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Introduction to Linguistic  
Theory

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**Syntax: The Sentence  
Patterns of  
Language**

# Learning Goals

- Hierarchical sentence structure
- Word categories
- X-bar
- Ambiguity
- Recursion
- Transformations

# 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 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  
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

\*Disa slept the baby

Disa slept

Disa slept

# What the Syntax Rules Do

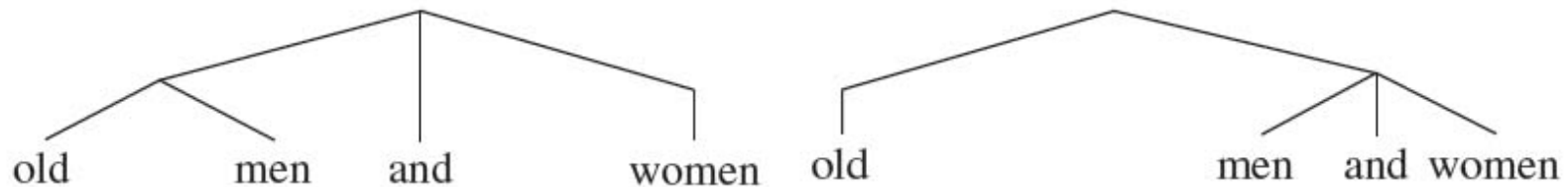
- Syntax rules also tell us how words form groups and are hierarchically ordered in a sentence

“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

- Grammaticality is not based on prior exposure to a sentence
- Grammaticality is not based on meaningfulness
- Grammaticality is not based on truthfulness



# Sentence Structure

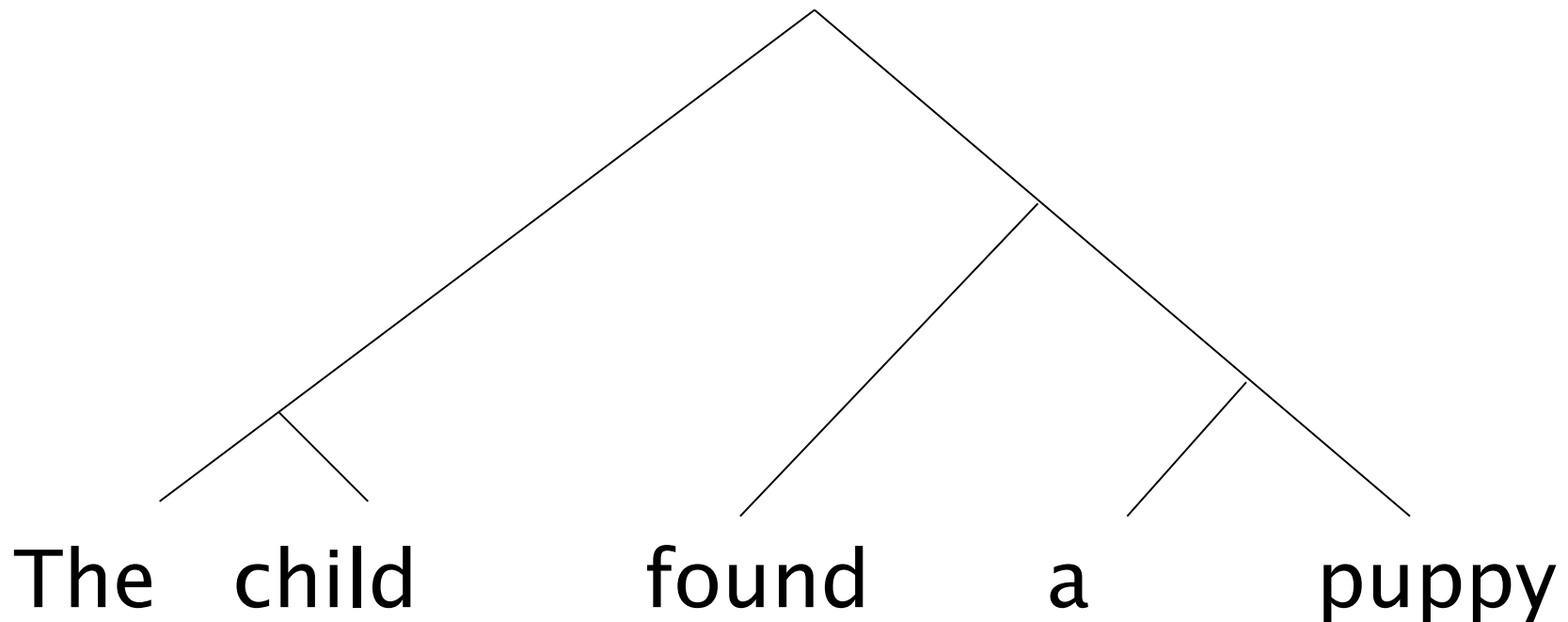
- We could say that the sentence “The child found the puppy” is based on the template:

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.”

# Constituents and Constituency Tests

- 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.

A police officer found a puppy.

Your neighbor found a puppy.

The child **found a puppy**.

The child **ate the cake**.

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

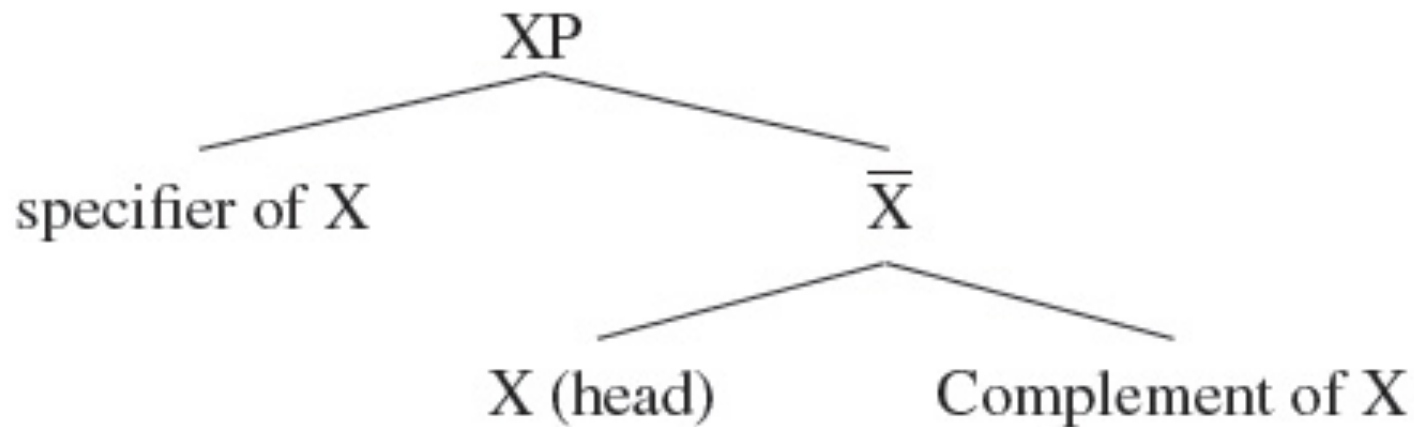
# Phrase Structure Trees

- The core of every phrase is its head
  - In the VP walk the pugs, the verb walk is the head
- The phrasal category that may occur next to a head and elaborates on the meaning of the head is a complement
  - In the PP over the river, the NP the river is the complement
- Elements preceding the head are specifiers
  - In the NP the fish, the determiner the is the specifier

