CAS LX 321 / MET LX 521 / GRS LX 621 *Syntax: Introduction to Sentential Structure*

March 4, 2024

1 What this is

Since we are operating without a textbook generally and because things have changed a fair amount along the way, I am going to try to summarize some "policy notes" here now, so there's something like a coherent account of where we are.

2 Phrase Structure Rules

We started out talking about the fact that sentences are constructed of words, and that words seem to come in classes. Generally, the classes are organized such that words within a single class can substitute in for one another. That is, verbs go where other verbs can go, nouns go where other nouns can go, etc. The definition of "syntactic category" is essentially a distributional one. We can look at them after the fact and try to get a sense of what nouns are like, but fundamentally nouns are the things that go where nouns go.

The Phrase Structure Rules were a formalism we adopted to try to characterize the sentences of English. In general, the idea is that when we have a complete grammar, we can differentiate the sentences of English from the non-sentences of English. (The same procedure can be followed for other languages as well of course.) A PSR is a "rewrite rule": S $\rightarrow$ N VP means that "An S can be rewritten as N VP" and the "trees" we are used to are basically a record of the derivation from S to whatever it is expanded to. We used "S" as the initial symbol at the beginning because it stood for "sentence." Our phrase structure rules were instructions about what different ways an "S" can be realized.

We can conceptually separate out the lexicon from the PSRs (the lexicon had the expansions like N $\rightarrow$ *cat*), and of course the structural PSRs are much more general than the individual lexical rules. Later on, we stopped even really writing lexical items in the same form as PSRs; instead, we list lexical items as basically having a pronunciation and a set of features that determine how they can be placed into a well formed tree. Examples of lexical items in the current style can be found in section 5.

There was also a bit of an excursion on the scientific process. A grammar (made of structural and lexical PSRs) is a hypothesis about what makes a good sentence in the language being studied. We can test this hypothesis by looking at what it predicts and seeing if it is borne out by the observed facts in the world, then revise the hypothesis if needed. We can also compare hypotheses directly by considering their relative complexity or their relative generality. Usually, a simpler and more general grammar/hypothesis is superior to a more specific one. So if two different grammars both cover the data set under investigation, the more general/simpler one is the better one to adopt.

3 Constituency tests

One of the tools we have available to test to see whether the structures we are hypothesizing match the actual structures of sentences is to see if the constituents in the hypothesized structures pass the constituency tests. I won't revisit all of the details here, but the basic idea of a constituency test is to see if a group of words in the sentence *act as a unit*. If they do, this is evidence that there is a node in the structure that contains just those words and nothing else.

The constituency tests that we have talked about come in two general types: replacement tests, and dislocation tests.

The replacement tests work under the assumption that if you can replace a group of words as a unit then there was a single node in the tree that contained them all and nothing else. The simplest form of this would be replacing a series (or "string") of words with a pronoun form, since we know for certain that a single word is a constituent of some sort. That would be the pronoun (or "**pro-form**") replacement test. The ellipsis test (which is mostly good only for finding VPs) is also essentially a replacement test. If you can leave out a string of words as a unit (which can in some cases lead to the addition of *do* in English), then the string of words forms a constituent. The **coordination** tests are also a form of replacement test, based on the assumption that you can coordinate two like constituents and put the result in the same place. So, an NP can be replaced by [NP and NP].

A good use of a replacement test will generally keep the meaning as close to the same as possible. It is unlikely that the meaning can be entirely preserved when replacing a series of words with zero or more different words, but if you let the meaning vary too much then the test is no longer reliable. For example, we know that "on the hill has" is not a constituent in "The tree on the hill has died" even though we can replace "one the hill has" with "frog" and get a perfectly good English sentence.

The dislocation tests move a string of words from one part of the sentence to another, and if you can move them as a unit. The most obvious of these is a **topicalization** or **fronting** test (which we had just called a **dislocation** test). In this, you pick up the constituent and move it to the front, as in "Pizza from Chicago, I like" (evidence that "Pizza from Chicago") is a constituent. The **clefting** test ("It is pizza from Chicago that I like") is also a kind of dislocation test. The dislocation tests are constrained by some things other than constituency, so sometimes a dislocation test will fail even if you are attempting to move a constituent.

If you are trying to argue for a particular string of words being a constituent, you generally want to use multiple different constituency tests and, essentially, let them "vote," since sometimes a constituency test might fail for an unrelated reason, or even occasionally pass misleadingly. For the most part, though, passing a constituency test is evidence of constituency, even if failing a constituency test is not evidence of non-constituency.

