Chapter 3

X'-Syntax (Part 1)

3.1 Introduction

- We have built a preliminary theory of syntax, and used it to precisely define notions like grammaticality, constituency, ambiguity.
- We've also used it to provide analyses of some natural language phenomena: coordination, nominal and verbal anaphora, nominal and verbal modifiers.
- Let's recap the underlying principles of CFGs which have been assumed.

(3.1)
a. Replacement rules/Phrase structure rules must be of the form $a \rightarrow b$
b. a must be a *non-terminal symbol*.
c. b is a sequence of (terminal or non-terminal) symbols

(3.2) Using rules in (3.1), we can derive some structures which are unattested in language.

a. PP $\rightarrow$ D S Adv
b. N $\rightarrow$ Deg PP
b. VP $\rightarrow$ (P)* S

Big Question: *What constraints can we put on the rules in* (3.1)*, to make stronger predictions about possible languages?*

- Various theories exist of how these rules can be more constrained. The one we're exploring here is *X'-Syntax*.
- X'-syntax is associated with Chomsky 1970, Jackendoff 1977, Kornai and Pullum 1990.
- It's adopted in slightly different forms by various syntactic frameworks including GB (Chomsky 1981), Minimalism (Chomsky 1995), GPSG (Gazdar et al. 1985), LFG (Bresnan et al. 2015).
- FAQs about X'-syntax
  1. *Is X'-syntax something we observed/discovered/demonstrated about natural language?*: No, it's a formal tool, a description language which may or may not be useful in writing down generalizations about natural language (we hope it's useful!).
  2. *Why do we make Design Choice A instead of Design Choice B?*: X'-syntax is a formal tool, so its various designers have made particular design decisions. These may or may not be useful. Design Choice B might end up being a better way to describe language, but adopting it means we are working with a slightly different theory.
- The central empirical phenomenon which we'll try to analyze using X'-syntax is "selection". Here's a taste:

(3.3)
a. Caesar died.
b. *Caesar produced.
c. *Caesar died four children.
d. Caesar produced four children.
e. Caesar gave a cookie to Sam.
f. *Caesar produced a cookie to Sam
g. *Caesar died that Sam likes fish.
h. Caesar thinks that Sam likes fish.
i. *Caesar thinks Susie that Sam likes fish.
j. Caesar tells Susie that Sam likes fish.

3.2 X′-basics

- Under X′-syntax, labels for non-terminal nodes are now more complex. Instead of simple labels like S, NP, PP, VP, they will be **sets of features, with values**.
  - The *category* feature tells us the lexical category of the node. It's possible values are N, V, P, A, Deg, and so on (the *basic categories*).
  - The *bar-level* feature tells us (loosely) "how high" the node is in the structure. It's possible values are any $n \geq 0$.
- Here are some examples of what node labels look like now:

(a) $\begin{bmatrix} \textit{Category}: & \text{N} \\ \textit{Bar-level}: & 2 \end{bmatrix}$ (b) $\begin{bmatrix} \textit{Category}: & \text{V} \\ \textit{Bar-level}: & 0 \end{bmatrix}$ (c) $\begin{bmatrix} \textit{Category}: & \text{P} \\ \textit{Bar-level}: & 1 \end{bmatrix}$, and so on

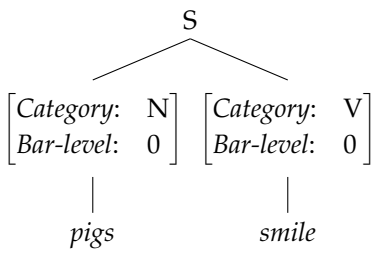
3.2.1 Projection

(3.4) **Projection**: a node Y is the nth projection of a node X iff:
a. Node X is *Bar-Level*: 0, and
b. Node X and Y have the same *Category* value

- How does this terminology apply to (a)–(c)?
- What does it mean to say that a node Y is the 0th projection of a node X?

