# Syntax: The Sentence Patterns of Language

# Lesson Three

# Syntax

- Any speaker of any human language can produce and understand an infinite number of possible sentences
- Thus, we can't possibly have a mental dictionary of all the possible sentences
- Rather, we have the rules for forming sentences stored in our brains
  - **Syntax** is the part of grammar that pertains to a speaker's knowledge of sentences and their structures

# What the Syntax Rules Do

- The rules of syntax combine words into phrases and phrases into sentences
- They also specify the correct word order for a language
  - For example, English is a Subject-Verb-Object (SVO) language
    - *The President nominated a new Supreme Court justice*
    - **President the new Supreme justice Court a nominated*
- They also describe the relationship between the meaning of a group of words and the arrangement of the words
  - *I mean what I say* vs. *I say what I mean*

# What the Syntax Rules Do

- The rules of syntax also specify the grammatical relations of a sentence, such as the subject and the direct object
  - *Your dog chased my cat* vs. *My cat chased your dog*
- Syntax rules specify constraints on sentences based on the verb of the sentence

**The boy found*
**The boy found in the house*
*The boy found the ball*

**Disa slept the baby*
*Disa slept*
*Disa slept soundly*

*Zack believes Robert to be a gentleman*
**Zack believes to be a gentleman*
*Zack tries to be a gentleman*
**Zack tries Robert to be a gentleman*

# What the Syntax Rules Do

- Syntax rules also tell us how words form groups and are hierarchically ordered in a sentence

  "*The captain ordered the old men and women off the ship*"

- This sentence has two possible meanings:

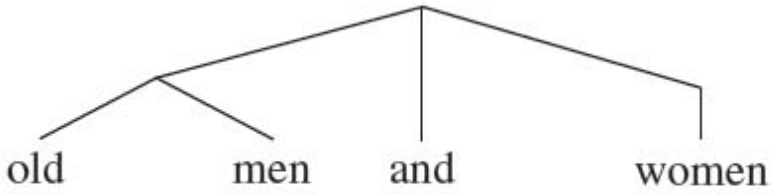
  - 1. The captain ordered the old men and the old women off the ship
  - 2. The captain ordered the old men and the women of any age off the ship

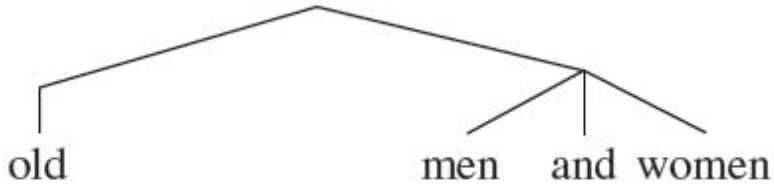
- The meanings depend on how the words in the sentence are grouped (specifically, to which words is the adjective 'old' applied?)

  - 1. The captain ordered the [old [men and women]] off the ship
  - 2. The captain ordered the [old men] and [women] off the ship

# What the Syntax Rules Do

- These groupings can be shown hierarchically in a tree




- These trees reveal the structural ambiguity in the phrase "old men and women"
  - Each structure corresponds to a different meaning
- Structurally ambiguous sentences can often be humorous:
  - Catcher: "Watch out for this guy, he's a great fastball hitter."
  - Pitcher: "No problem. There's no way I've got a great fastball."

# What Grammaticality Is Not Based On

- People can judge grammaticality without ever having heard the sentence before

  *"Enormous crickets in pink socks danced at the prom."*

- Grammaticality is not based on meaningfulness

  *"Colorless green ideas sleep furiously."*

  *"A verb crumpled the milk."*

  *'Twas brillig, and the slithy toves*
  *Did gyre and gimble in the wabe*

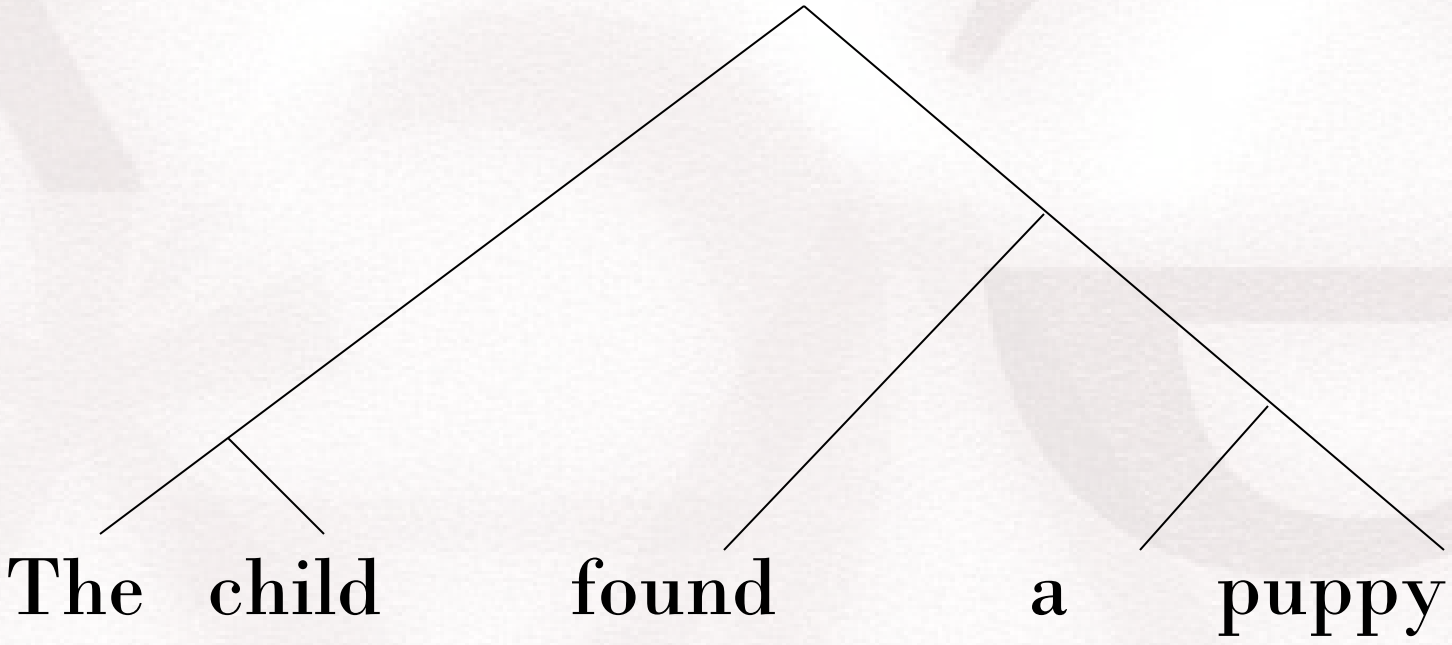
- Grammaticality is not based on truthfulness