4 Tree relations

We can define some relations between nodes in the tree (dominance, precedence, c-command), and there are some testable things that seem to be best stated in terms of these relations. (This fact is part of why we believe those relations to be linguistically significant—we could of course make up almost any kind of relationship expressible in a tree structure, but the question would be whether this relationship is needed when describing the syntax of a language. Dominance, precedence, and c-command do seem to be needed at least.)

In particular, c-command (X c-commands Y iff neither dominates the other and the first branching node that dominates X also dominates Y) seems to be required when talking about when anaphors like *themselves* or negative polarity items like *anybody* are allowed. So, for one thing, the antecedent of an anaphor must c-command the anaphor.

(1) a. [The penguins]$_i$ saw themselves$_i$.
b. * [Themselves]$_i$ saw [the penguins]$_i$.
c. * [The child [near [the penguins]$_i$]] saw themselves$_i$.

5 Subcategorization and lexical entries

Within the larger category of "verbs" we find that they come in several types. Although we can divide verbs in a bunch of different ways (stative vs. eventive, stage-level vs. individual level, unaccusative vs. unergative, etc.), one of the most relevant to us concerns the "valence" of a verb. A verb generally describes the relation between a number of different arguments. Some verbs have only one participant (intransitive verbs), some have two (transitive verbs), some have three (ditransitive verbs), or none (weather verbs).

The concept of a "subcategory" is kind of just what it sounds like. It is a classification of subtypes—e.g., intransitive verbs and transitive verbs are both subclasses of verbs. They both act like verbs (for example, they both can be placed into the past tense, or a participle form), but yet they also act distinctly from one another. In particular, an intransitive verb does not need an object, while a transitive verb does.

We considered how to handle subcategories, and initially we kind of treated intransitive verbs and transitive verbs as fully different categories (by giving them categories of "Vi" and "Vt"). These different labels both have a "V" in them, but that doesn't actually affect the machinery. We might as well have called them "☺" and "☹"—the only thing that would tell us that they are both verbs is some kind of background assumption/list of things that act like verbs. This doesn't "feel right"—the way linguists usually label this feeling is that we have "missed a generalization." There is something better than this to do. We want them all to be the same category ("V") but yet still be able to characterize the difference between transitive and intransitive verbs. (One reason for this is that you can replace a transitive verb + object with an intransitive verb, like *Pat eats lunch* → *Pat swims*. If transitive verbs and intransitive verbs were different categories, this would be a bit mysterious—and at the very least would seem to require a more complex and redundant grammar to handle properly.)

Following the intuition that the distinction between a transitive verb and an instransitive verb is really something about the lexical entry, we added a *subcategorization frame* to lexical entries. This is basically a feature (property) of the verb, and features are generally expressed like "[+feature]". Thus we have written subcategorization frames as being enclosed in brackets with a "+" at the beginning.

We take the structure of a lexical entry to be as follows:

(2) word, category, features

There are really all kinds of features a lexical entry might have. It might be animate, it might be mass, it might be indefinite. But for verbs, one of the things it has is a specification of whether it is transitive or intransitive (etc.).

What it *means* to be transitive is that the verb needs an object. A (nominal) object will be a DP (based on something we did a little bit later, but eventually it was a DP and not an NP). One way to characterize what it means to have an object is that the V and the DP are sisters. So the subcategorization frame is essentially a description of the constituent into which the verb "fits." A transitive verb has a feature [+ __ DP], which means that you can use this verb as long as it is in a constituent where it is followed by a DP.

A ditransitive verb (like *put*) needs both a DP and a PP, in that order. So we give it a subcategorization frame [+ __ DP PP]. Meaning that we can use this verb in a constituent where there is a following DP and PP. Note too that this is a ternary branching structure: one branch goes to the V, one to the DP, and one to the PP.

(3) *dance*, V, [+ __]

(4) *call*, V, [+ __ DP]

(5) *put*, V, [+ __ DP PP]

We in fact got more sophisticated than this even, once it became clear that sometimes verbs impose additional constraints on the properties of their arguments. For example, it might be that a verb requires not just any PP but a PP of a particular type, like a locative PP. So we can specify that like:

(6) *put*, V, [+ __ DP $PP_{[+loc]}$]

6 Heads, phrases, and feature projection

It seems to be the case that in any "phrasal" unit, there is an element that is most prominent. The most straightfoward examples of this might be a verb phrase, where the verb is most prominent, or a prepositional phrase, where the preposition is most prominent.