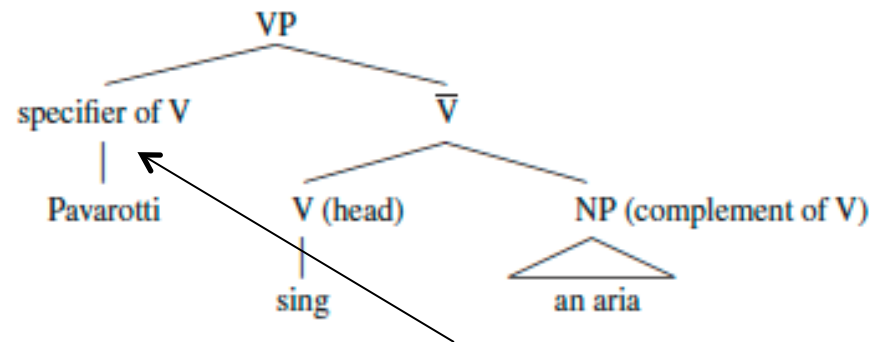
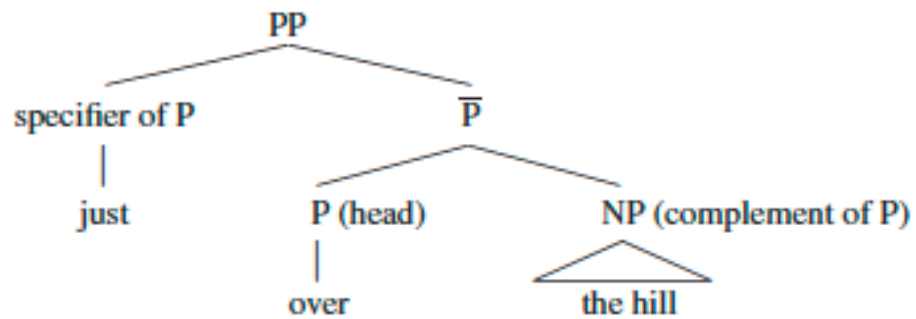


# Phrase Structure Trees

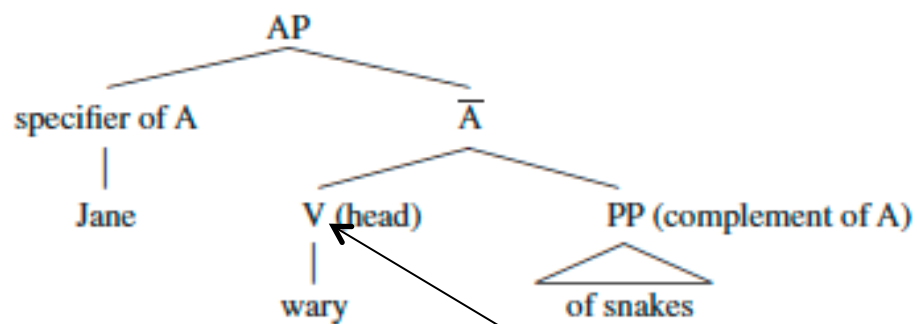
- The internal structure of phrasal categories can be captured using the X-bar schema:



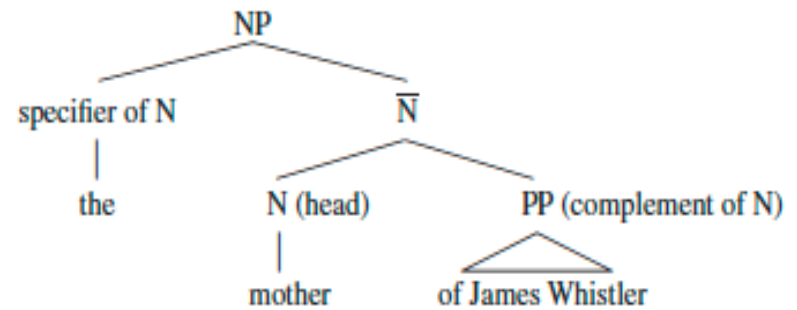
# examples



The subject will later in Spec-T

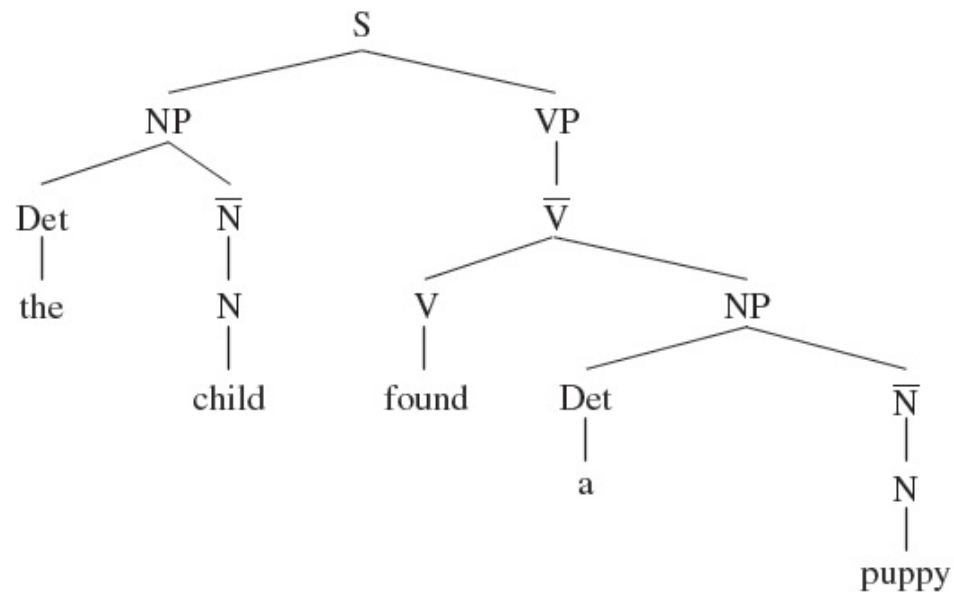


This should be A



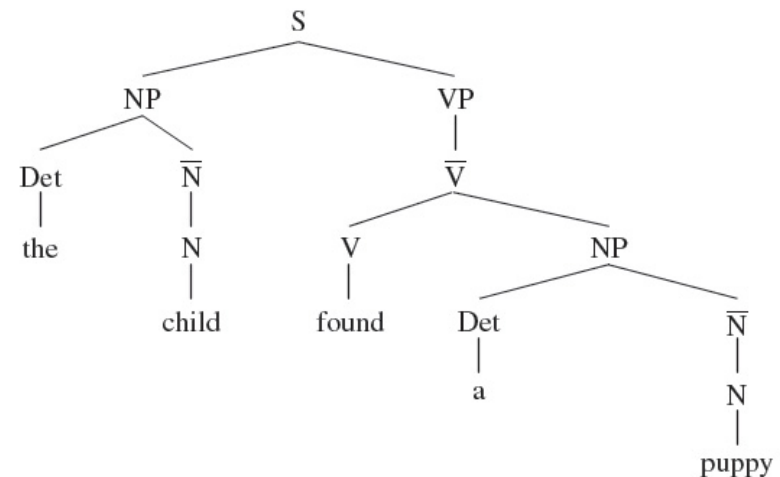
# Phrase Structure Trees

Phrase structure (PS) trees show the internal structure of a sentence along with syntactic category information:



# Phrase Structure Trees

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

# Phrase Structure Trees: 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

# Phrase Structure Trees: 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

# Building Phrase Structure Trees

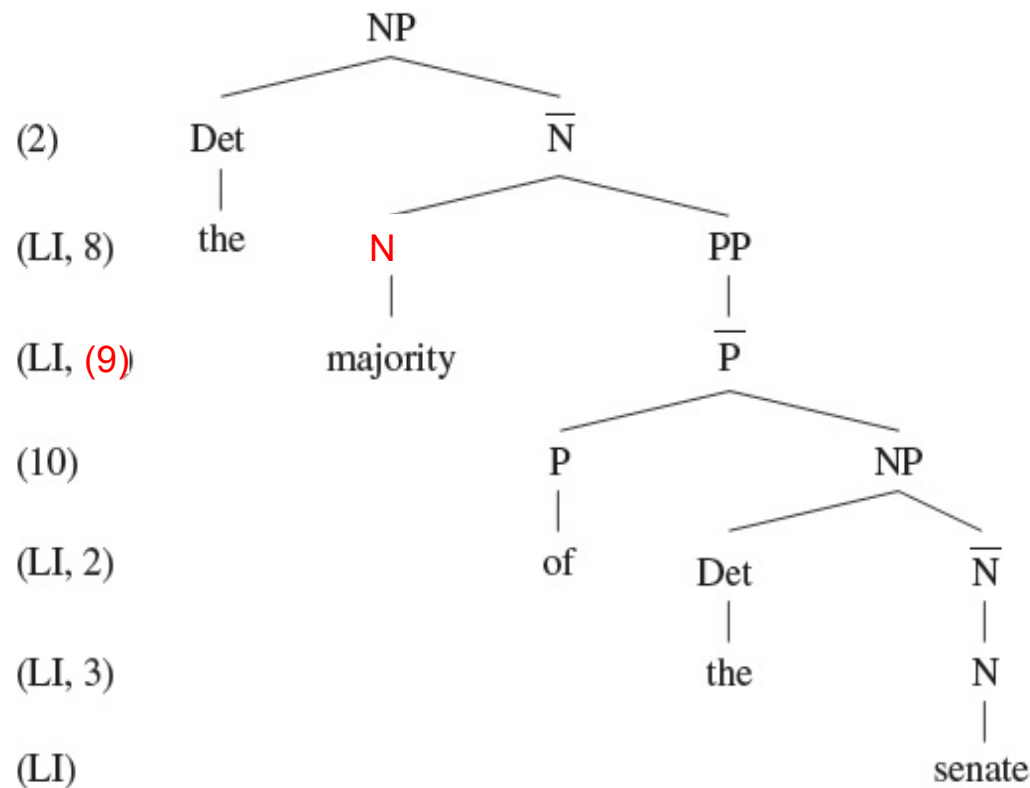
- Phrase structure rules specify the well-formed structures of a sentence
  - A tree must match the phrase structure rules to be grammatical

1.  $S \rightarrow NP VP$
2.  $\bar{NP} \rightarrow Det \bar{N}$
3.  $\bar{N} \rightarrow N$
4.  $\bar{VP} \rightarrow \bar{V}$
5.  $\bar{V} \rightarrow V NP$
6.  $\bar{V} \rightarrow V PP$
7.  $\bar{V} \rightarrow V AP$

8.  $\bar{N} \rightarrow N PP$
9.  $\bar{PP} \rightarrow \bar{P}$
10.  $\bar{P} \rightarrow P NP$
11.  $\bar{AP} \rightarrow \bar{A}$
12.  $\bar{A} \rightarrow A$
13.  $\bar{A} \rightarrow A PP$

# Building Phrase Structure Trees

The majority of the senate became afraid of the vice president.



1.  $S \rightarrow NP VP$

2.  $NP \rightarrow Det \bar{N}$

3.  $\bar{N} \rightarrow N$

4.  $VP \rightarrow \bar{V}$

5.  $\bar{V} \rightarrow V NP$

6.  $\bar{V} \rightarrow V PP$

7.  $\bar{V} \rightarrow V AP$

8.  $\bar{N} \rightarrow N PP$

9.  $PP \rightarrow \bar{P}$

10.  $\bar{P} \rightarrow P NP$

11.  $\bar{A} \rightarrow \bar{A}$

12.  $\bar{A} \rightarrow A$

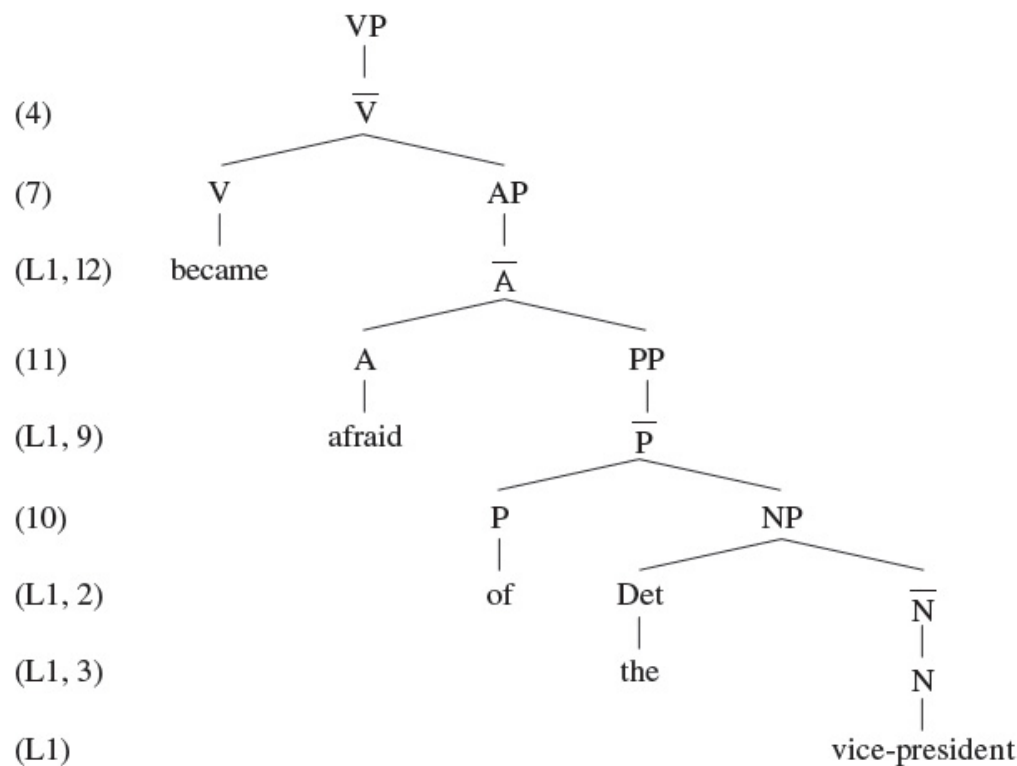
13.  $\bar{A} \rightarrow A PP$

Corrections to the textbook typos are in red.



# Building Phrase Structure Trees

The majority of the senate became afraid of the vice president.



1.  $S \rightarrow NP VP$

2.  $NP \rightarrow Det \bar{N}$

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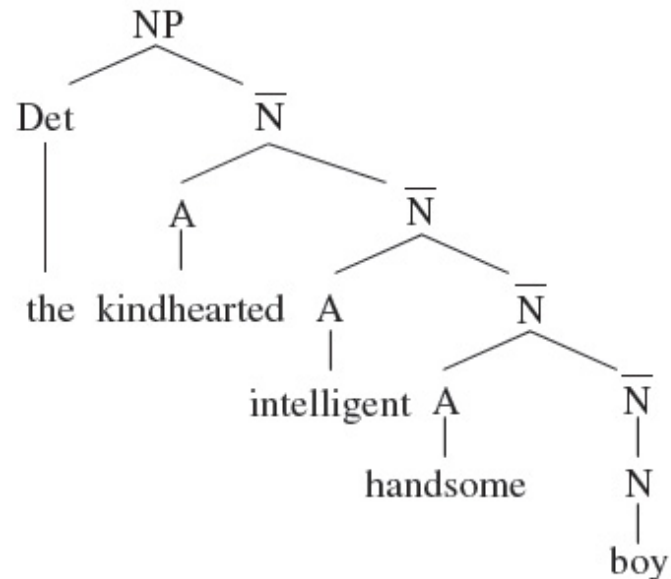
# The Infinity of Language: Recursive Rules

