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The Origin and Rationale of X-bar Syntax

Abstract

The present paper is intended as a reasonably elementary introduction to the nature of X-bar syntax, an important module in the structure of a modern transformational-generative grammar. The examples have been taken from English; however, since X-bar syntax is an integral part of the overall structure of Universal Grammar, the analyses presented here extend to any language.¹

1. The essence of X-bar syntax

X-bar syntax can initially be defined in terms of two features: 1. **multi-layered structuring** between lexical categories like N, V, A and P and **maximal phrasal projections** like NP, VP, AP and PP, some of the layers being recursively generated; 2. The replacement of **category-specific** by **category-neutral** rules to achieve cross-categorical generalization.

2. Constituent structure - a simple example

In American structural linguistics an important approach to syntax (in so far as syntax was ever reached) was the analysis of phrases and sentences into their I(mmediate) C(onstituent)s.² Consider the following example:

(1) *The professor of Russian* lives in this house

IC-analysis would assign structure (1') to the subject-NP of (1) (the dots are **constituent-nodes** and the integers are for ease of reference):

¹ The paper is an adapted version of a chapter to appear in Jacobsen (forthcoming). I wish to thank my colleagues Kjær Jensen, Per Anker Jensen, Henning Nølke and Margrethe Petersen for helpful comments. I am grateful to Lis Rejnert Jensen for knocking the unwieldy manuscript into shape.

² The classical statement of the IC-analysis of American structuralism is Wells (1947). IC-analysis was preeminently an operational procedure based on a set of analytical techniques applied to the physical data. Node-labelling was not automatic. See for example Gleason (1965: 151ff.) and Jacobsen (1978: 7ff.). In the Phrase Structure component of a TG-grammar, node-labelling is automatic. A more technical discussion may be found in Postal (1964).

(1')

Subsequent labelling of nodes would define 1 as an **NP**, 3 as a **PP**, 4 as a **determiner**, 6 as a **preposition**, 5 and 7 as **nouns**. In this context, the important node to note is 2. 2 defines *professor of Russian* as a constituent, to which we may provisionally attach the label **nominal**, and which represents a structural layer in between the full NP and the lexical category (i.e. word class) noun. There is a good deal of syntactic evidence that such an analysis is correct. First *professor of Russian* can be coordinated with another similar word sequence:

(2) *The professor of Russian and dean of the faculty*

Only constituents can be coordinated. Secondly, *professor of Russian* can be pronominalized:

(3) *The new professor of Russian is better than the old one*

Only constituents can be pronominalized. Thirdly, *professor of Russian* can undergo Right Node Raising:

(4) *Tom may be, and George certainly is, professor of Russian*³

Only constituents can undergo Right Node Raising. Fourthly, *professor of Russian* can occur independently in certain structures:

(5) *He is professor of Russian*

In (5) *professor of Russian* is clearly a constituent - a nominal. The question arises: is it also an NP? The answer is yes, but some kind of

³ In classical TG (4) was assumed to be derived from (i):

(i) Tom may be professor of Russian, and George certainly is professor of Russian by the following two elementary operations: The first occurrence of *professor of Russian* is deleted under identity; the second occurrence of *professor of Russian* is raised away from its predicate position and attached as the right daughter of the highest S (see for example Jacobsen (1986: 253)).

“defective” NP. Thus (6), (7) and (8) show clearly that our constituent and full NPs have only overlapping distribution:

- (6) He is *professor of Russian*
 (7) He is *the professor of Russian*
 (8) $\left\{ \begin{array}{l} \textit{The professor of Russian} \\ \textit{*Professor of Russian} \end{array} \right.$ was present

In sum, there is ample syntactic evidence that *professor of Russian* should be layered as a constituent occurring between NP and N.⁴

The Phrase Structure rules of a traditional TG-grammar would analyse the professor of Russian by a rule like (9):

- (9) NP → Det N PP

which would assign structure (9’):

- (9’)

This is manifestly inadequate: *professor of Russian* is not defined as a constituent. Hence (9’) could not account for the possibility of *one-pronominalization* in (3).⁵

⁴ Harris did provide more formalized versions of the theory of multilayered structures; see the discussion in Harris (1951: 266ff.). However, Harris did not concern himself with cross-categorial generalizations.