# Sentence Structure

- We could say that the sentence "The child found the puppy" is based on the template Det—N—V—Det—N
  - But this would imply that sentences are just strings of words without internal structure
  - This sentence can actually be separated into several groups:
    - [the child] [found a puppy]
    - [the child] [found [a puppy]]
    - [[the] [child]] [[found] [[a] [puppy]]

# Sentence Structure

- A **tree diagram** can be used to show the hierarchy of the sentence:



# Constituents and Constituency Tests

- **Constituents** are the natural groupings in a sentence
- Tests for constituency include:
  - 1. "stand alone test": if a group of words can stand alone, they form a constituent
    - A: "What did you find?"
    - B: "A puppy."
  - 2. "replacement by a pronoun": pronouns can replace constituents
    - A: "Where did you find a puppy?"
    - B: "I found *him* in the park."
  - 3. "move as a unit" test: If a group of words can be moved together, they are a constituent
    - A: "The child found a puppy." → "A puppy was found by the child."

# Constituents and Constituency Tests

- Experimental evidence shows that people perceive sentences in groupings corresponding to constituents

- Every sentence has at least one constituent structure

  - If a sentence has more than one constituent structure, then it is ambiguous and each constituent structure corresponds to a different meaning

# Syntactic Categories

- A **syntactic category** is a family of expressions that can substitute for one another without loss of grammaticality

| | |
|---|---|
| *The child* found a puppy. | The child ***found a puppy***. |
| *A police officer* found a puppy. | The child ***ate the cake***. |
| *Your neighbor* found a puppy. | The child ***slept***. |

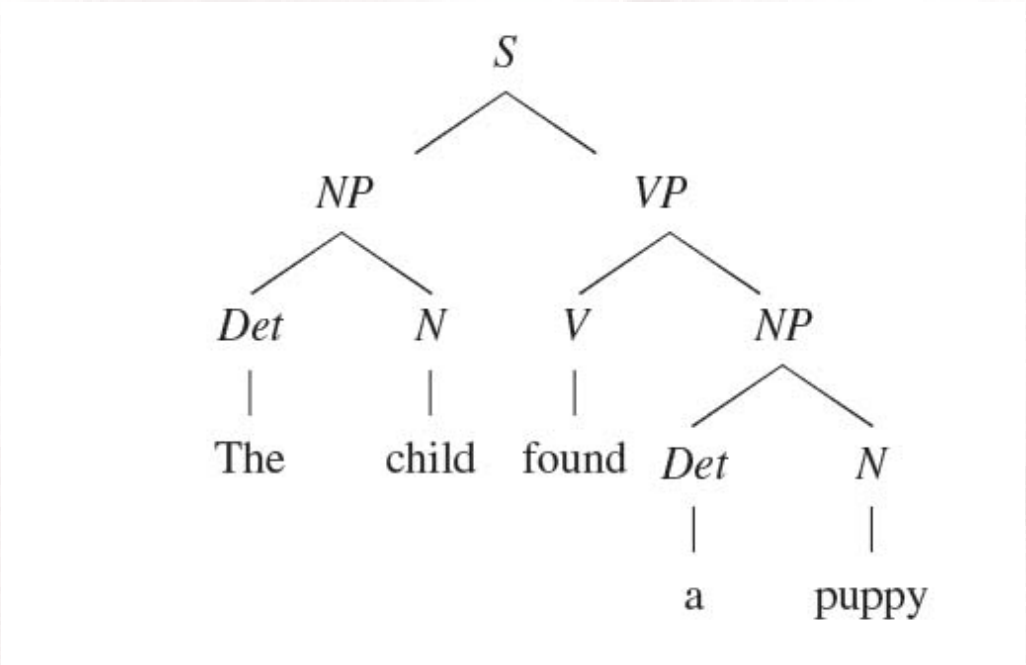
- All the underlined groups constitute a syntactic category known as a **noun phrase (NP)**
  - NPs may be a subject or an object of a sentence, may contain a determiner, proper name, pronoun, or may be a noun alone
- All the bolded groups constitute a syntactic category known as a **verb phrase (VP)**
  - VPs must always contain a verb but may also contain other constituents such as a noun phrase or a **prepositional phrase (PP)**

# Syntactic Categories

- Phrasal categories: NP, VP, PP, AdjP, AdvP
- Lexical categories:
  - Noun: *puppy, girl, soup, happiness, pillow*
  - Verb: *find, run, sleep, realize, see, want*
  - Preposition: *up, down, across, into, from, with*
  - Adjective: *red, big, candid, lucky, large*
  - Adverb: *again, carefully, luckily, very, fairly*
- Functional categories:
  - Auxiliary: verbs such as *have,* and *be,* and modals such as *may, can, will, shall, must*
  - Determiners: *the, a, this, that, those, each, every*

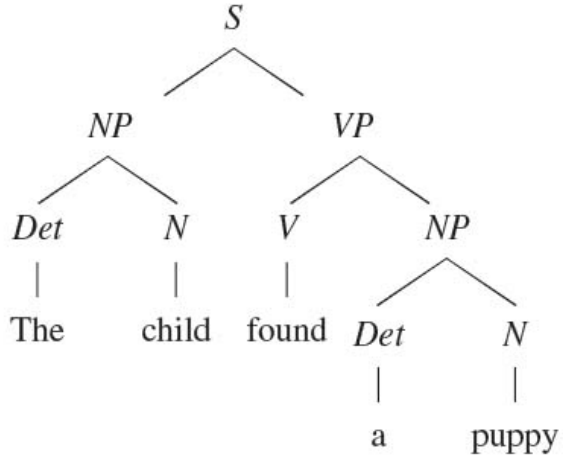
# Phrase Structure Trees and Rules

- A **phrase structure (PS) tree** (or **constituent structure tree)** is a tree diagram with syntactic category information:



# Phrase Structure Trees and Rules

- In a PS tree, every higher node **dominates** all the categories beneath it
  - S dominates everything
- A node **immediately dominates** the categories directly below it
  - The VP immediately dominates the V and the NP