- **Recursive** rules are rules in which a phrasal category can contain itself

$$14. \bar{N} \rightarrow A \bar{N}$$

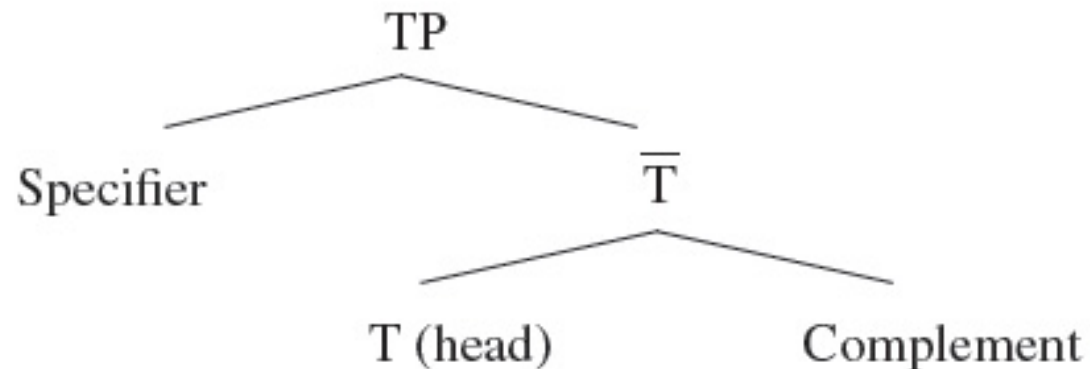
- Recursive rules allow a grammar to generate an infinite number of sentences

–the kindhearted, intelligent,  
handsome, ... boy



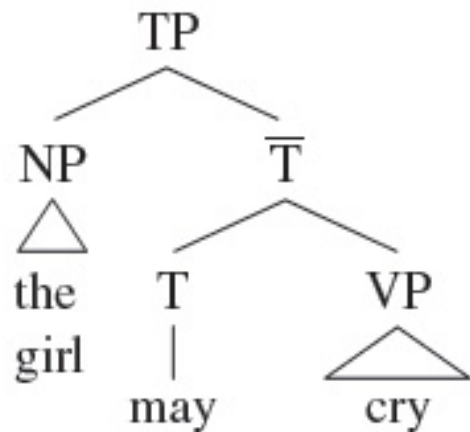
# What Heads the Sentence

- All sentences contain information about tense—when a certain event or state of affairs occurred, so we can say that Tense is the head of a sentence
  - So sentences are TPs, with T representing tense markers and modals

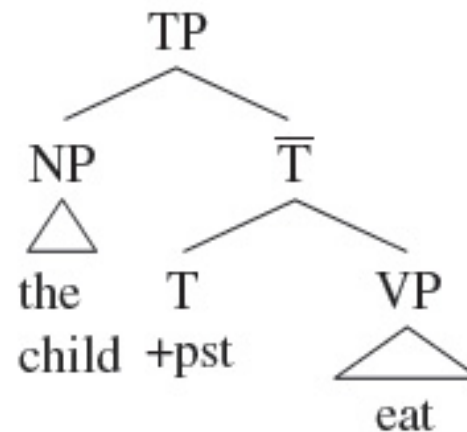


# What Heads the Sentence

The girl may cry.



The child ate.



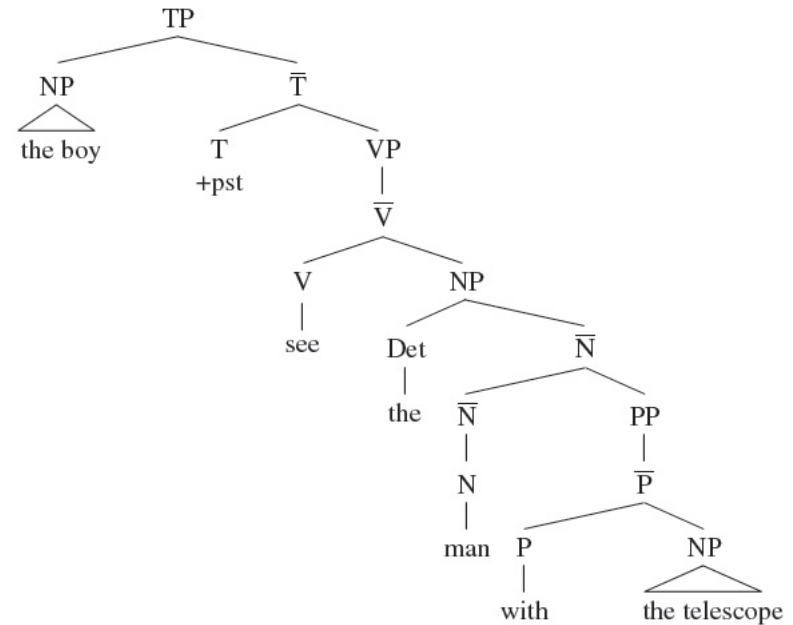
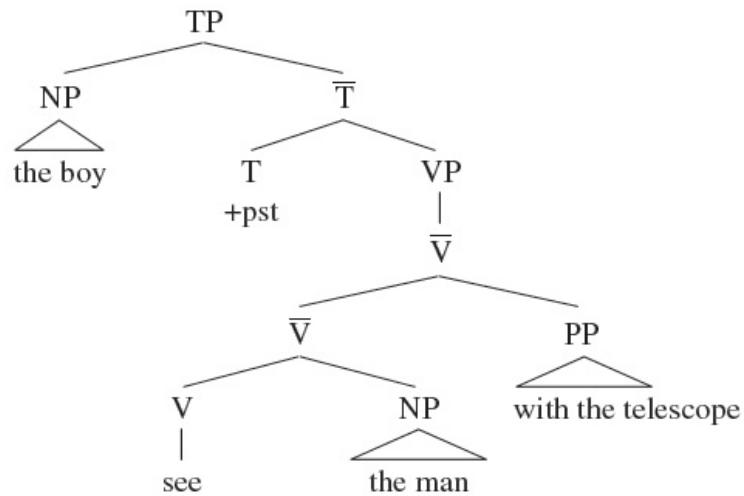
# Structural Ambiguities

- 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



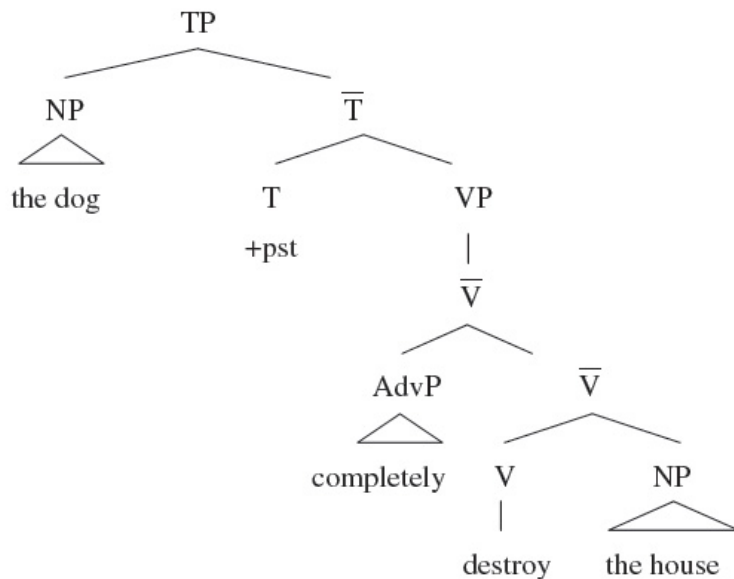
- The boy used a telescope to see the man