⁵ Despite their grossly inadequate structural descriptions, rules like (9) remained in use for almost 15 years. No doubt, one of the reasons for this was the formulation of transformational rules as operations on strings rather than on structures.

3. The origin of X-bar syntax within the TG-paradigm - Chomsky's "Remarks on Nominalization"

Consider (10) and (11):

(10) Anne criticized her boyfriend

(11) Anne's criticism of her boyfriend

(11) is a **Nominalization** of (10). Until the late sixties it was assumed that (11) was derived from (10) by a transformational rule. Chomsky pointed to a number of fundamental difficulties involved in the transformational approach. Details need not concern us here.

Chomsky then went on to propose the **Lexicalist Hypothesis**. By this proposal items like *criticize* and *criticism* form a single neutral lexical entry specified as +N or +V (*criticism* would be formed by a low-level morphological rule). This neutral lexical item has a fixed set of selectional, subcategorization, and semantic features, such that a dependency relation may hold between one subset of the features (in particular semantic features) and +N, and between another subset of the features and +V (thus *do (things)* and *deeds* do not mean the same).

Chomsky notes that all major English categories, N, V, A and P may be preceded by **specifiers** and followed by **complements** and proposes a rule schema generalizing over the phrasal categories NP, VP, AP and PP.⁶ In particular, he introduces the variable X to range over N, V, A and P and the symbol X (= X')⁷ to denote the node immediately dominating X. Rule (12), then specifies that all major lexical categories can have one or more complements:

(12) $X' \rightarrow X \text{Comp}_X$

where **Comp(lement)** is a functional term (on a par with 'subject' or 'object') with no independent status in the grammar: it merely serves as an abbreviation for some sequence of nodes, all of them maximal projections. (12), then, is an abbreviation for (12')⁸:

(12') (i) $V' \rightarrow V \text{Comp}_V$

(ii) $N' \rightarrow N \text{Comp}_N$

(iii) $A' \rightarrow A \text{Comp}_A$

(iv) $P' \rightarrow P \text{Comp}_P$

⁶ Chomsky is not very specific on PPs, but we will include them here.

⁷ The bar-notation and the prime-notation are equivalents. We shall use the prime-notation for typological reasons. We shall continue to talk about X-bar syntax.

⁸ I owe this explication of Chomsky's notation to Jackendoff (1977).

The specifier is introduced by (13):

$$(13) X'' \rightarrow \text{Spec}_X X'$$

(13) is an abbreviation for (13'):

$$(13') \quad (i) V'' \rightarrow \text{Spec}_V V'$$

$$(ii) N'' \rightarrow \text{Spec}_N N'$$

$$(iii) A'' \rightarrow \text{Spec}_A A'$$

$$(iv) P'' \rightarrow \text{Spec}_P P'$$

'Specifier', like *Comp*, is a functional term⁹ The conjunction of (13ii) and (12ii) would generate a structure like (14):

$$(14)$$

If Comp_N = the PP of *Russian* and N = *professor*, we have now defined *professor of Russian* as an N' -constituent.

Between them (12') and (13') represent what may be referred to as the **Two-Level Hypothesis**: all major phrasal categories consist of two structural layers. At this point, the canonical form of Phrase Structure rules can be stated as in (15) (where $n \in \{1, 2\}$):

$$(15) X^n \rightarrow \dots X^{n-1} \dots$$

(15) provides a structure like (15'):

⁹ The material in the specifier is dependent on the category. Chomsky associates Spec_V with the traditional auxiliary node, Spec_N with the traditional determiner, and Spec_A with traditional degree phrases.