One could imagine various ways one might define "prominent" but what we mean specifically here is that the most prominent element (the "head") is the one whose properties determine the properties of the phrase. This is "feature projection" from the head, and it is how that lexical entry for *put* above actually works. In a sense, there isn't any such thing as a fundamental PP that has a [+loc] feature—a [+loc] PP is one that has as its head a [+loc] P. So, we say that the feature [+loc] "projects" from the head of the phrase to the phrase. So, the head of the phrase is the one that contributes its features to the phrase.

Having said this leads us also to hope that maybe, since almost every phrase we have made use of has a head, that this could be a general property of grammar: every phrase has a head.

The fact that verbs seem to be able to select for specific (kinds of) PPs (such as the [+loc] PP above) was the motivation for feature projection. The fact that verbs can select for specific types of embedded clauses motivates the idea that C is the home of "clause type" (declarative, interrogative, imperative, etc.) and that features of C project to CP. The fact that C can select for certain types of sentence (i.e., *for* selects for an infinitive clause vs. *that* which selects for a tensed clause) tells us that tense is the head of the sentence, so we called it TP.

We discussed how to do subject agreement, which we implemented by supposing that T and its specifier share features, and that T assigns features to VP (which shares them with V). There are still things to be worked out here, though. For one thing, the specifier-head feature sharing does not appear to be fully general, because a DP does not seem to inherit the features of a possessor in its specifier. Also, we'll need to assume some kind of feature assignment from V to its object if we are to cover the assignment of accusative case to objects. So, we are not quite done with this yet, but we have made a start.

7 Sentence types and complement sentences

Sentences come in at several types. The two that are relevant for us are declaratives and questions. We hypothesize that this is top-level information carried by the C, so a C can be either an interrogative C (forming a question) or a declarative C (forming a statement). There are verbs that are sensitive to these properties, so *believe* takes only declarative clauses, while *wonder* takes only interrogative clauses.

So, since we need CP to have the feature distinguishing interrogative from declarative clauses, we suppose that it is a feature of its head, C, and moreover we assume that all clauses are specified for clause type, and so always have a C.

In main clauses (in English at the very least), you can't hear the C in a declarative clause, but we still assume it is there. In embedded clauses, such a C can be optionally realized as *that*.

Similarly, C is sometimes selective for what kind of TP it takes. *For* requires an infinitive TP, while *that* requires a tensed (finite) TP. So, by the same logic, we assume that the feature that distinguishes infinitives from tensed TPs is a feature of T (that projects up to TP for the purpose of selection).

(7) *believe*, V, [+ __ $CP_{[+D]}$]

(8) *ask*, V, [+ __ $CP_{[+Q]}$]

(9) *know*, V, [+ __ CP] (or [+ __ $CP_{[+D]}$], [+ __ $CP_{[+Q]}$])

(10) *whether*, C, [+Q]

(11) *if*, C, [+Q]

(12) *that*, C, [+D], [+ __ S_{+TNS}]

(13) *for*, C, [+D], [+ __ S_{-TNS}]

(14) ∅, C, [+D]

(15) *to*, T, [–TNS]

(16) [+past], T, [+TNS]

8 X-bar theory

Going slightly out of order here, we determined that, after looking at a lot of the various phrases and their heads, that it seems like there are some generalizations we can make about the relationship of phrases to heads and the configurations they come in, which has come to be known as "X-bar theory." The idea is that there is a pan-category template for how phrases are built. The policies we will adopt are these:

- Phrases (XP) have a unique head (X). Features from X project to XP.
- Complement (YP) is sister to the head (X).
- Specifier (ZP) is sister to X′ and daughter of XP.
- Phrases (WP) can be adjoined to phrases (XP). A hypothesis/policy decision
- Phrases (WP) can be adjoined to X′. A hypothesis/policy decision
- There is always an X′. A hypothesis/policy decision
- Branching need not be binary. A hypothesis/policy decision

Note a couple of things here. Basically to keep things uniform (but wasteful of ink), we are requiring an X′ node all the time, even when it is not necessary to define a specifier. Ternary branching still occurs in at least two situations at this point. One is ditransitive verbs, and the other is coordination.

As for why we need to allow adjunction both to X′ and to XP:

(17) Before the end of the movie, I finished my popcorn.

