such as (4)
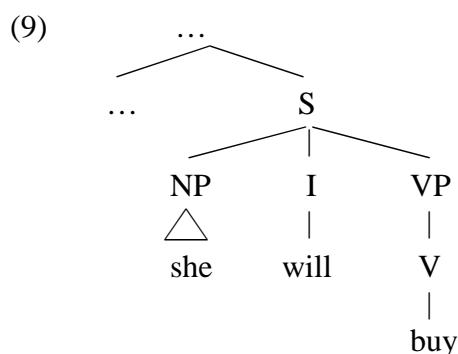
(4)   What will she buy?

However, as you can easily notice, in the case of "direct questions,", there is an additional difference: the position of the root-clause modal-auxiliary verb that of the root-clause subject are inverted.

Regarding such sentences as (3c) and (4), we still have to figure out why they don't violate the Thematic-Role Criterion? Since the relevant sentences are grammatical, we should conclude that *buy* is somehow able to assign its internal-role to an appropriate argument. In fact, the NP that receives the internal-role of THEME (namely, the role of that which is bought) appears to be the Question-NP *what*. Question-NPs are NPs such as *who*, *what*, *where*, *which book*, *when*, *why*, and *how* in English or *dare*, *nani*, *doko*, etc. in Japanese (or the equivalent NPs in any human language). Such NPs are called *wh*-NPs, or simply *wh*-phrases, since, in English, they are typically spelled beginning with letters with *wh*.

That *what* is an argument of *buy* in the sentences above is confirmed by (5)-(8), where [NP D book] clearly serves as the THEME of *buy* in each of the examples:
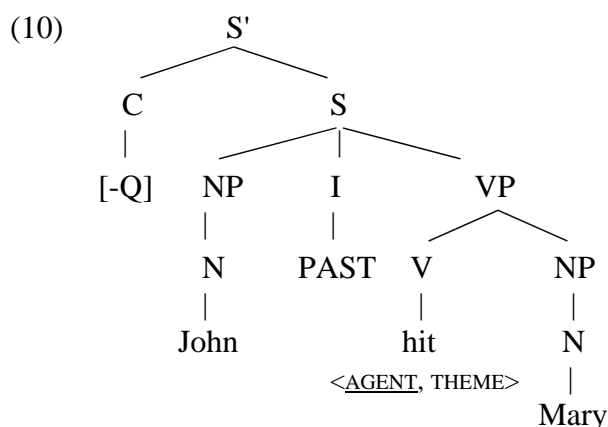
(5)   She will read [NP a <u>book</u>]
(6)   [NP which <u>book</u>] will she read?

(7)   I know that she will buy [NP a <u>book</u>]
(8)   I know [NP which <u>book</u>] she will buy

A related issue has to do with the structure of sentences like (3c), (4), (6), and (8). Focusing for the moment only on the structure of S, it appears that VP consists of a V and nothing else, that is, there is no "object NP" to serve as an internal argument, as in (9).

(9)

```
            …
          /   \
        …       S
              / |  \
            NP  I   VP
            △   |   |
           she will V
                    |
                   buy
```

However, it is not clear why a VP like this is possible in the case of, say, (3c) but not in (3b), for example; the PS rules certainly allow a structure as in (9). Also, since *buy* has an internal thematic-role, (9) should result in a violation of the Thematic-Role Criterion.

Recall that we have assumed that thematic-roles are assigned to designated structural positions. An internal role is assigned to the "sister" of V. V assigns its external role to an argument that is a "sister" of the VP that is the "mother" of V. Consider *John hit Mary*:

(10)

```
              S'
            /    \
           C       S
           |      / | \
         [-Q]   NP  I   VP
                |   |   /  \
                N  PAST V    NP
                |       |    |
              John     hit   N
                   <AGENT, THEME>  |
                              Mary
```

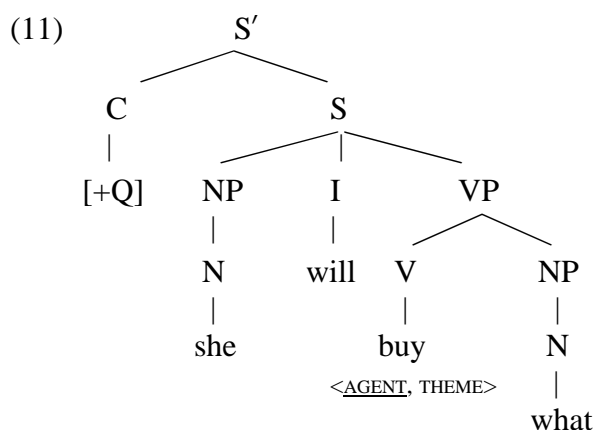The verb *hit* has the two thematic-roles <<u>AGENT</u>, THEME>. The internal THEME role is assigned to [NP Mary] and the external AGENT role is assigned to [NP John].