- The boy saw the man who had a telescope

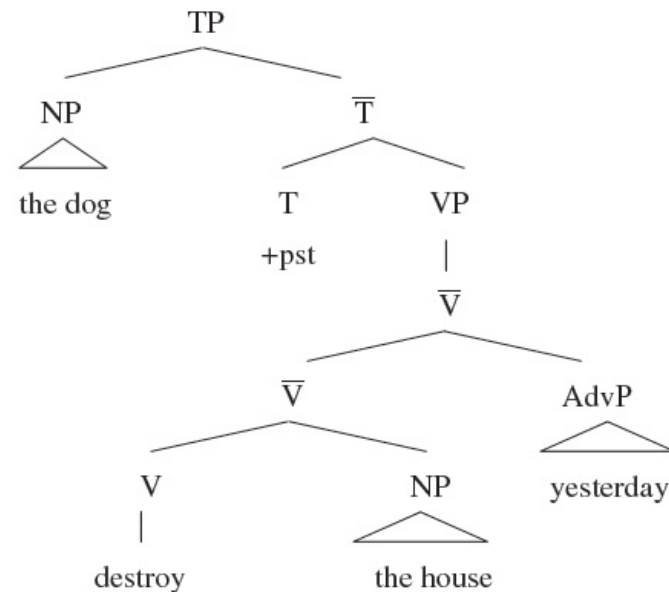
# More Structures

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

17.  $\bar{V} \rightarrow \text{AdvP } \bar{V}$



16.  $\bar{V} \rightarrow \bar{V} \text{AdvP}$



# Transformational Analysis

- 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

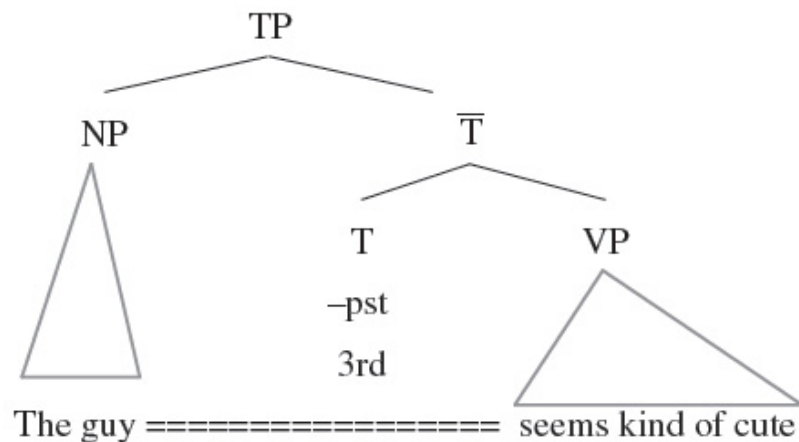
- Yes-no questions are generated in two steps:
  - 1. The PS rules generate a declarative sentence which represents the basic structure, or **deep structure (d-structure)** of the sentence
  - 2. A **transformational rule** then moves the auxiliary before the subject to create the **surface structure (s-structure)**

# 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
  - The Move rule can be applied to any PP as long as it is an adjunct to V.
  - Subject-verb agreement stretches across all structures between the subject and the verb:

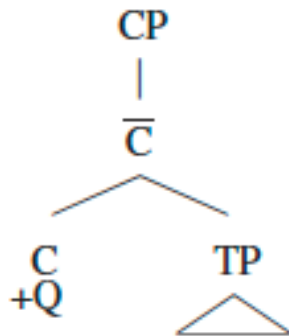


# Yes/No

- The formation of yes-no questions comes from the transformation Move relocating the T from the corresponding declarative sentence:
- The boy will sleep **will** the boy      sleep

# C takes TP

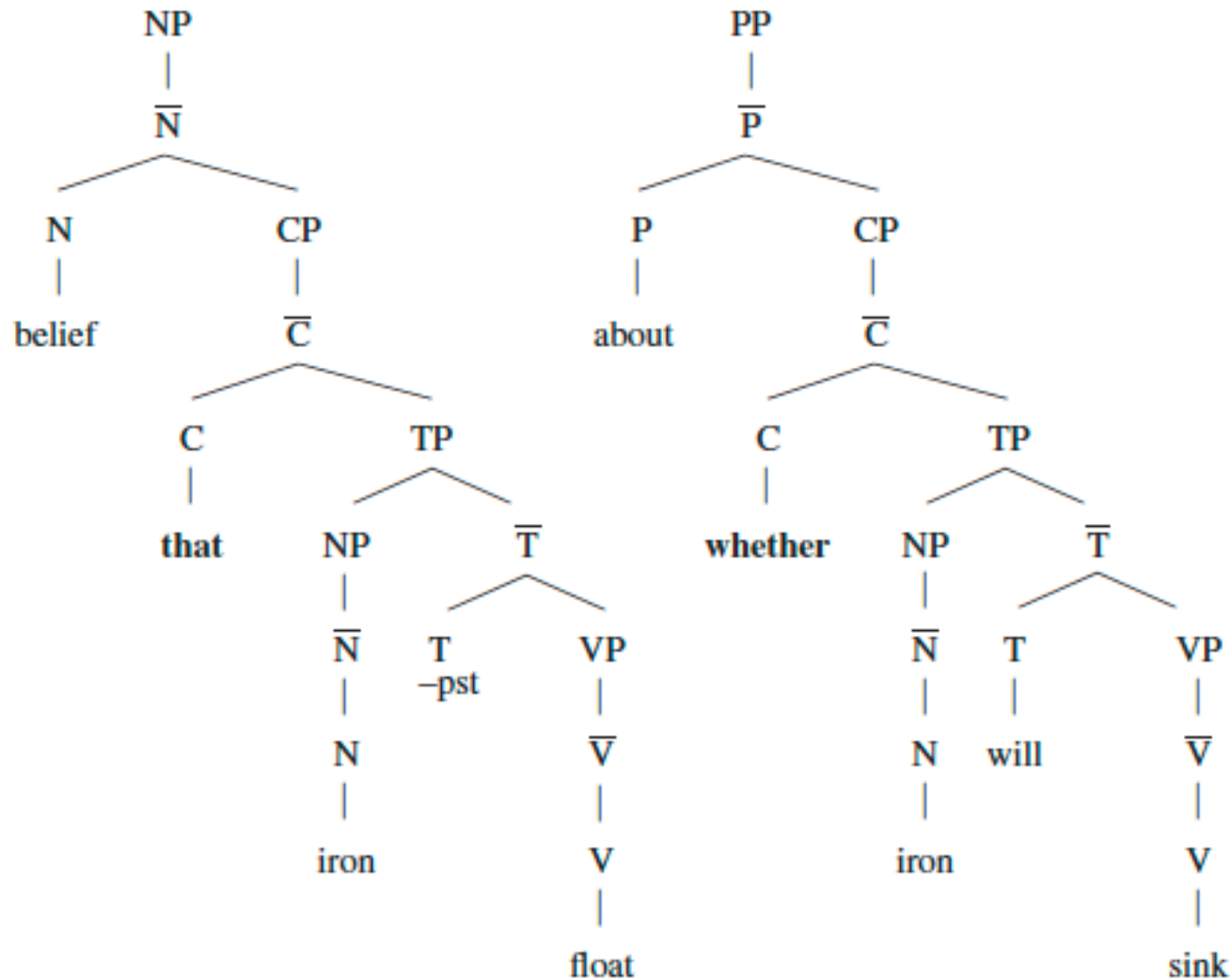
- C takes TP as its complement, C can have Q feature, but not always