(18) Pat said that before the end of the movie, I finished my popcorn.

There needs to be a place between C (*that*) and the TP (*I finished my popcorn*) that the adjunct *before the end of the movie* can go. The only place that could be adjoined is TP. If it had been adjoined to T′, we would expect it to follow the subject.

There was also an example that might suggest that heads can adjoin to heads (*wumpus-hunting*), so we effectively now allow adjunction to anything in principle. However, there is no way to state "adjunction to anything is allowed in principle" in the notation (because we don't have a variable that can stand for head/bar/phrase status), so we'll need to expand that.

So, the X′ schema at this point it should look like this:

(19)

a.	$XP \rightarrow (YP)\ X'$	optional specifier, a phrase YP
b.	$X' \rightarrow X\ (ZP)$	optional complement, a phrase ZP
c.	$XP \rightarrow WP\ XP$	leftward XP adjunct, a phrase WP
d.	$XP \rightarrow XP\ WP$	rightward XP adjunct, a phrase WP
e.	$X' \rightarrow WP\ X'$	leftward X' adjunct, a phrase WP
f.	$X' \rightarrow X'\ WP$	rightward X' adjunct, a phrase WP
g.	$X \rightarrow W\ X$	leftward X adjunct, a head W
h.	$X \rightarrow X\ W$	rightward X adjunct, a head W

For adjunction where we can't tell whether it is to XP or to X', we will presume it is to XP. That is most of the time. The only cases that occur to me where we need to assume adjunction is to an X' level is to T' (when an adverb comes between the subject and an auxiliary, to the extent that is grammatical).

9 Determiner phrases and pronouns

For various reasons we came to the conclusion that the nominal arguments in sentences are actually projections of D—they are DPs. This means that there is always a D, even if you can't hear one.