(15')

In (15') X is the head of the entire construction and of X', and X' is the head of X''; ... indicates that heads may be preceded or followed by some category. Notice that (15) is an explicit formal statement of the **endocentricity constraint** on base structures. This was never formalized in traditional Phrase Structure rules (for discussion, see Lyons (1968: 330ff)). In section 6 we will give a more precise formulation of (15).

Armed with these notions, we now return to (10) and (11). They would be assigned structures like (10') and (11') (adapted from Chomsky (1970) and assuming of course the initial rule $S \rightarrow N'' V''$):

(10')

(11')

It is now obvious what multilayered X-bar syntax has achieved: 1. A structural similarity between nominal and sentential structures (as indicated by the boxed nodes) and the similarity between the encircled nodes V' and N'.¹⁰ These generalizations are made possible by X-bar syntax in conjunction with the Lexicalist Hypothesis.¹¹ The spurious nominalization transformation can be eliminated.

Since 1970, X-bar syntax has come to play an integral part of transformational-generative grammar. In the next section we shall show in a little more detail the parallel analyses of the internal structures of the four major phrasal categories. After this we set up the required generalizations.

¹⁰ The definition of the functional notions 'subject' and 'object' can now be generalized over sentences and nominal structures in the following way: the subject is the N" which is immediately dominated by S or the N" which occurs in specifier-position; the object is the N" which is immediately dominated by V' or N'. In the phrase *criticism of her boyfriend*, the semantically empty preposition *of* is inserted by a low-level rule. We will not go into the details of that.

¹¹ In recent developments of the theory of TG-grammar, the lexicon plays a crucial role. The Lexicalist Hypothesis may be seen as the precursor of this.

4. The internal structure of NP, VP, AP and PP

4.1. NP

To generate NPs we will formulate the following set of rules (henceforth we will assume that Spec is optional):

- (16) (i) $N'' \rightarrow (\text{Spec}) N'$
 (ii) $N' \rightarrow N' XP$
 (iii) $N' \rightarrow N XP^*$

We will refer to (16i) as **the specifier rule**. Rule (16ii), which is recursive and optional, is **the adjunct rule**. Rule (16iii) is **the complement rule**; the asterisk indicates that there may be any number of complements.¹² Thus an N and its sister complement(s) expand into an N'; and an N' and its sister adjunct (there is always only one) expand into a new N'.

Consider the following example:

- (17) The theory of grammar that I admire most

By (16) this would be assigned structure (17'):

- (17')

with the relative clause generated by the adjunct rule.¹³ Relative clauses can stack up, as in (18):

- (18) The car that you bought that I admire most

¹² At first sight this might appear to lead to massive overgeneration. However, this is prevented by the lexicon, as we shall see in section 8.

¹³ In section 9 we shall see that the sentence-schema can also be accommodated by X-bar syntax. In particular, the relative clause in (17') is an instantiation of XP.

The structure of (18) would contain one more N' than (17); and so on.

In order to account for premodifying adjectives, we would need the “mirror-image” of (16ii). Something like (19) might do:

(19) N' → XP N'

(19) would assign structure (20) to a phrase like *beautiful girl*:

(20)

(19) still needs to be recursive: adjectives can stack up, just like relative clauses. Consider (21) (from Jacobsen (1978: 354 ff.)):

(21) He bought a beautiful old yellow English cottage

That the adjectives are stacked is revealed by *one*-pronominalization facts. Consider the following sentences, in which N' stands for *beautiful old yellow English cottage*:

(22) He always wanted to buy a N', and finally he bought the *one* out there

(23) He was looking for a N', but found only a derelict *one*

(24) He bought a N', and I bought a beautiful new *one*

(25) He bought a N', and I bought a beautiful old green *one*

(26) He bought a N', and I bought a beautiful old yellow French *one*

Our rules would recursively assign structure (27) to *a beautiful old yellow English cottage*:

(27)

(27) adequately accounts for the *one*-pronominalization facts.