(3.5) **Rule 1** – *Lexicality*: all non-terminals except S must be a projection of some node.

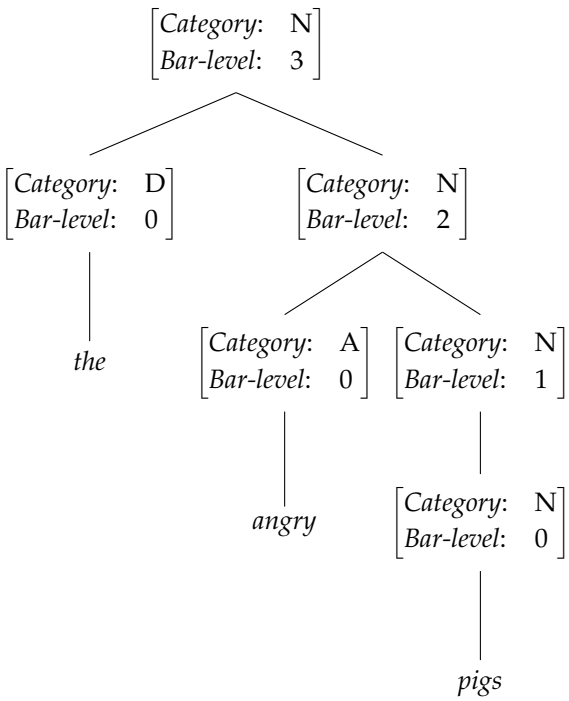
- Here's the new notation for a basic tree (on the right). Does it obey *Lexicality?*



(3.6) **Rule 2** – *Succession*: For any node with *Category*:X (a category which is not S),
a. If it has *Bar-Level*: $n > 0$, then it has exactly one *Category*:X child with a *Bar-Level*: $n - 1$.
b. If it has *Bar-Level*: 0, then it has one child, a terminal (i.e., a lexical item).

- Does this tree obey *Succession?*

(3.7)



- *Question:* Is there a maximum number which *Bar-Levels* can reach?
  - Jackendoff 1977 says its 3. Others like Bresnan 1976 say there's no maximum. Most X'-syntacticians assume there's no maximum.

3.2.2 Abbreviations

- Obviously this notation is hard to work with. Here are some abbreviations.

(3.8) Assuming a node has *Category*: X (and is not S)...

a. If it doesn't have any higher projections, write XP (a **maximal projection**).

b. If it has *Bar-Level*: 0, and does have higher projections, write X.

c. If it has *Bar-Level*: $n > 0$, and does have higher projections, write X'.

- Let's rewrite the tree in (3.7) with these abbreviations. Hint: it looks a lot like our previous trees.

(3.9)

(3.10) Do the following rules obey succession?

a. S $\rightarrow$ NP VP

b. A' $\rightarrow$ *very* A'

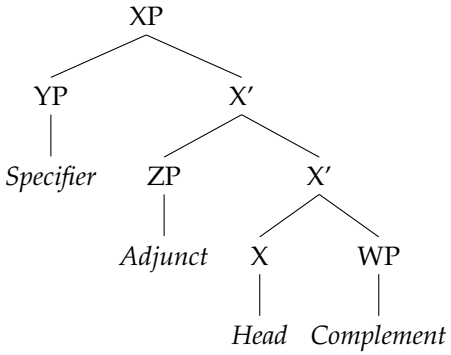
c. A' $\rightarrow$ DegP A'

c. NP → DP PP
d. N′ → *pigs*
e. N → *pigs*
f. NP → *pigs*

3.3 Specifiers, complements, heads, and adjuncts

- X′-syntax allows us to define four central concepts.

(3.11)



(3.12)
a. **Head**: a node with *Bar-Level*:0.
b. **Complement**: a node which is the sibling to a head.
c. **Adjunct**: a node which is the sibling to an X′, and the child of an X′.
d. **Specifier**: a node which is the sibling to an X′, and the child of an XP.