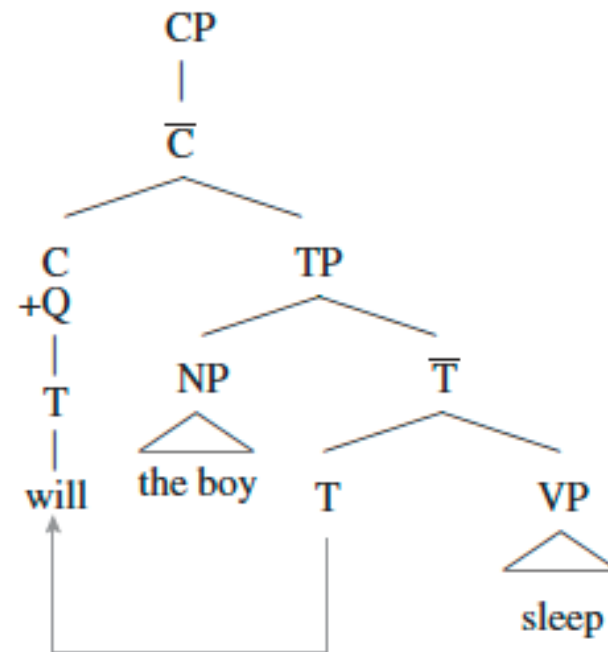
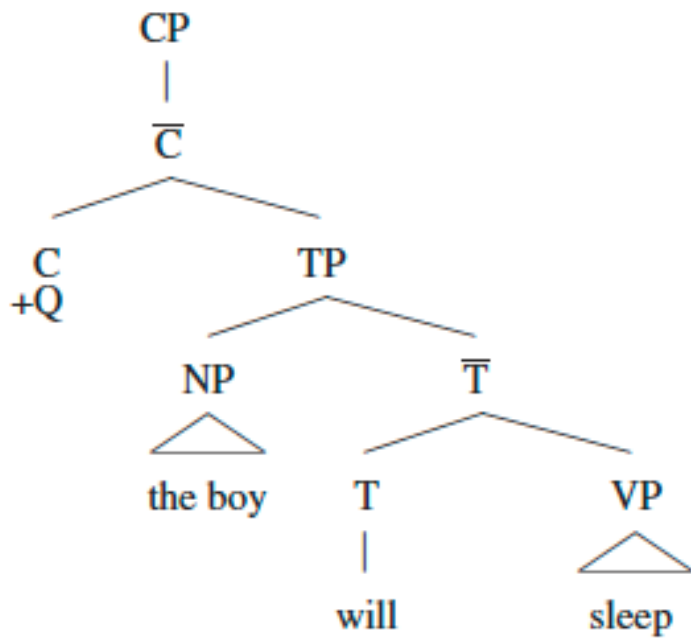
# Embedded CP's

- CP's are needed not just for questions:
  - belief that iron floats (NP complement)
  - wonders if iron floats (VP complement)
  - happy that iron floats (AP complement)
  - about whether iron will sink (PP complement)

# Examples of embedded CP



# Yes/No questions T->C





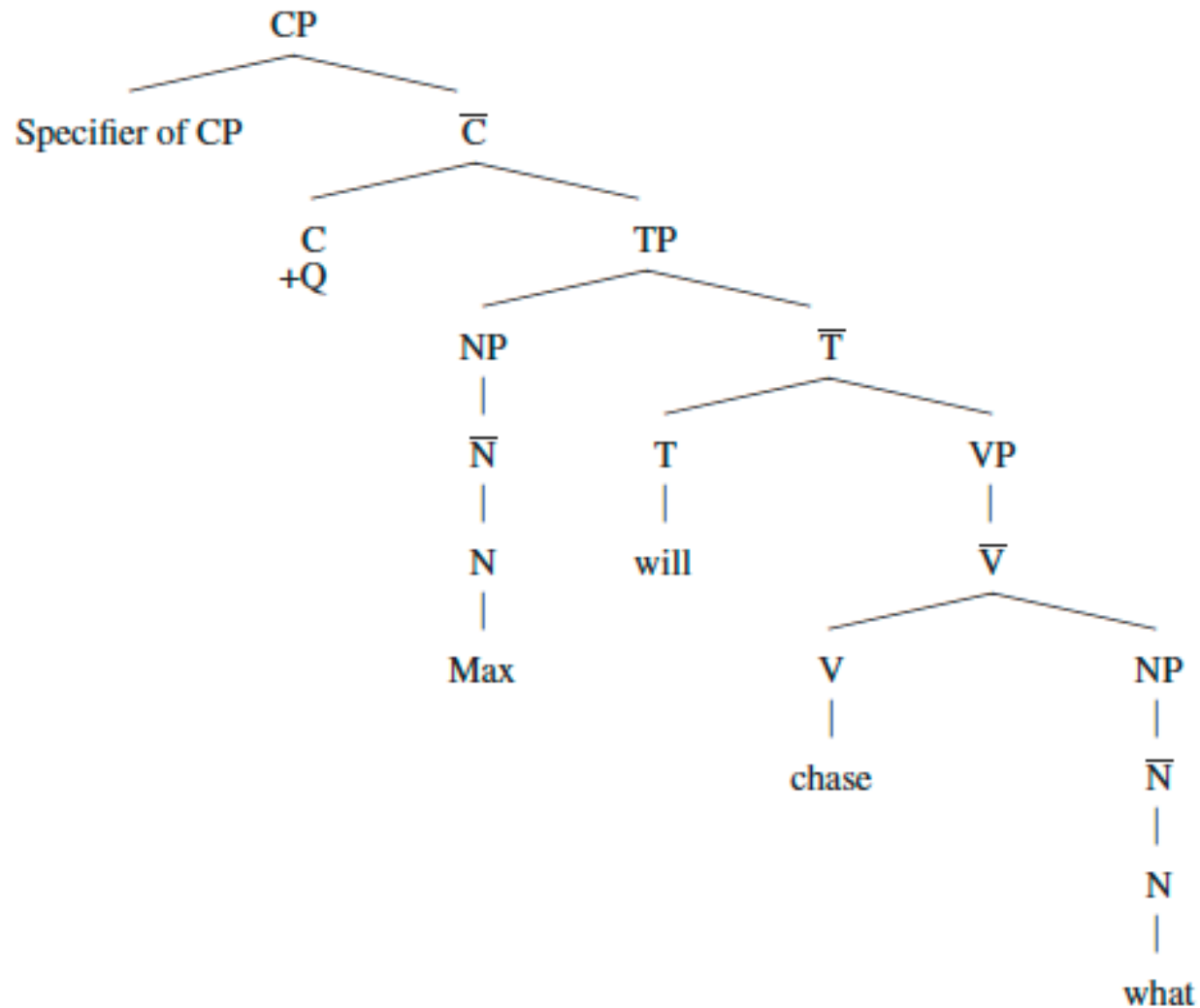
# Wh Questions

Example: What will Max chase?

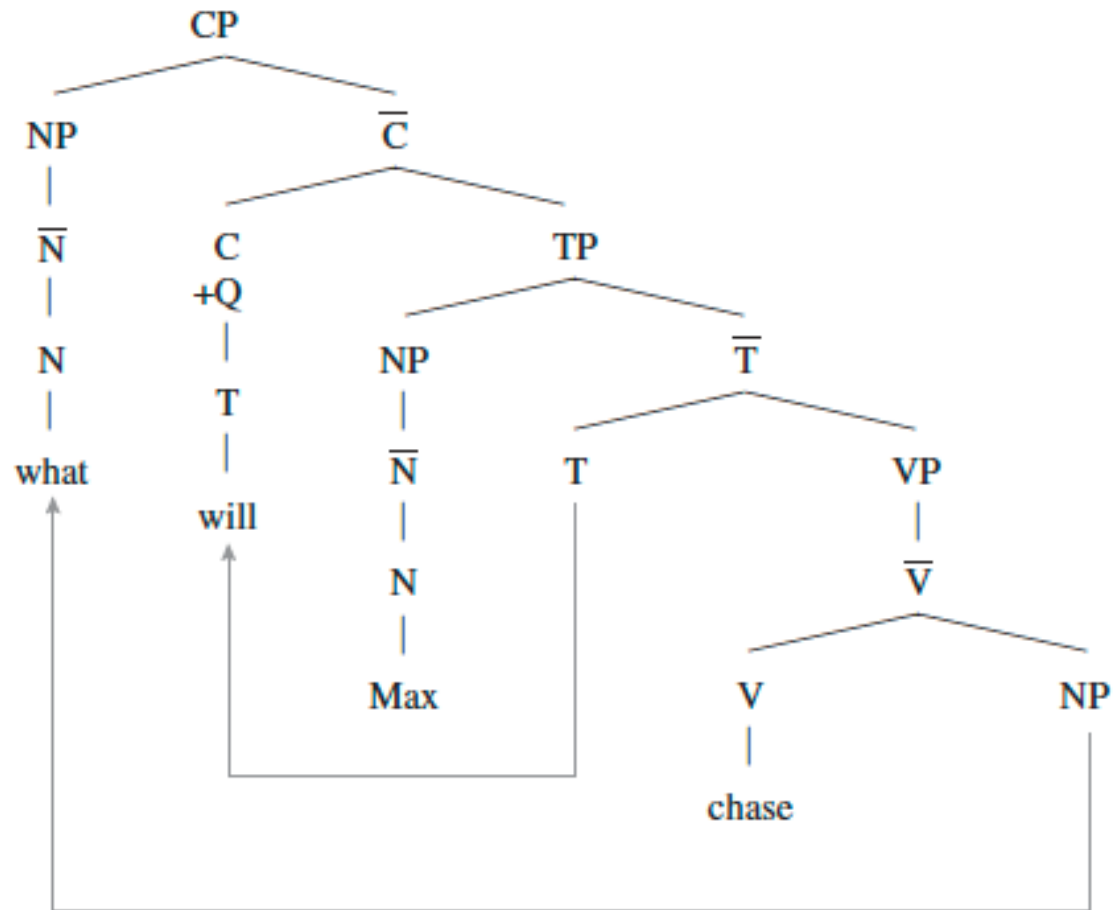
- This Wh question is formed in three steps:
  - 1. The PS rules generate a basic declarative word order:  
Max will chase what?
  - 2. Move shifts the word what to the beginning of the sentence: What Max will chase?
  - 3. Move shifts the modal will to occur before the subject NP: What will Max chase?