In some cases, complements can precede their nominal heads. Consider the relationship between (28) and (29) (we ignore the ambiguity of (29)):

(28) He is our *professor of Russian*

(29) He is our *Russian professor*

To account for (29), we need the “mirror image” of (16iii):

(30) $N' \rightarrow XPN$

Given (30), we can assign structure (29') to *Russian professor*:

(29')

We will assume that it is only in the marked case that complements can occur to the left of their heads in English.¹⁴

4.2. VP

Consider the bracketed VP in (31):

(31) John will [study the letter in the office this afternoon]

The Phrase Structure rules of a traditional TG-grammar would assign structure (31') to this VP:

(31')

In this the complement and the two adjuncts are all daughters of VP and right sisters of V. Again, this is inadequate, as revealed by a simple *do so* pronominalization test:

- (32) (i) John will study the letter in the office this morning and
Mary will *do so* too
(ii) ... and Mary will *do so* this afternoon
(iii) ... and Mary will *do so* in the kitchen this evening

In (32i) *do so* replaces the entire VP; in (32ii) *do so* replaces *study the letter in the office*; in (32iii) *do so* replaces *study the letter*. These two strings are not defined as constituents in (31').

To account for these facts we need rules as those in (33) (parallels of the rules in (16)):

- (33) (i) $V'' \rightarrow (\text{Spec}) V'$
(ii) $V' \rightarrow V' XP$
(iii) $V' \rightarrow V XP^*$

¹⁴ On this, see also section 6. For a full account of nominal premodifiers (and premodifiers in general) in the X-bar syntax approach, see Radford (1988). See also Haegemann (1991).

These would assign structure (34) to the VP in (31'):

(34)

(34) would account for the *do so* facts in (32).

4.3. AP

Consider (35):

(35) John is [very desirous of success]

Traditional Phrase Structure rules would assign structure (35') to the bracketed AP in (35):

(35')

Intuitively, this is not satisfactory; thus it seems reasonable to assume that *desirous of success* is a head plus a complement (analogous with the VP *desire success*), but then *desirous* and *of success* should form one

constituent; by the same token, it is arguable that *very* is a specifier. To capture this, we need rules like (36):

- (36) (i) $A'' \rightarrow (\text{Spec}) A'$
 (ii) $A' \rightarrow A' XP$
 (iii) $A' \rightarrow A XP^*$

Given (36), we assign structure (37) to the AP in (35):

(37)

In (38) the adjunct rule has applied:

(38)

4.4. PP

Arguably PPs also have specifiers. An example would be *right* in (39):

(39) He went [right through the tunnel]

If we now formulate the rules in (40) (analogous to (16), (33) and (36)) to account for PPs:

- (40) (i) $P'' \rightarrow (\text{Spec}) P'$
 (ii) $P' \rightarrow P' XP$
 (iii) $P' \rightarrow P XP^*$

we can assign structure (41) to the bracketed PP in (39):

(41)

One PP may occur inside the other as in (42):

(42) This edition dates [from before the war]

The rules would assign structure (42') to the bracketed PP in (42):

(42')

5. Generalizing the rules

We have shown in the preceding section that the major phrasal categories NP, VP, AP and PP show remarkable structural symmetry. In order to make this structural symmetry explicit, we need to formulate a general rule schema to replace rules (16), (33), (36) and (40):

- (43) (i) $X'' \rightarrow (\text{Spec}) X'$
 (ii) $X' \rightarrow X' YP$
 (iii) $X' \rightarrow X YP^*$

where Y may, but need not be distinct from X (thus X may be V and YP PP; alternatively X may be N and YP NP; this would require the insertion of the semantically empty preposition *of* (cf. note 10)).