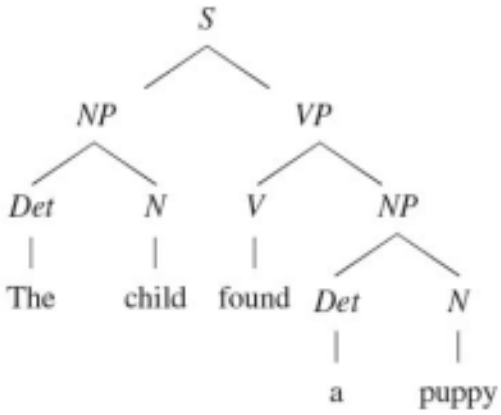



- **Sisters** are categories that are immediately dominated by the same node
  - The V and the NP are sisters

# Phrase Structure Trees and Rules

- Phrase structure rules specify the well-formed structures of a sentence
  - A tree must match the phrase structure rules to be grammatical
- This tree is formed using the following rules:

S → NP VP
NP → Det N
VP → V NP



# Phrase Structure Trees and Rules

- But, a VP could also contain:
  - A verb only: *The woman <u>laughed</u>.*
  - A PP: *The woman laughed <u>in the garden</u>.*
  - A CP: *The man said <u>that the woman laughed</u>.*

- We therefore have to account for these possible sentences in our phrase structure rules and need the following rules so far:

1. S → NP VP
2. NP → Det N
3. VP → V NP
4. VP → V
5. VP → V PP
6. PP → P NP
7. VP → V CP
8. CP → C S

# Phrase Structure Trees and Rules

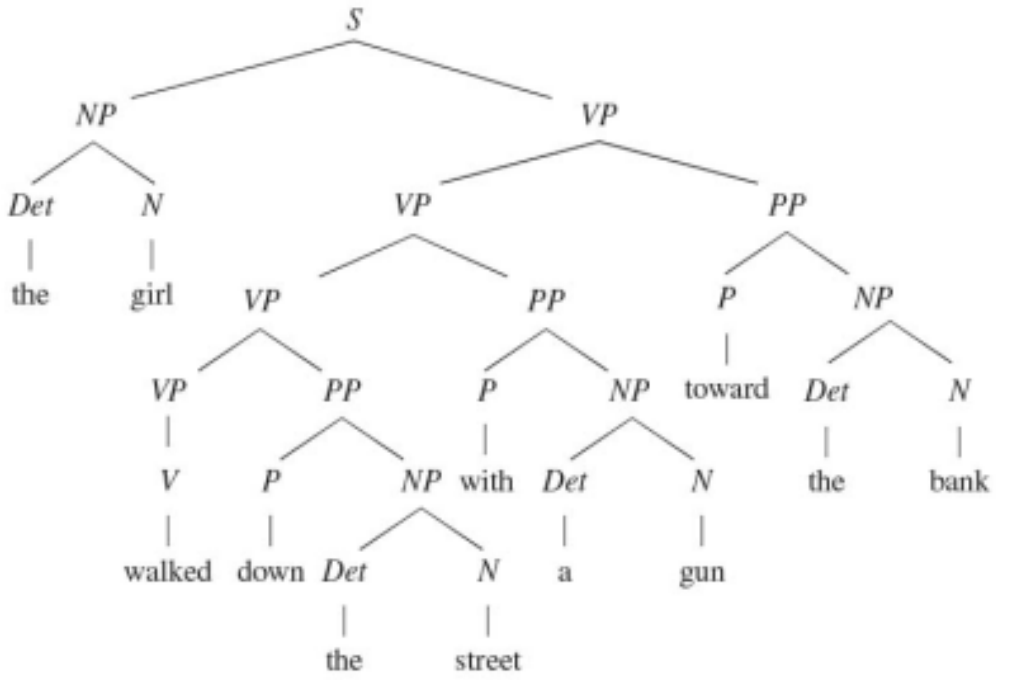
- Phrase structure rules are used as a guide for building trees
- To build a tree you expand every phrasal category until only the lexical categories remain
- By following the guidelines in the phrase structure rules, we can generate all the possible grammatical sentences in a language
  - Any tree that violates the phrase structure rules will represent an ungrammatical sentence

# The Infinity of Language: Recursive Rules

- **Recursive** rules are rules in which a phrasal category can contain itself
  - Such as an NP containing another NP…
    - NP → NP PP allows for the sentence: *I saw the man with the telescope in a box.*
  - …or a VP containing a VP…
    - VP → VP PP allows for a sentence like: *The girl walked down the street in the rain.*
  - …or a CP containing a S…
    - CP → C S allows for embedding sentences inside sentences such as: *The children hope that the teacher knows that they are good students.*
- Recursive rules allow a grammar to generate an infinite number of sentences (in this case by adding PPs indefinitely)

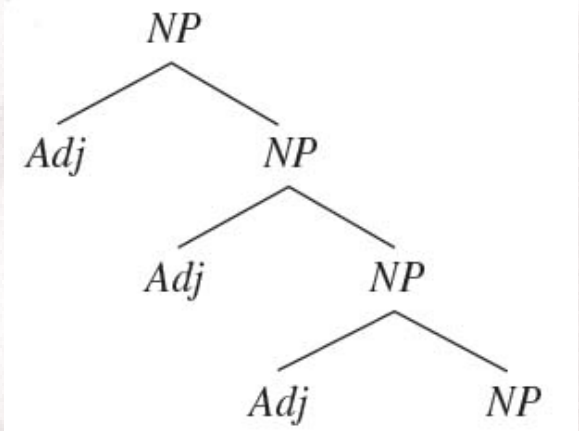
# The Infinity of Language: Recursive Rules

- The recursive phrase structure rule VP → VP PP allows the following tree:



# Recursive Adjectives and Possessives

- The case of multiple adjectives leads us to revise our PS rules:
  - *The kindhearted, intelligent, handsome boy had many girlfriends* leads us to create the PS rule NP → Adj NP

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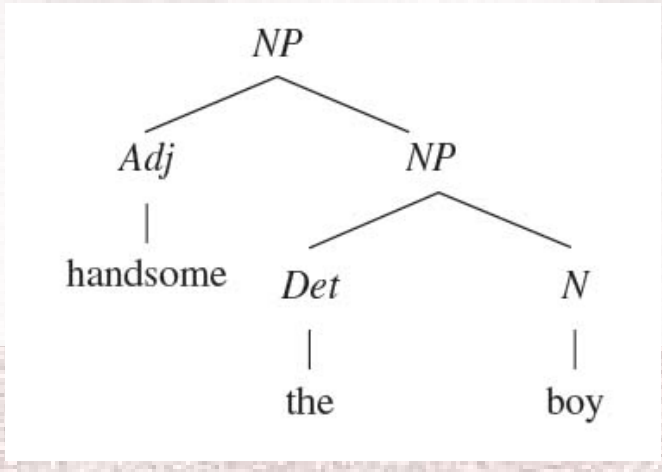
  - However, this rule would allow an adjective to come before a determiner, which is not possible in English