# Wh-derivation

The d-structure for *What will Max chase?* is:

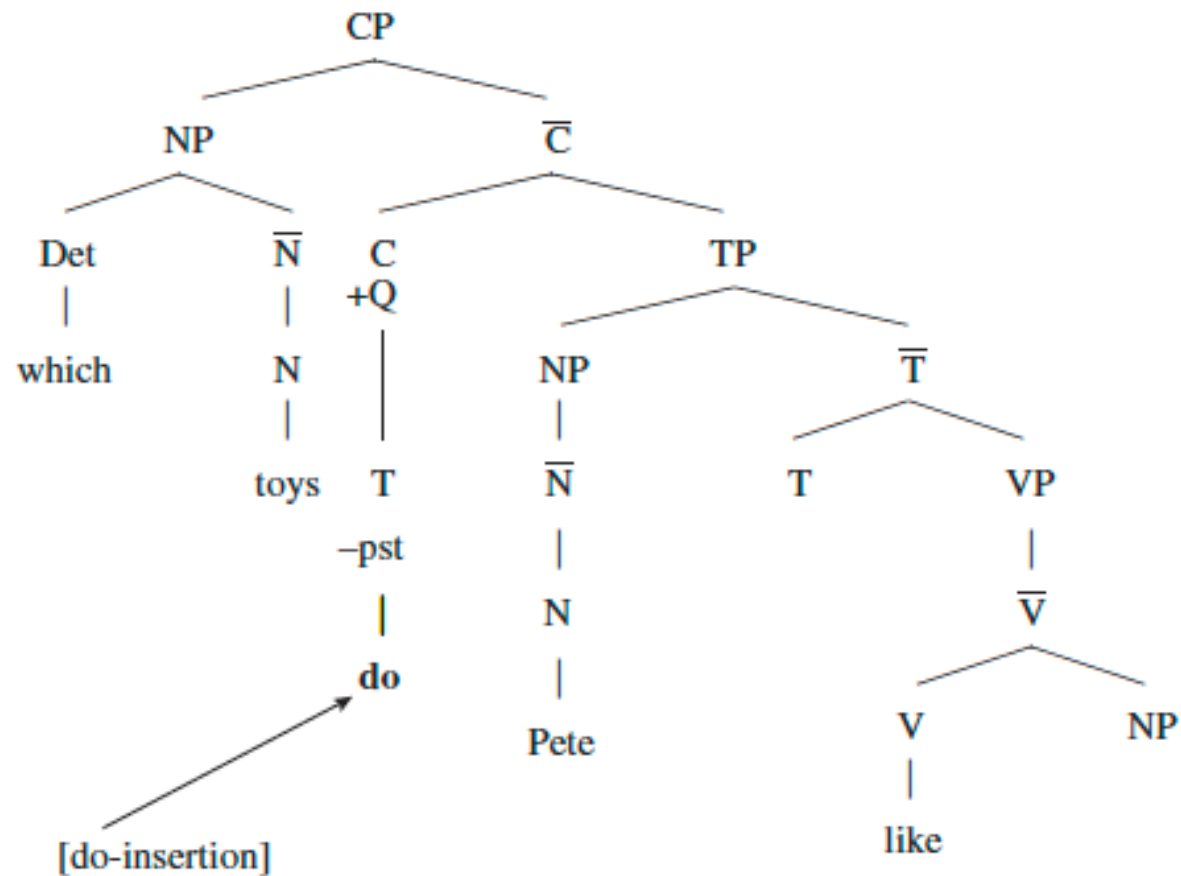


# Wh-movement



# Do-insertion

- Which toys does Pete like



# Modals/ Auxiliaries

1. Spot has chased a squirrel.

2. Nellie is snoring.

- Like the modals, the auxiliaries have and be move to the position preceding the subject in both yes-no questions and wh questions.

3. Has Spot \_\_\_\_ chased a squirrel?

4. Is Nellie \_\_\_\_ snoring?

5. What has Spot \_\_\_\_ chased \_\_\_\_?

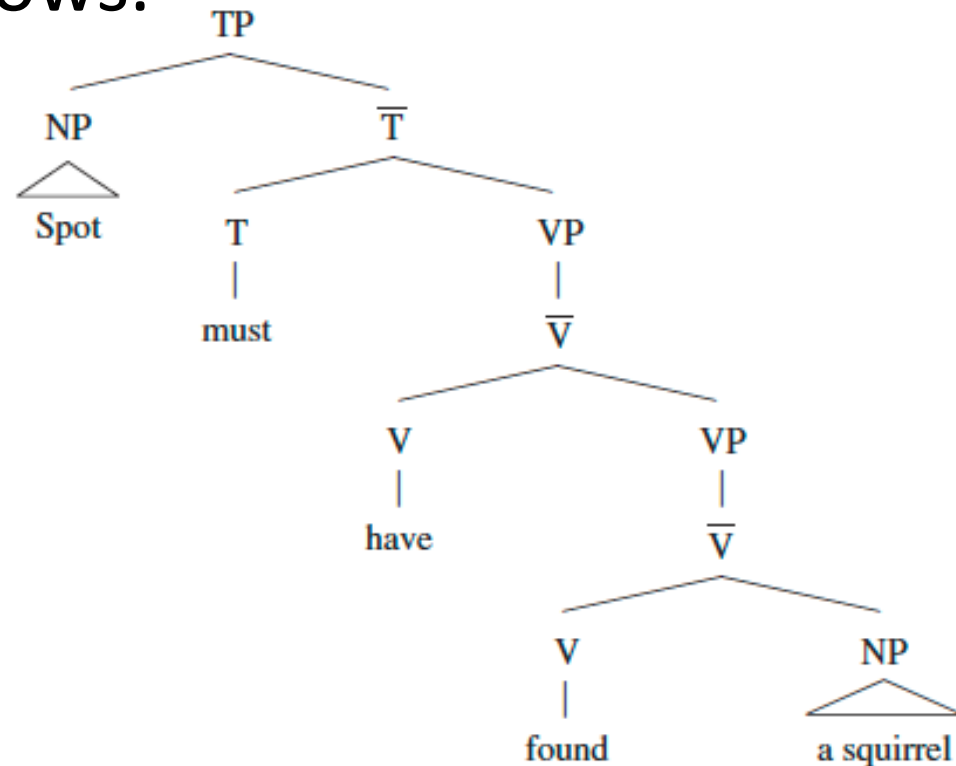
- The question is: where do have and be originate in the d-structure?