Thus in a question like *what will she buy*, even if we acknowledge that the internal argument of *buy* is *what*, this NP does not seem to be in a position in which it can receive a thematic-role from V. Is there any way to resolve this seeming paradox?

Yes: Sentences have more than one syntactic structure representation. This proposal should in fact sound familiar since we reached a similar conclusion regarding representations of linguistic sounds; recall we postulated both an Underlying Representation (UR) and a Surface Representation (SR) of words (more precisely, morphemes) in our study of phonology.
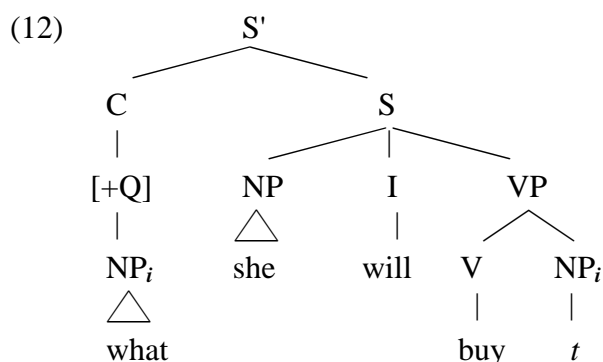
Suppose that sentences too have both an underlying representation, which is a structure derived by the PS rules, into which particular lexical items have been inserted, and a surface representation, which is derived from the underlying representation by syntactic rules. The underlying level of syntactic representation of a sentence is called its D-Structure, whereas the surface level of syntactic representation of a sentence is referred to as the S-Structure of the sentence.

The D-structure for a question like *what will she buy* is as follows:

(11)

```
                    S′
              ┌─────┴─────┐
              C           S
              │      ┌─────┼─────────┐
           [+Q]     NP     I         VP
                    │      │      ┌───┴───┐
                    N     will    V       NP
                    │             │       │
                   she           buy      N
                          <AGENT, THEME>  │
                                         what
```

If we assume that thematic-roles are assigned to arguments at D-Structure, there is no problem: both roles of the predicate *buy* can be assigned to arguments in the correct configurations in the D-Structure (11).
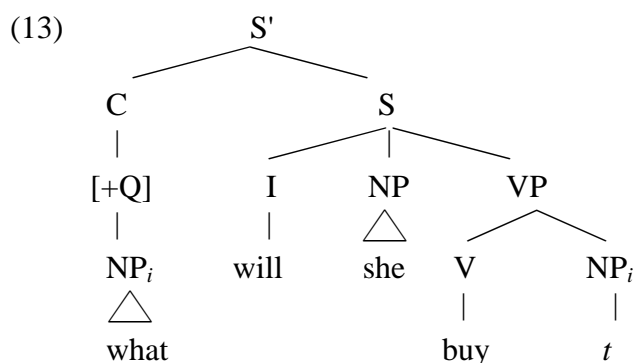
D-Structure is then mapped to an S-Structure by the application of **transformational rules**. There are various types of transformations. The prototypical type is a **movement transformation**, namely, a transformation that takes some constituent and "moves" it to some other position in the structure. The movement transformation of concern to us here, called Wh-Movement, moves a *wh*-phrase from its D-structure position to a [+Q] C. The structure resulting from the application of this transformation to (11) is shown in (12):

(12)

```
                       S'
               ┌───────┴───────┐
               C               S
               │        ┌───────┼───────┐
            [+Q]        NP      I        VP
               │        △       │     ┌──┴──┐
            NP_i       she     will   V    NP_i
             △                        │     │
            what                     buy    t
```