# Recursive Adjectives and Possessives

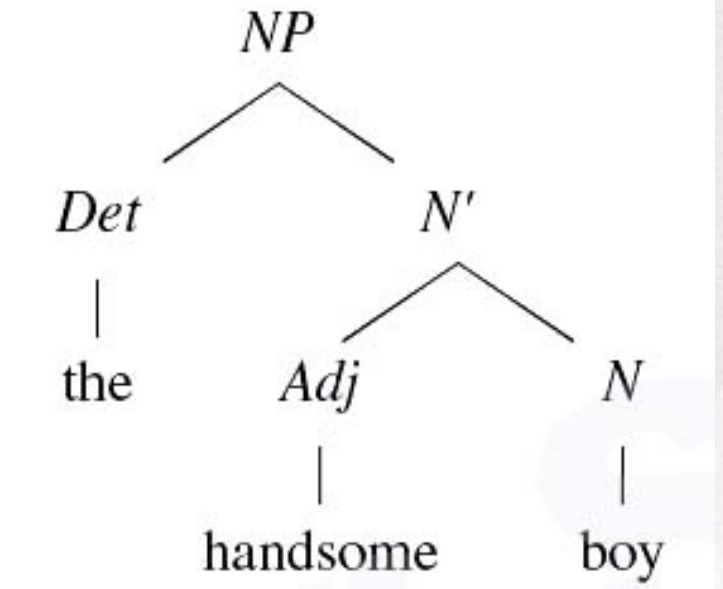
- **The problem is that determiners and adjectives function differently**
  - **They both modify a noun**
  - **But, while an NP can have multiple adjectives, it can only have one determiner**
  - **Also, an adjective directly modifies a noun whereas a determiner modifies the chunk of Adj + N**

    - **Therefore the determiner must be the sister of the group [Adj + N]**

    - **So, we need to add one more level of structure between the NP and the N which is called N'**

    - **Now we have the necessary sisterhood requirements and we must revise our phrase structure rules to account for N'**

      **NP → Det N'**
      **N' → Adj N**
      **N' → N**



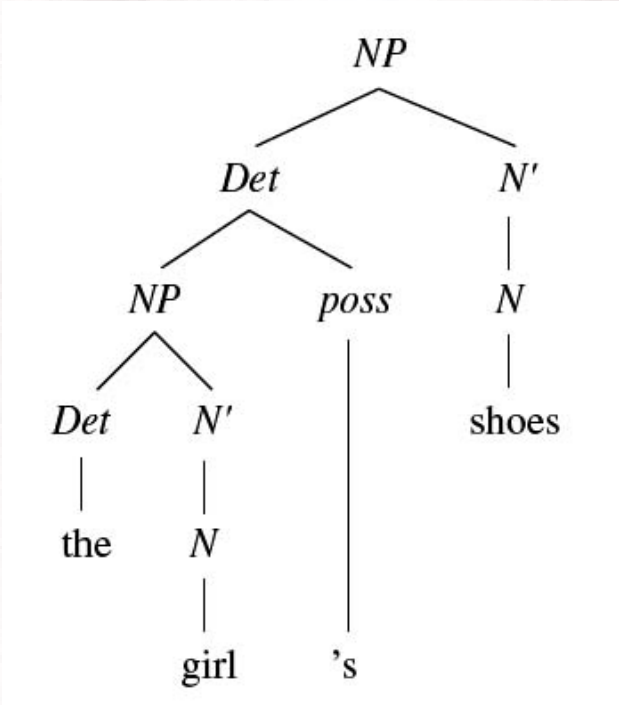
# Recursive Adjectives and Possessives

- Possessor NPs such as in ***the girl's*** *shoes* function as a determiner with the *'s* representing possession (*poss*)

- So, we need to add another PS rule to our inventory:
  Det → NP poss

- This new rule forms a recursive set with the rule NP → Det N'

- The recursive nature of PS rules is common to all languages



# Heads and Complements

- Phrase structure trees also show the relationships among the elements in a sentence
  - **The NP immediately dominated by the S is the subject**
  - **The NP immediately dominated by the VP is the direct object**
- **Another relationship is between the head of a phrase and its sisters**
  - **The head of a phrase names the phrase (e.g. the noun is the head of a noun phrase, a verb is the head of a verb phrase, etc.)**
  - **Every phrase has a head, but may or may not take a complement, or sister category**
    - **For example, a VP will have a head (a verb) and may take a complement such as an NP or a CP**

# Heads and Complements: Selection

- Some heads require a certain type of complement and some don't
  - The verb *find* requires an NP: *Alex found the ball.*
  - The verb *put* requires both an NP and a PP: *Alex put the ball in the toy box.*
  - The verb *sleep* cannot take a complement: *Alex slept.*
  - The noun *belief* optionally selects a PP: *the belief in freedom of speech.*
  - The adjective *proud* optionally selects a PP: *proud of herself*
- **C-selection** or **subcategorization** refers to the information about what types of complements a head can or must take

# Heads and Complements: Selection

- Verbs also select subjects and complements based on semantic properties (**S-selection**)
  - The verb murder requires a human subject and object

    *!The beer murdered the lamp.*

  - The verb drink requires its subject to be animate and its optional complement object to be liquid

    *!The beer drank the lamp.*

- For a sentence to be well-formed, it must conform to the structural constraints of PS rules and must also obey the syntactic (C-selection) and semantic (S-selection) requirements of the head of each phrase