(3.13) *Some questions:*
a. What does *Succession* say about heads?
b. Complements, adjuncts, and specifiers must always be maximal projections (XPs). Why? (Hint: look at *Succession*).

- These terms are used everywhere in theory-building. Examples of typical theories:

(3.14)
a. Samoan subject pronouns are best analyzed as specifiers of a TP.
b. Basque absolutive clitics are best analyzed as complements of a V.
c. Danish relative clauses are best analyzed as adjuncts to an NP.

- Let's start with nominal structures. Some hypotheses about English (to be revised as we go on):
  - Determiners (*a, the, my*) are specifiers of NP.
  - Nominal adjectival modifiers (*angry*, *clever*) are left-branching adjuncts to NP.
  - Nominal PP-modifiers (*with long hair*, *in a tree*) are right-branching adjuncts to NP.
- Using these hypotheses, how would we draw *the clever student with long hair*? Note: there are 2 solutions, don't worry about the internal structure of *with long hair*.

(3.15)

- A hypothesis about English PPs: The NP object of a preposition is its complement.
- Using this hypothesis, how would we draw *with long hair*? Be careful with NPs without determiners.

(3.16)

- A hypothesis about English APs (to be revised): The degree-modifier is its specifier.
- Using this hypothesis, how would we draw *quite happy*?

(3.17)

- Finally, English VPs:
  - Direct objects are complements to V.
  - Verbal PP-modifiers are right-branching adjuncts to VP.
  - VPs don't have specifiers.
- Using these hypotheses, how would we draw *read the book with a lamp*?

(3.18)

3.4 Putting it together

- Let's get the hang of drawing trees by putting it all together
- The following sentence is two-ways ambiguous, draw both trees, making sure X′-syntax rules, and the hypotheses above are followed.
- Tips
  - What are the two readings intuitively?
  - What do pronouns, *one*-anaphora, *do so*-anaphora, coordination tell us about each reading?

(3.19) The old monkey pointed at the rhino with a banana.

3.5 Selection

- Let's look at some of the 'selection' examples from the introduction.

(3.20)
a. Caesar died.
b. *Caesar produced.
c. *Caesar died four children.
d. Caesar produced four children.
e. Caesar gave a cookie to Sam.
f. *Caesar produced a cookie to Sam

- Assuming a PS rule [V′ → V NP] gets the wrong result. Why?

- We've encountered this problem in previous weeks. What was our solution?

- This type of solution is called "subcategorization". It determines the relationship between a head and its complements.

(3.21) *Subcategorization (the basic idea)*: Lexical items can be grouped together based on the syntactic type of their complement(s).

- To incorporate this idea into the grammar, we use features (following Bresnan 1972).
- Now we add a third feature type to the grammar, *Select*. *Select* tells us what kinds of complements heads can have.

(3.22) *Heads Select:* All and only nodes with *Bar-Level*:0 have a *Select* feature.

- (a) is the expanded notation for an intransitive verb, (b) is a transitive verb. What are the features telling us in plain English?

(3.23)
(a) $\begin{bmatrix} \textit{Category}: & \text{V} \\ \textit{Bar-level}: & 0 \\ \textit{Select}: & \text{ø} \end{bmatrix}$ (b) $\begin{bmatrix} \textit{Category}: & \text{V} \\ \textit{Bar-level}: & 0 \\ \textit{Select}: & \text{N} \end{bmatrix}$

- To link these new head categories to lexical items, we just add the following PS rules.