6. A universal rule schema

So far, we have been discussing X-bar syntax solely on the basis of examples taken from English. This has obviously had an effect on the way the rules have been formulated. In particular, we have assumed throughout that the category symbols occurring to the right of the arrow are strictly ordered. However, it is well known that word order is subject to parametric variation across languages. For example, English is a **head-first** language in the sense that, in the unmarked case, complements follow their heads.¹⁵ Other languages like Korean and Japanese are **head-final**, i.e. complements precede their heads; such languages have **postpositions** rather than **prepositions**. In English attributive adjectives precede their heads (cf. (19) above); in French, in the unmarked case, they follow their heads; and so on. It follows from this that (43) (and the "mirror-image" rules (19) and (30)) are language-specific. In order to formulate a universal rule schema, we need to remove the ordering constraint from (43), as in (44), where ; indicates an unordered set:

- (44) (i) $X'' \rightarrow (\text{Spec}) ; X'$
 (ii) $X' \rightarrow X' ; YP$
 (iii) $X' \rightarrow X ; YP^*$

(44) generates the following set of structures:

¹⁵ In connection with our discussion of (29) we noted that the complement of nouns may occur to the left of the head. This is also the case in some PPs, e.g. *herewith*, *thereby*, etc. These are marked constructions.

(45)

In other words, (44) defines the hierarchical structuring or the **(immediate) dominance relations** of constituents.

Let us assume, then, that (44) is part of Universal Grammar, perhaps parametrized (cf. next section): it is "there" already when the child starts acquiring his language. An essential part of language acquisition therefore is to set the relevant word-order parameter on the basis of input data.

The rules formulated in section 4, and generalized in section 5, can be viewed as the output of a set of **Linearization rules** operating on the options specified in (45).

7. The configurationality parameter

It has been argued in the literature (e.g. Chomsky 1980; 1981) that some languages like Japanese have no structural layers intermediate between lexical heads and maximal projections. Rather, they have flat structures like those generated by traditional Phrase Structure rules (cf. e.g. (9'), (31') and (35') above). Thus, where English (and a vast number of other languages) has the canonical structure (46):

(46)

Japanese would have the canonical structure (47):

(47)

Clearly (44) would not apply to a nonconfigurational language. In other words, (44) may be subject to parametric variation. We will leave it at that.

8. The Projection Principle

In connection with our discussion of rule (16iii), we noted that the grammar would massively overgenerate. How should this be avoided? The answer to this question is: by means of the lexicon. In particular, each N, V, A and P, that is each lexical head, will have associated with it a **complementation specification**. Thus, the complementation specification for a verb like *give* will look as in (48):

(48) [_ NP, NP]

(48) states that *give* takes two NP-complements, no less, no more. In the typical instance heads take only one or two complements (if any at all). Therefore, although rule (16iii) (or rule (44iii)) allows any number of complements to be generated, this overgeneration is properly curbed by the lexicon. Only structures that can be projected from the complementation specifications of heads are proper syntactic structures. This is the

essence of the **Projection Principle**, which is of crucial importance in modern transformational-generative theory.

It will be seen that X-bar syntax, in conjunction with the Projection Principle, has virtually eliminated traditional Phrase Structure rules from transformational-generative grammar.¹⁶

9. X-bar syntax and the sentence-schema

In traditional transformational grammar, the structure of a sentence looked roughly as in (49):

(49)

Later, in the seventies, especially under the influence of Bresnan's work (Bresnan (1974; 1979)), the following sentence-schema evolved:

(50)

¹⁶ Stowell (1981) has pioneered the work in the elimination of traditional Phrase Structure Rules. See also Chomsky (1986a; 1986b).

There where good arguments for adopting (50) over (49). These will not be reviewed here. Notice that neither (49) nor (50) conforms to X-bar syntax in any obvious way.

In recent years, however, a new sentence-schema has been developed and empirically motivated (see for example Chomsky (1986a; 1986b)). It looks as follows:

(51)

The three encircled constituents are heads (I = **inflection**, C = **complementizer**). V is head of V' (and V''); I is the head of I' (and I''); C is the head of C' (and C''). We will not be concerned here with the details of (51). It is sufficient for our purposes to note that (51) represents an extension of X-bar syntax to the entire sentence.¹⁷

In effect, the sentence is defined as the largest phrase.

¹⁷ Notice that 'Relative Clause' in (17') should now be replaced by C'' (or, equivalently, CP).

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