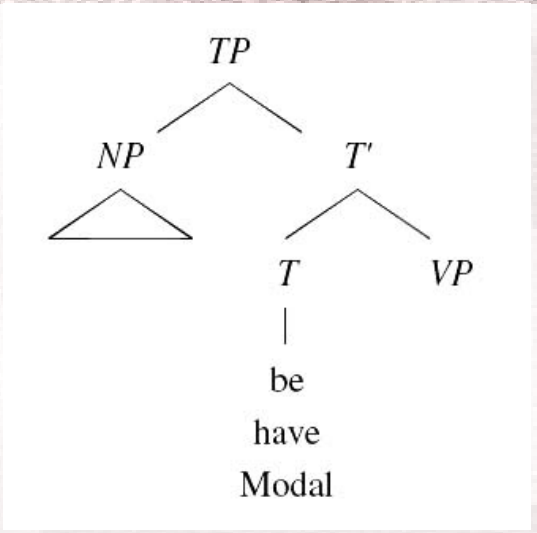
# What Heads the Sentence

- The category of Auxiliary verbs (such as *will*, *has, is,* and *may* as well as modals *might, could, would*, and *can*) heads a sentence because a sentence is about a situation of state of affairs that happens at some point in time

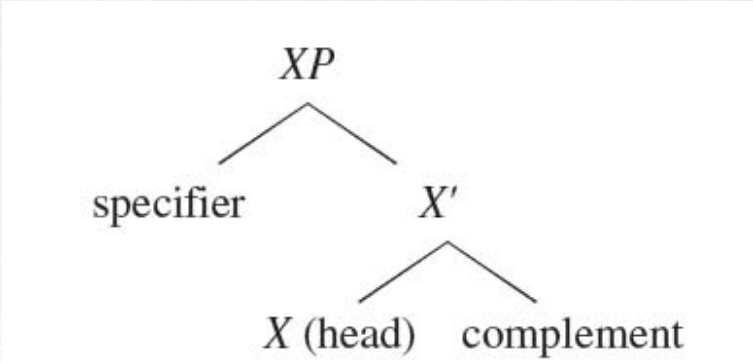
- Particular kinds of auxiliaries go with certain kinds of VPs
  - *be* selects the progressive form of the verb
    - *The baby is eating.*
  - *have* selects the past participle form of the verb
    - *The baby has eaten.*
  - The modals select the infinitival form of the verb
    - The baby must eat.

# What Heads the Sentence

- Many linguists use the symbols **T (tense)** and **TP (tense phrase)** instead of Aux and S, with the TP having an intermediate **T'** category

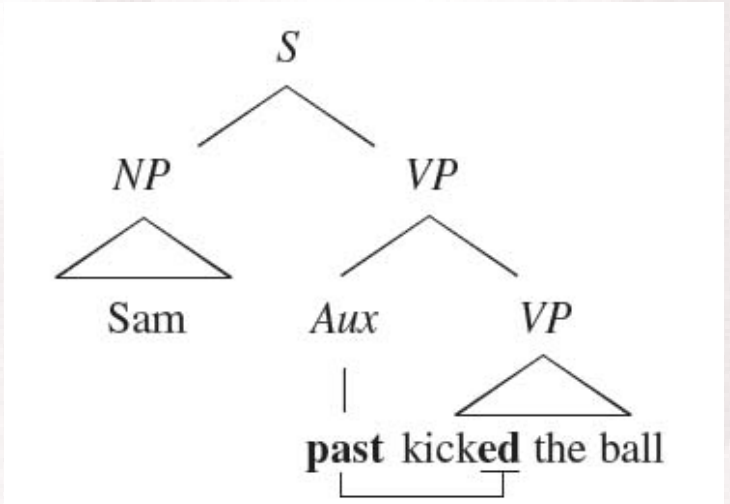



- **X-bar theory** is the theory that all XPs have three levels of structure
  - 1. the XP
  - 2. the specifier (modifier)
  - 3. X' with head X and a complement



# What Heads the Sentence

- We can now add the rule VP → Aux VP into our PS rules
- However, not all sentences seem to have auxiliaries
  - *Sam kicked the soccer ball.*
- But, this sentence does have the past tense morpheme *–ed*, and in sentences without an auxiliary, the tense is the head of the S
  - Instead of having a word under Aux, there is a tense specification
  - The tense specification must match the inflection on the verb



# Structural Ambiguities

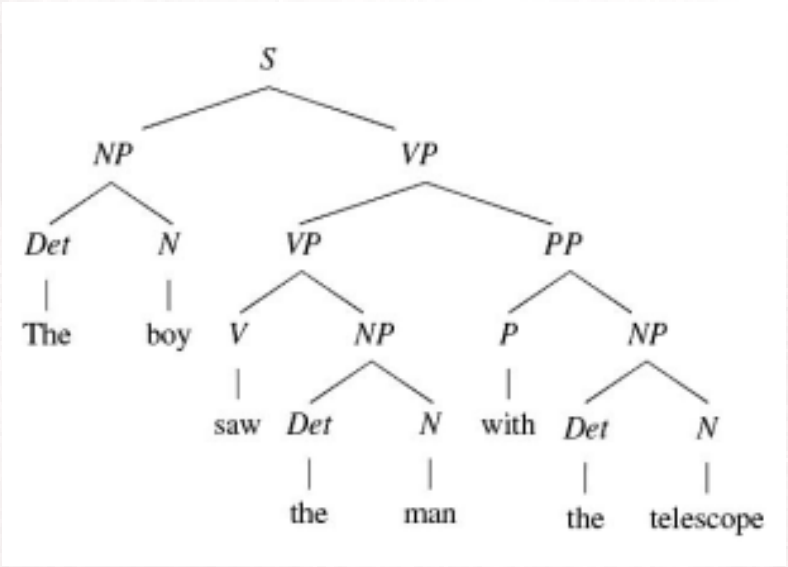
- The following sentence has two meanings:

  *The boy saw the man with the telescope*

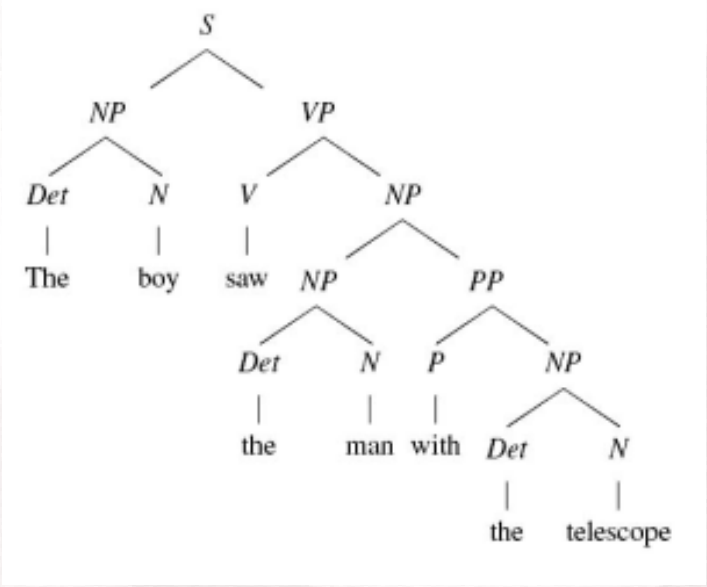
- The meanings are:
  - 1. The boy used the telescope to see the man
  - 2. The boy saw the man who had a telescope