(20) the book

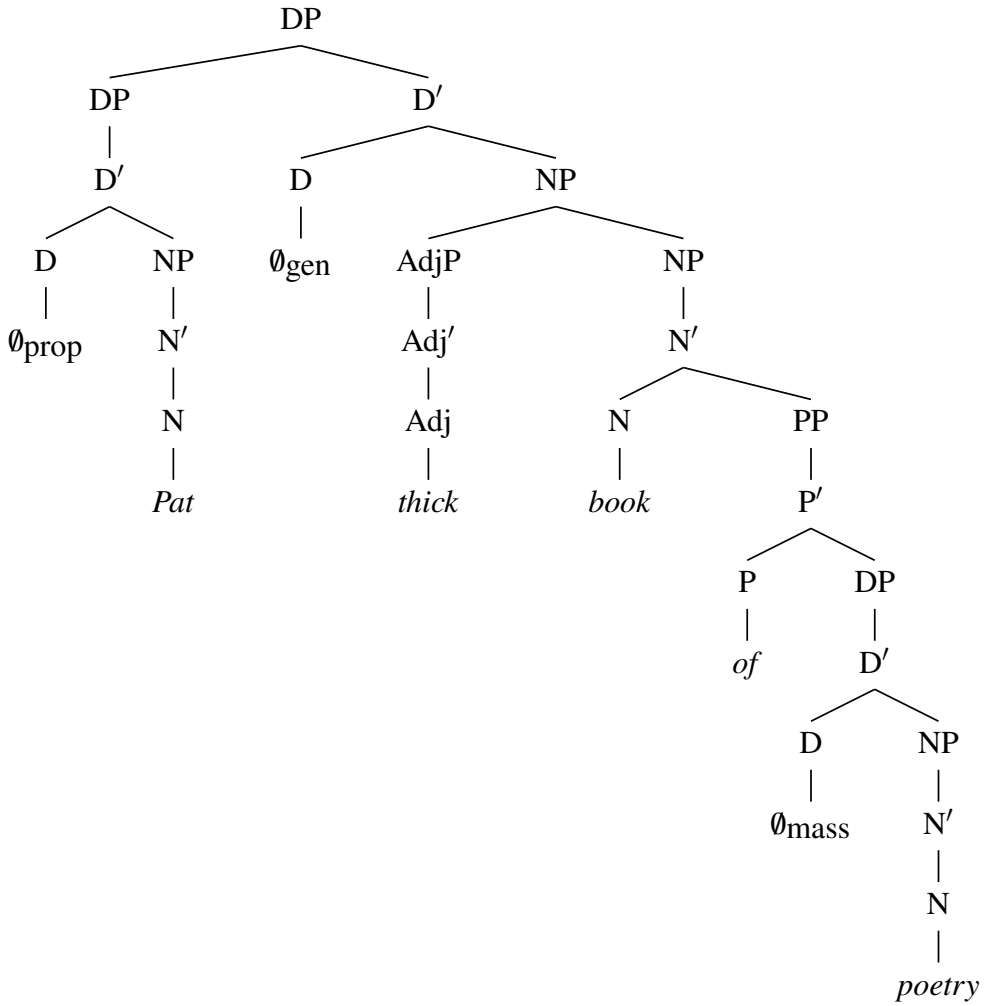
(21) a book

(22) $\emptyset_{\text{indef}}$ books — alternatively, $\emptyset_{\text{pl}}$

(23) $\emptyset_{\text{indef}}$ corn — alternatively, $\emptyset_{\text{mass}}$

(24) $\emptyset_{\text{prop}}$ Pat

For possessives, we will adopt a regular X' structure for those. We will assume the head is the determiner D $\emptyset_{\text{gen}}$, reason being that we can assume the same D for possessors that are pronouns or full DPs. (The idea is that a pronoun is realized in its genitive form when it is in the specifier of a D $\emptyset_{\text{gen}}$, and a DP will be in the *'s* form.)



10 Complements and adjuncts

In the context of a verb phrase, there is a relatively clear distinction between things that are complements and things that are adjuncts. To recap:

Complements	Adjuncts
May be obligatory	Are always optional
Cannot be iterated	Can be iterated
Display lexical sensitivity	Are not lexically sensitive
Are sisters to the head	Sister and mother node have the same label

However, there is still a lot of nuance here. It seems to be possible to consider something to be "obligatory" but yet not pronounced, which we detect semantically by noticing that there is some kind of "understood" participant even if it is not said overtly. And it certainly is not always possible to leave things unstated in English, although we have never really explored what the conditions are under which an obligatory argument could be left unpronounced.

Conceptually, if we consider that a verb represents a relationship between participants (e.g., a baking relationship that holds between an agent and a theme), the things that are needed to complete the relationship are the complements/arguments. Things that are just serving as optional modifiers are the adjuncts.

There are fuzzy cases, right from the outset. So, given that you can say *I ate* and *I ate pizza*, is *eat* a transitive verb with an obligatory object that you can sometimes leave unsaid?

One type of argument I use when trying to decide this is to see if the hypothetically omitted argument can be referred to with a pronoun later. I think with *eat* this does not work.

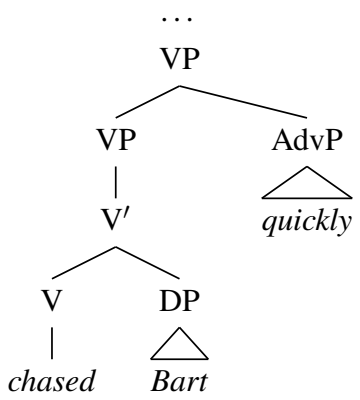
(25) a. I ate pizza. It had pineapple on it.
b. * I ate. It had pineapple on it.

The conclusion I take from that is that there are two verbs *eat*, a transitive verb *eat* that has an obligatory argument (a theme) and an intransitive one *eat*. The apparent optionality is not actual optionality—rather, it is the optionality based on the free will to choose which verb you use.

It is of course likely that there is some deeper relationship between the two verbs *eat*. One may be derived from the other one, or perhaps they just historically came from the same source. The fact that they have not drifted apart suggests that they are still related in some deeper way, but still not in a way that we're attempting to model. For us, we just assume that there are two verbs.

All of this makes running these tests hard, you need to think about it. The fact that sometimes you find *eat* with an object and sometimes you don't does not entitle you to conclude that the object of *eat* is optional (and thus some kind of adjunct).

Structurally, adjuncts are attached in a particular way as well. The basic idea is that if you have some basic phrase X′ (or XP), and you attach an adjunct to it, that does not change the nature of the basic phrase. It is still an X′ (or XP). And so, the representation reflects that. Here we had a VP without the adjoined adverb, and after we adjoin the adverb we still have a VP.



Complements and adjuncts exist beyond just verbs as well, though the intuitions about semantics become less useful. But, the object of a P is a complement, for example. The NP sister of D is a complement. It's really a structural notion.

11 Outro

That I think basically covers the motivations and the current state of things as of the point of the midterm exam.