Here, I am assuming that movement leaves behind a "trace," indicated by the notation t, in the original position. We will further assume a trace is, by convention, always "co-indexed"
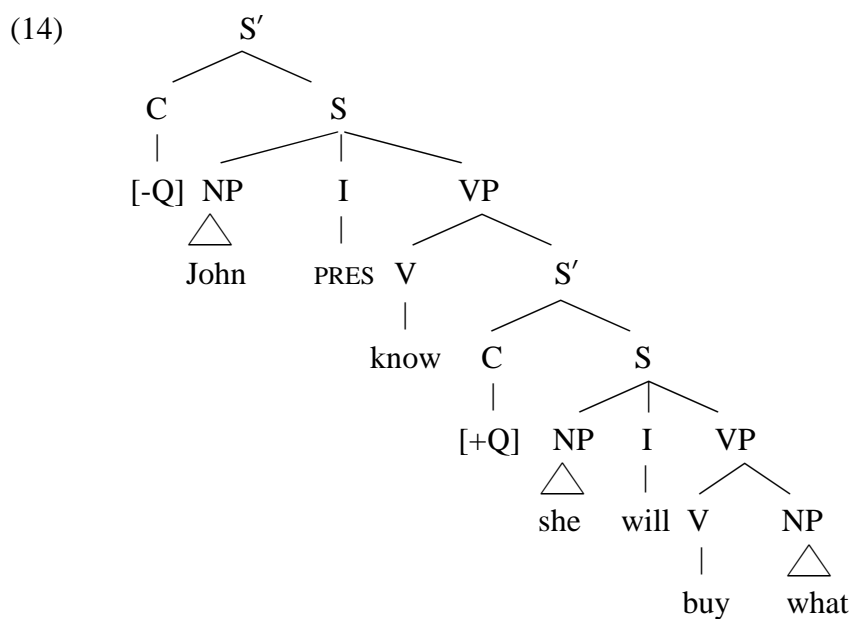
with the moved constituent that created it. A trace is a syntactic category with no phonological or semantic features that serves, in some sense, as a "maker" of the history of the derivation; it tells us exactly where some constituent, which may now be located somewhere else in the structure due to a transformational rule application, used to be.

Is (12) the S-Structure of the sentence under discussion? No. We have not yielded the correct word order yet. As it turns out, in root-questions at least one more transformation must apply before we can "arrive at" S-Structure. Namely, a transformation is needed to invert the subject NP and an auxiliary verb *will*. Although there are various possibilities that could be considered, here we will simply assume that the transformation in question simply inverts (that is, reverses the order) two adjacent "sister" nodes. We will refer to this transformational rule as the Subject-Aux(iliary) Inversion Transformation, and the structure resulting after its application to (12) is in (13).

(13)

```
                       S'
              _____/ _____
             C                    S
             |              _____/ \_____
           [+Q]            I    NP        VP
             |             |    △       _/ \_
           NP_i           will  she    V     NP_i
            △                   |       |
           what                       buy     t
```
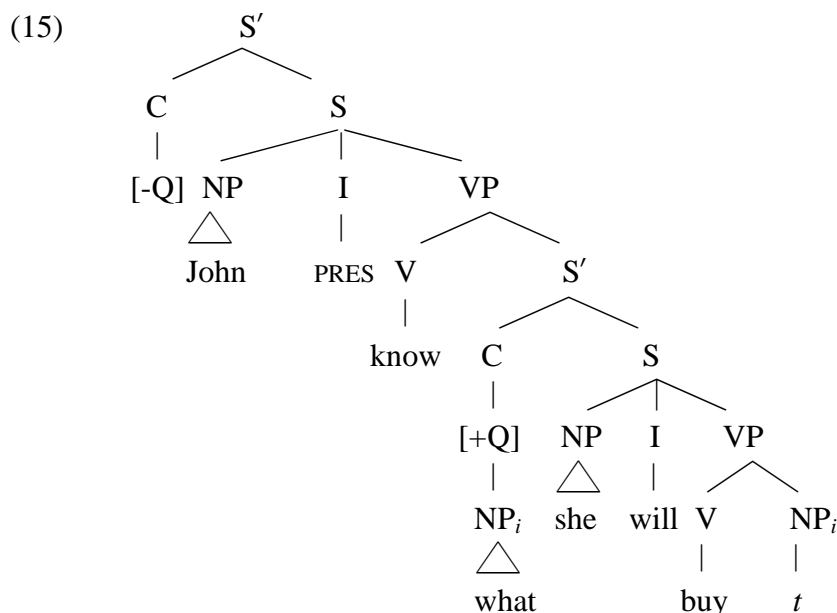
Since apparently no other transformational rules must apply to the sentence under discussion, we can conclude that (13) is a legitimate S-Structure corresponding to the D-Structure in (11). The structure in (12), on the other hand, is merely an "intermediate" step that arises in the course of the derivation from D-Structure to S-Structure; it has no special name or significance.