- Each of these meanings can be represented by a different phrase structure tree
  - The two interpretations are possible because the PS rules allow more than one structure for the same string of words

# Structural Ambiguities




- The boy used a telescope to see the man




- The boy saw the man who had a telescope

# Other Structures

- Thus far we have fourteen phrase structure rules in our inventory
- However, this set is not complete and cannot account for sentences such as:
  - 1. *The dog completely destroyed the house.*
  - 2. *The cat and the dog are friends.*
  - 3. *The cat is coy.*

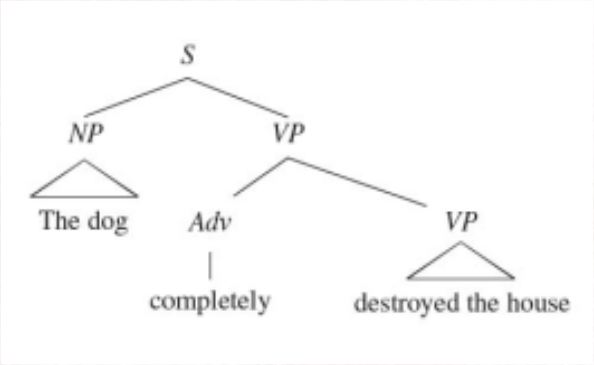
| | | | |
|---|---|---|---|
| 1. | S | → | NP VP |
| 2. | NP | → | Det N' |
| 3. | Det | → | NP poss |
| 4. | NP | → | N' |
| 5. | NP | → | NP PP |
| 6. | N' | → | Adj N' |
| 7. | N' | → | N |
| 8. | VP | → | V |
| 9. | VP | → | V NP |
| 10. | VP | → | V CP |
| 11. | VP | → | Aux VP |
| 12. | VP | → | VP PP |
| 13. | PP | → | P NP |
| 14. | CP | → | C S |

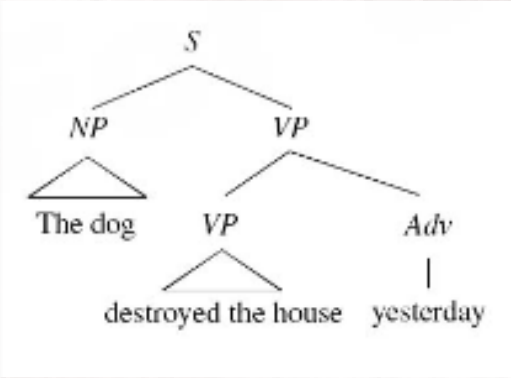
# Other Structures

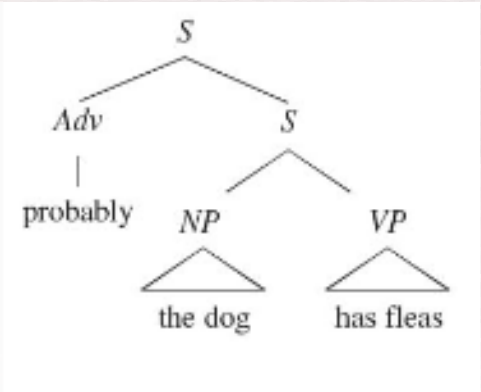
- Adverbs are modifiers that can specify how (*quickly*, *slowly*) and when (*yesterday*, *often*) an event happens

- Adverbs are sisters to phrasal categories and can go to the right or left of the phrasal categories VP and S

VP → Adv VP  VP → VP Adv  S → Adv S



# Other Structures

- A **coordinate structure** is formed when two constituents of the same category are joined with a conjunction such as *and* or *or*
  - In a coordinate structure, the second element of the coordination ($NP_2$) forms a constituent with *and* (see "move as a unit" test)

- Sentences can also have the verb *be* followed by an adjective
  - In these cases the main verb *be* acts like the auxiliaries *be* and *have*

# Sentence Relatedness

- Recognizing that some sentences are related to each other is another part of our syntactic competence

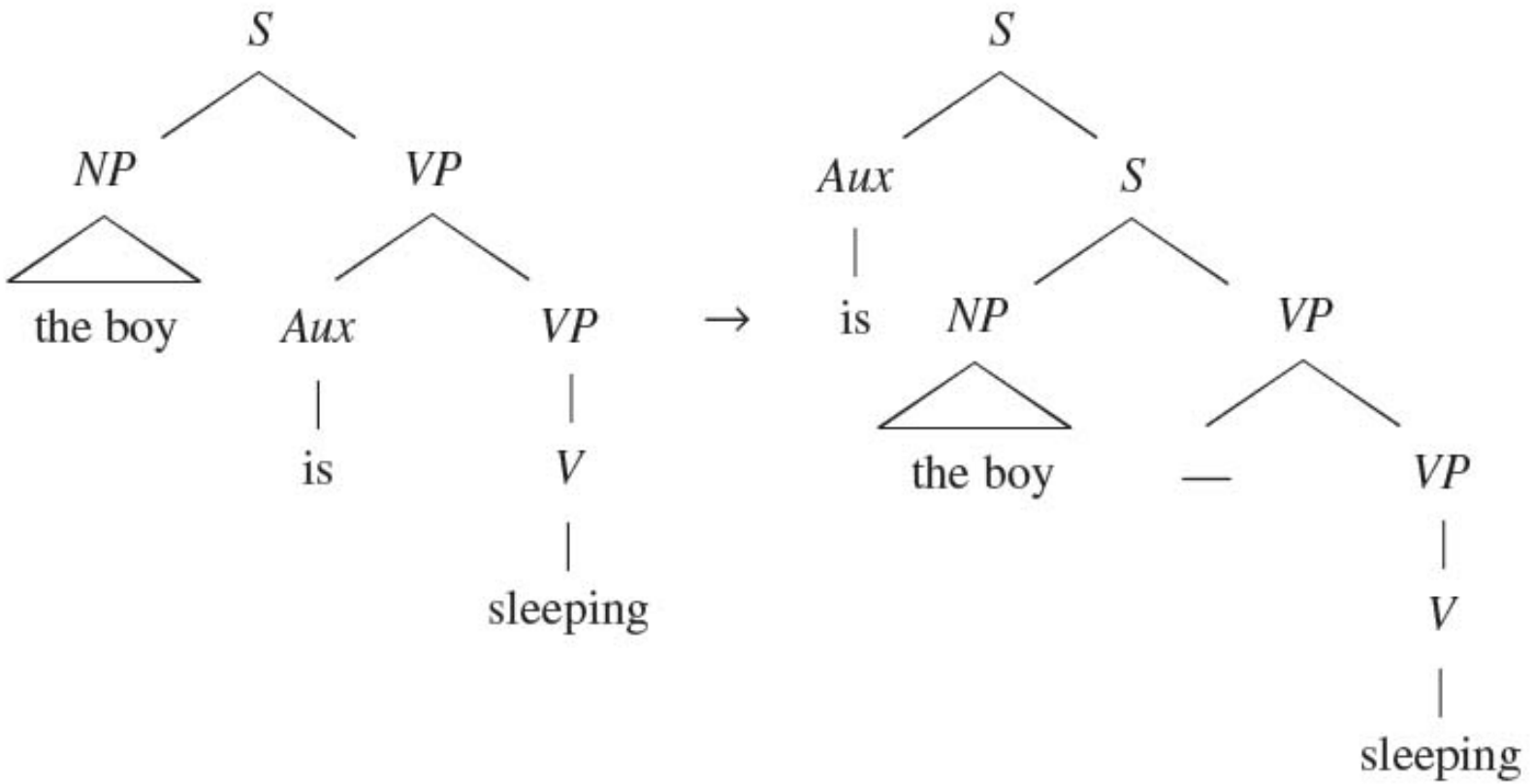
*The boy is sleeping.* *Is the boy sleeping?*