(3.24) (a) $\begin{bmatrix} \textit{Category}: & \text{V} \\ \textit{Bar-level}: & 0 \\ \textit{Select}: & \text{ø} \end{bmatrix} \rightarrow \textit{died}$ (b) $\begin{bmatrix} \textit{Category}: & \text{V} \\ \textit{Bar-level}: & 0 \\ \textit{Select}: & \text{N} \end{bmatrix} \rightarrow \textit{produced}$

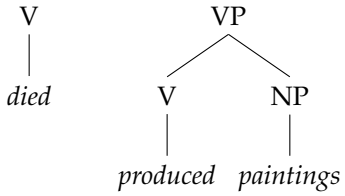
- The possible values for the *Select* feature are wide open.
  - We definitely want category labels like N to be possible values as in (3.23).
  - Sometimes we want more specific subcategories, even individual lexical items.
  - We'll see more and more examples as we go on.
- Based on (3.20e), what would the PS rule introducing *gave* be (*a la* 3.24)?

(3.25)

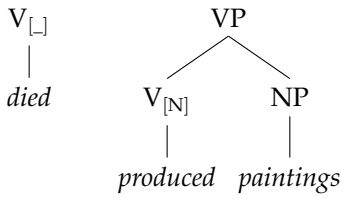
(3.26) *Head-Complement Rule:* In a head-complement relationship, the *Category* features of the complement(s) must match the *Select* features of the head.

Abbreviations

- Usually we can just use our standard abbreviations for heads (i.e., just V), without representing the *Select* feature. The information about what kind of complement it takes should be obvious from the category of the complement.



- If selection is relevant for the discussion, we can add the *Select* feature as a subscript to the head.



- Let's look at the following data and update our grammar to incorporate them.

(3.27)
a. Sam is afraid of catastrophes.
b. *Sam is afraid to Sally.
c. *Sam is sleepy of catastrophes
d. *Sam is sleepy to Sally.
e. Sam seemed afraid of catastrophes.
f. *Sam seemed sleepy of catastrophes.
g. Sam seemed afraid to Sally.
h. Sam seemed sleepy to me.
i. Sam seemed afraid of catastrophes to me.

j. *Sam seemed sleepy of catastrophes to me.

- State the PS rules introducing *seemed*, *sleepy*, and *afraid*. Draw trees for (e), (h), and (i).

(3.28) *PS Rules*

(3.29) *Trees*

More abbreviations:

- We might want to state the "subcategorization frame" of a lexical item, telling us what kinds of complements this lexical item can select. Instead of writing the full PS rule like in (3.24), we can just write the following abbreviations.

(3.30) a. *died*, V, [_]
b. *produced*, V, [_ N]
c. *ate*, V, [_ (N)]
d. *swatted*, V, [_ $\left\{ \begin{array}{c} \text{N} \\ \text{P}_{\text{at}} \end{array} \right\}$]
e. *proud*, A, [_ (P_{of})]

3.6 Further readings

- X'-syntax is originally traced to Chomsky 1970. Jackendoff 1977 and Pullum 1985 present fleshed out variants of it. Kornai and Pullum 1990 give a complete formalization.
- The original discussion of complement selection is Bresnan's 1972 dissertation. Grimshaw 1979 is also influential, especially in terms of notation. An influential Minimalist instantiation of selection is Adger 2003.

3.7 Possible paper topics

- Many theories of syntax (especially in Minimalism) assume all trees must be binary branching. As a consequence, any XP that has a specifier must also have a complement (ask yourself why). Is this a worthwhile prediction? NB: Hale and Keyser (1993, 2002), in their account of the causative alternation (*the glass broke* vs. *I broke the glass*), engage explicitly with this question.
- Sag 2003 provides a fascinating case, from German and Polish, in which dative case assigning and accusative case selecting verbs can coordinate just in case the object's dative and accusative forms are homophonous. What does this tell us about selection, coordination, case, morphology, and how they all interact?
- VSO languages (languages with verb-subject-object ordering, e.g., Celtic, Polynesian, Mayan) have often been claimed to have verbs which select both the subject and object as complements, e.g., V : [_ NP NP]. See McCloskey 1979 on Irish, Ball 2009 on Tongan. This means that subjects in these languages are structurally very different from subjects in non-VSO languages like English. Is there evidence for this distinction?

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