Let's now consider the derivation of an embedded (indirect) question, such as (3c):

(14)

```
                       S′
              _____/ _____
             C                    S
             |           _____/ _____
           [-Q] NP      I           VP
               △       |        __/ \__
              John    PRES      V       S′
                                |     _/ \_
                              know   C      S
                                     |    _/|\_
                                   [+Q]  NP  I   VP
                                         △  |  _/ \_
                                        she will V    NP
                                              |    △
                                            buy   what
```

The tree-diagram above corresponds to the D-Structure of (3c). In the derivation from D-Structure to S-Structure, Wh-Movement applies, moving the *wh*-phrase *what* to the embedded C, which contains the feature [+Q]. The resulting structure is shown in (15), which corresponds to the S-Structure of the sentence (assuming no further transformations apply). In particular, note that the Subject-Aux Inversion transformation does not apply in embedded/indirect questions, unlike root/direct questions.

(15)

```
                    S′
              ┌─────┴─────┐
              C           S
              |      ┌─────┼─────────┐
            [-Q]    NP     I         VP
                    △      |    ┌─────┴────┐
                   John  PRES   V          S′
                               |     ┌─────┴─────┐
                             know    C           S
                                     |    ┌───────┼──────┐
                                   [+Q]  NP   I      VP
                                     |    △   |   ┌───┴───┐
                                   NPᵢ  she  will  V     NPᵢ
                                    △              |      |
                                   what           buy     t
```

Note also that all of the instances of transformations that we have considered must apply. In other words, they are *obligatory* rules. This is shown by the ungrammaticality of the following direct questions:

(16) a.   *She will buy what?   No transformation has applied.
      b.   *Will she buy what?   Only Subject-Aux Inversion has applied.
      c.   *What she will buy?   Only Wh-Movement has applied.

Wh-Movement, the transformation that moves a *wh*-NP to a [+Q] C, applies in both direct and indirect (embedded) questions. However, as we saw above, Subject-Aux Inversion, the transformation that inverts the subject-NP and an auxiliary verb, applies only in root (direct) questions:
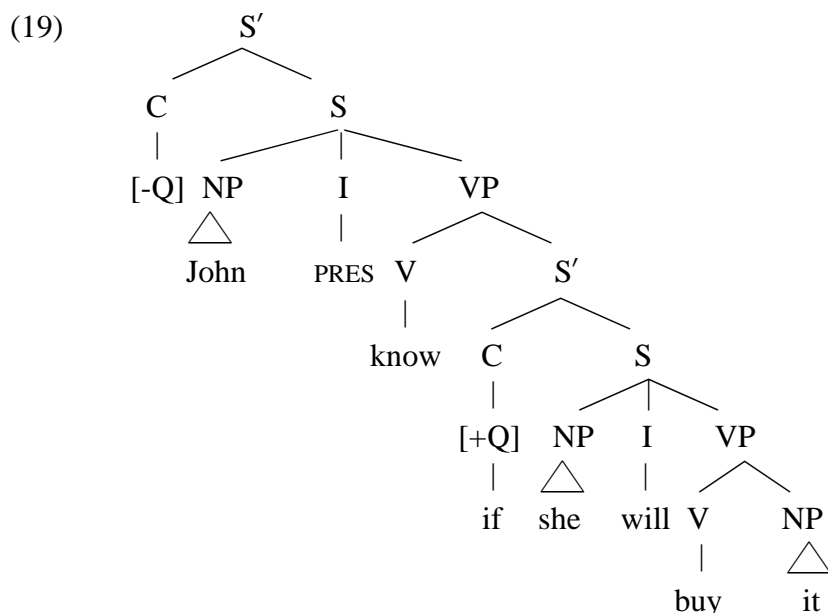
(17) a.   *John knows what will she buy.
      b.   *John knows will she buy what.
      c.   *John knows she will buy what.

In addition to questions involving *wh*-phrases, there are also questions called *Yes/No*-Questions. *Yes/No*-Questions, like *Wh*-Questions, have both direct and indirect variants. *Yes/No*-Questions are used to "ask" (directly or indirectly) about the truth or falsity of some proposition. Direct *Yes/No*-Questions are answered either "yes" or "no," hence the name. Here are some examples:
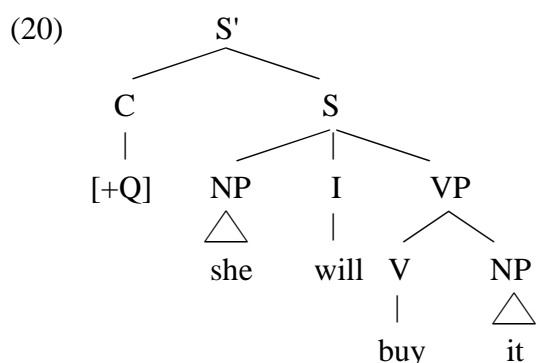
(18) a.   Will John buy the book?
      b.   I know whether John will buy the book.
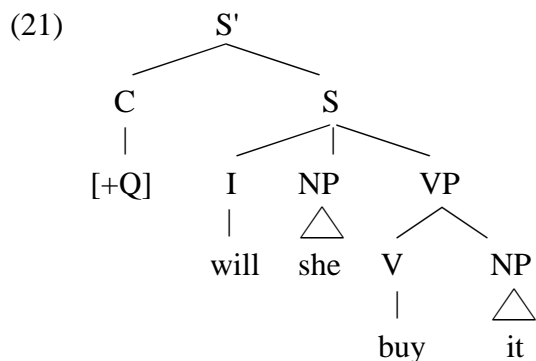   c.   I know if John will buy the book.