- The first sentence is a **declarative sentence**, meaning that it asserts that a particular situation exists
- The second sentence is a **yes-no question**, meaning that asks for confirmation of a situation
- The difference in meaning is indicated by different word orders, which means that certain structural differences correspond to certain meaning differences
  - For these sentences, the difference lies in where the auxiliary occurs in the sentence

# Transformational Rules

- Yes-no questions are generated in two steps:
  - 1. The PS rules generate a declarative sentence which represents the basic structure, or **deep structure** (**d-structure**) of the sentence
  - 2. A **transformational rule** then moves the auxiliary before the subject to create the **surface structure** (**s-structure**)
    - The "Move Aux" rule: Move the highest Aux to adjoin to (the root) S.
    - When the Aux is moved, this results in a gap in the tree, which is represented by a "__"
    - The gap represents the position from which a constituent has been moved

# Transformational Rules



# Transformational Rules

- Other sentence pairs that involve transformational rules are:
  - Active to passive
    - *The cat chased the mouse.* → *The mouse was chased by the cat.*
  - *there* sentences
    - *There was a man on the roof.* → *A man was on the roof.*
  - PP preposing
    - *The astronomer saw the quasar with the telescope.* → *With the telescope, the astronomer saw the quasar.*

# The Structural Dependency of Rules

- Transformations are structure-dependent, which means they act on phrase structures without caring what words are in the structures
  - PP preposing can be applied to any PP if it is immediately dominated by a VP
  - The complementizer *that* may be omitted when it precedes an embedded sentence as long as the embedded sentence does not occur in subject position
    - *I know that you know.* — *I know you know*
    - *That you know bothers me.* — **You know bothers me.*
  - Subject-verb agreement stretches across all structures between the subject and the verb

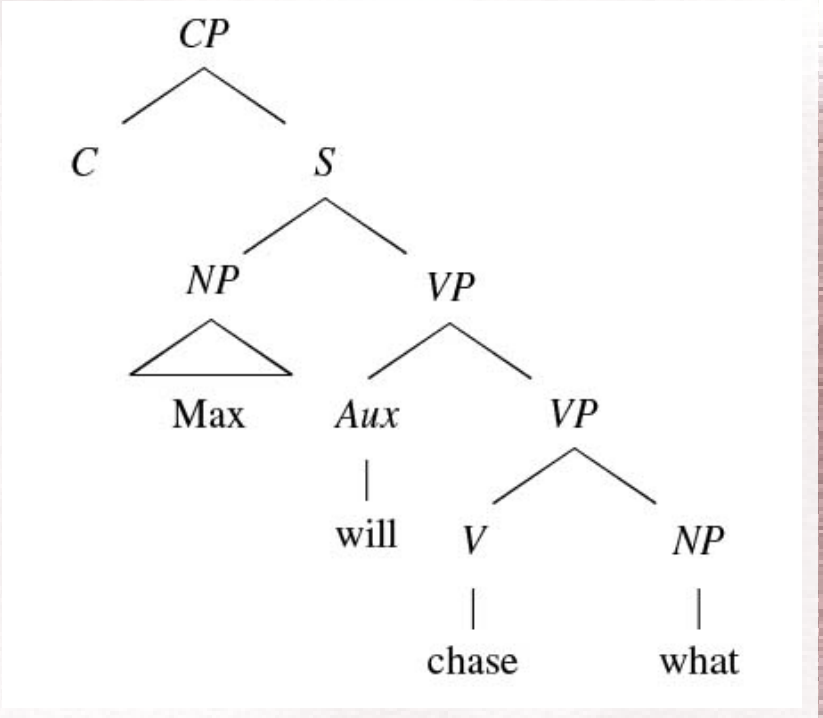
# *Wh* Questions

Example: *What will Max chase?*

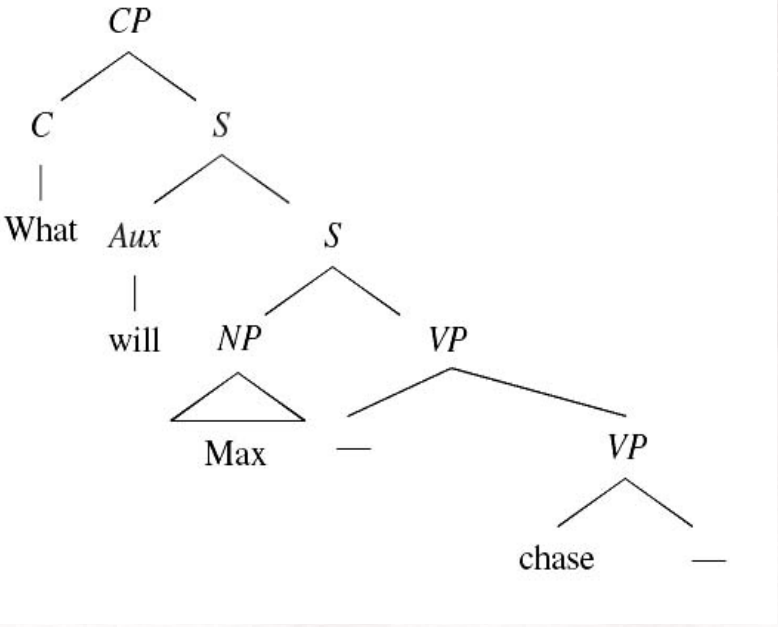
- *Wh* questions are formed in three steps:
  - 1. The PS rules generate a CP d-structure with the *wh* phrase occupying an NP position within the S (in this case a direct object position)
  - 2. The transformational rule Move Aux moves the auxiliary (in this case *will)* to adjoin with the S
  - 3. The transformational rule Move *wh* moves the *wh* word (in this case *what*) to the beginning of the sentence

# *Wh* Questions

- Deep structure for *What will Max chase?*




- Surface structure for *What will Max chase?*



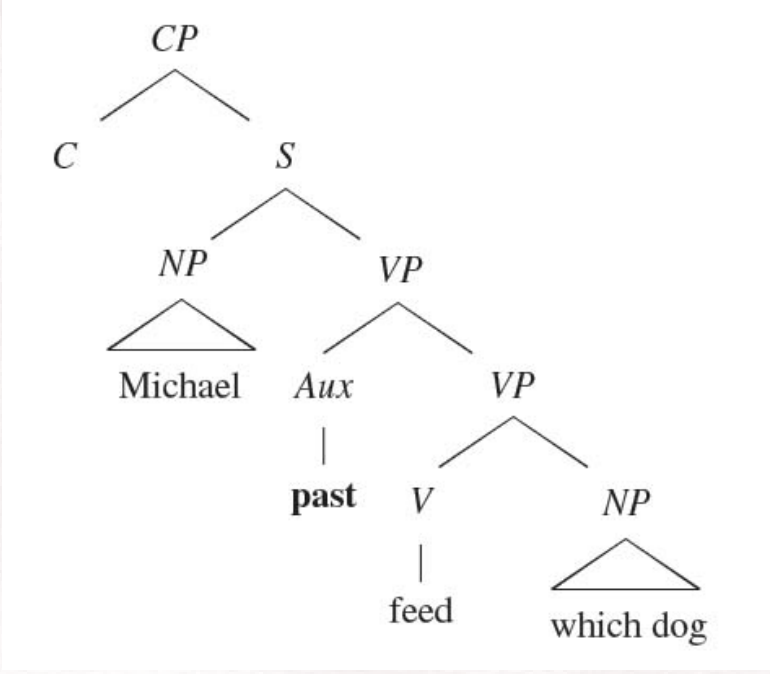
# *Wh* Questions

Example: *Which dog did Michael feed?*

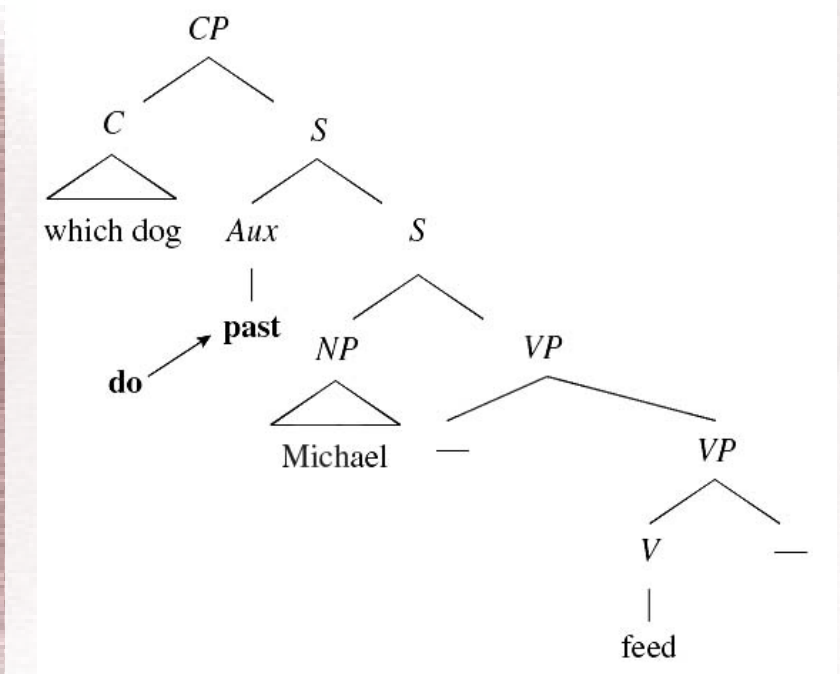
- Here the auxiliary *do* is not a part of the d-structure of the sentence
  - The d-structure is: *Michael fed which dog?*
- The Move Aux rule will move the auxiliary, in this case only the past tense
- Another rule called "*do* support" will then insert a *do* in the Aux spot to carry the tense

# *Wh* Questions

- Deep structure for *Which dog did Michael feed?*




- Surface structure for *Which dog did Michael feed?*



# UG Principles and Parameters

- Universal Grammar (UG) provides the basic design for all languages, and each language has its own **parameters**, or variations on the basic plan
  - All languages have PS rules that generate d-structures
  - All phrases consist of heads and complements
  - All sentences are headed by Aux (or T)
  - All languages seem to have movement rules
  - However, languages have different word orders within phrases and sentences, so heads and complements may be present in different orders across languages

# UG Principles and Parameters

- Not all languages have *wh* movement, but for those that do:
  - The question element always moves to C
    - But this is done in various ways (Italian vs. English vs. German vs. Czech)
  - A *wh* phrase cannot move out of certain relative clauses or clauses beginning with whether or if
  - A wh phrase cannot be extracted from inside a possessive NP
- These features of wh movement are present in all languages that allow wh movement and are part of the innate blueprint for language that is UG

# Sign Language Syntax

- The syntax of sign languages also follow the principles of UG and has:
  - Auxiliaries
  - Transformations such as **topicalization**, which moves the direct object to the beginning of a sentence for emphasis, and *wh* movement
  - Constraints on transformations

- That UG is present in signed languages and spoken languages shows that the human brain is designed to learn *language*, not just speech.