Again, there is an asymmetry between root and embedded contexts: only in root *Yes/No-Question* does an auxiliary in the I node appear before the subject. On the other hand, in embedded *Yes/No-Questions*, there is always a "phonetically realized" complementizer, either *whether* or *if*, filling the embedded C position, but never in root *Yes/No-Questions* (or embedded *Wh-Questions*, for that matter) do we see such a "phonetically realized" C.

The structure for an embedded *Yes/No-Question*, such as *"John knows if she will buy it"* is shown in (19). Since no transformations apply, (19) corresponds to both the D-structure **and** S-structure of the sentence. Notice that we can also use the complementizer *whether* in place of *if*, with no effect on the structure or the meaning of the sentence.

(19)

```
                        S′
                   ┌────┴────┐
                   C         S
                   |    ┌─────┼──────┐
                 [-Q]  NP    I      VP
                       △     |    ┌──┴───┐
                      John  PRES  V      S′
                             |    |   ┌──┴───┐
                            know  C        S
                                  |   ┌─────┼────┐
                                [+Q]  NP   I    VP
                                  |   △    |  ┌──┴──┐
                                  if  she will V    NP
                                             |    △
                                            buy    it
```

Root *Yes/No-Questions* are more interesting since the S-structure differs from the D-structure. The D-structure of a direct *Yes/No-Question* such as *"Will she buy the book?"* is shown in (20). The S-structure, after application of the Subject-Aux Inversion transformation, is shown in (21).

(20)

```
              S'
          ┌───┴───┐
          C       S
          |   ┌───┼────┐
        [+Q]  NP  I    VP
              △   |  ┌──┴──┐
             she will V    NP
                     |    △
                    buy    it
```

(21)

```
                    S'
              _____|_____
             C             S
             |         ____|____
           [+Q]       I   NP    VP
                      |   △    __|__
                     will she V     NP
                              |     △
                             buy    it
```
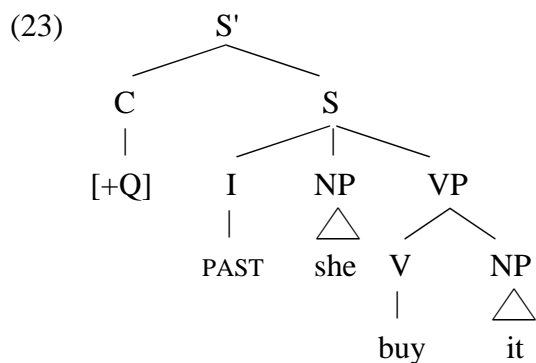
One final point: note that for Subject-Aux Inversion to apply there must be an auxiliary verb, such as the modal-auxiliary *will*, located in the I category that undergoes inversion with the subject. If there is no such auxiliary, and the I position is filled with an inflectional tense morpheme, such as PAST or PRES, then the "dummy verb" *do* must be inserted, as shown by (22).

(22)   a.   What did/does she buy?
       b.   Did/does she buy a book?

This is presumably because the application of Subject-Aux Inversion moves the inflectional affix to a position where it can no longer be properly attached to the verb (they are no longer adjacent since the subject intervenes between them). Just like we saw when the verb is deleted under VP deletion, the "dummy verb" *do* is inserted to "save" the stranded affix. The structure resulting from applying Subject-Aux Inversion to a sentence with an inflectional affix in I is shown in (23).

(23)

```
                    S'
              _____|_____
             C             S
             |        _____|_____
           [+Q]      I    NP     VP
                     |    △    __|__
                   PAST  she  V     NP
                             |     △
                            buy    it
```

Then, the rule of *Do*-Insertion can apply to (23) to yield (24):

(24)

```
                    S'
              _____|_____
             C             S
             |        _____|_____
           [+Q]      I    NP     VP
                     |    △    __|__
                   PAST  she  V     NP
                     |        |     △
                    do       buy    it
```