- Note that have and be can occur in the same sentence with a modal:

- Nellie may be snoring.
- Spot must have found a squirrel.

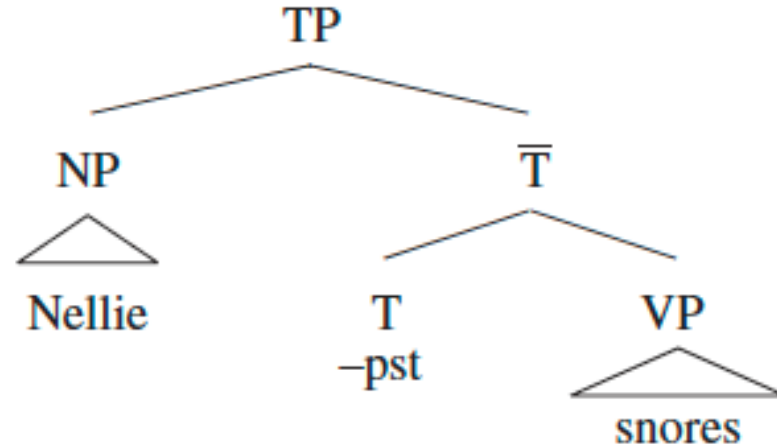
# recursive v

- Our analysis leads us to conclude that have/be originate under V in a recursive  $\bar{V}$  structure, as follows.



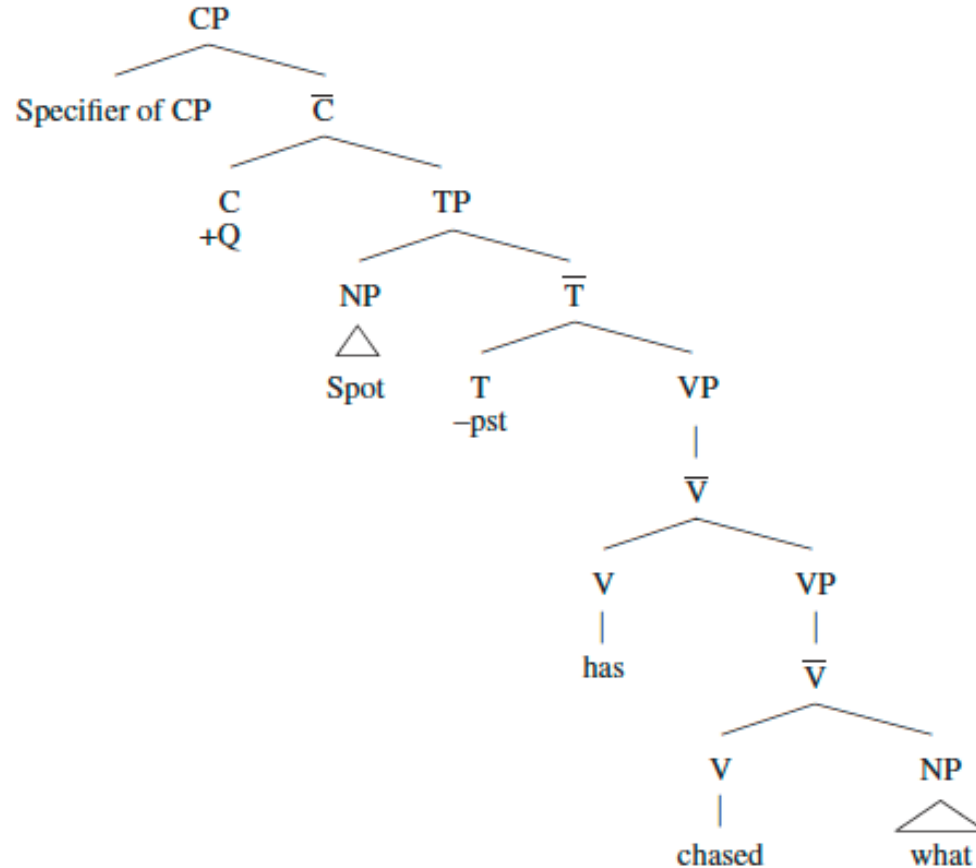
# Tense/Modal

- When there is no modal, T is occupied by a tense feature, which is realized on have/be, as would be the case for other verbs like snore:



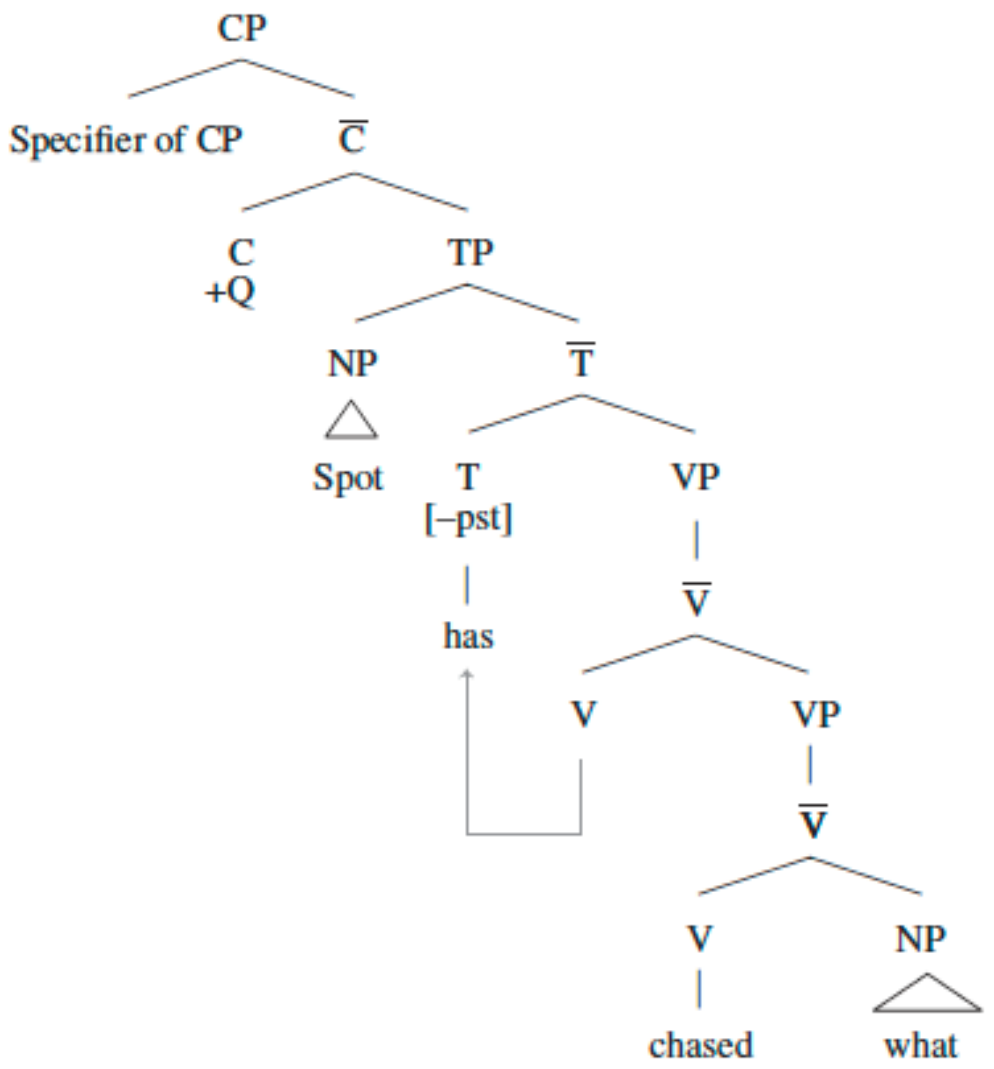
# Movement from V->T->C

- What has Spot chased?
- Here is the d-structure (from the X-bar derived phrase structure rules):

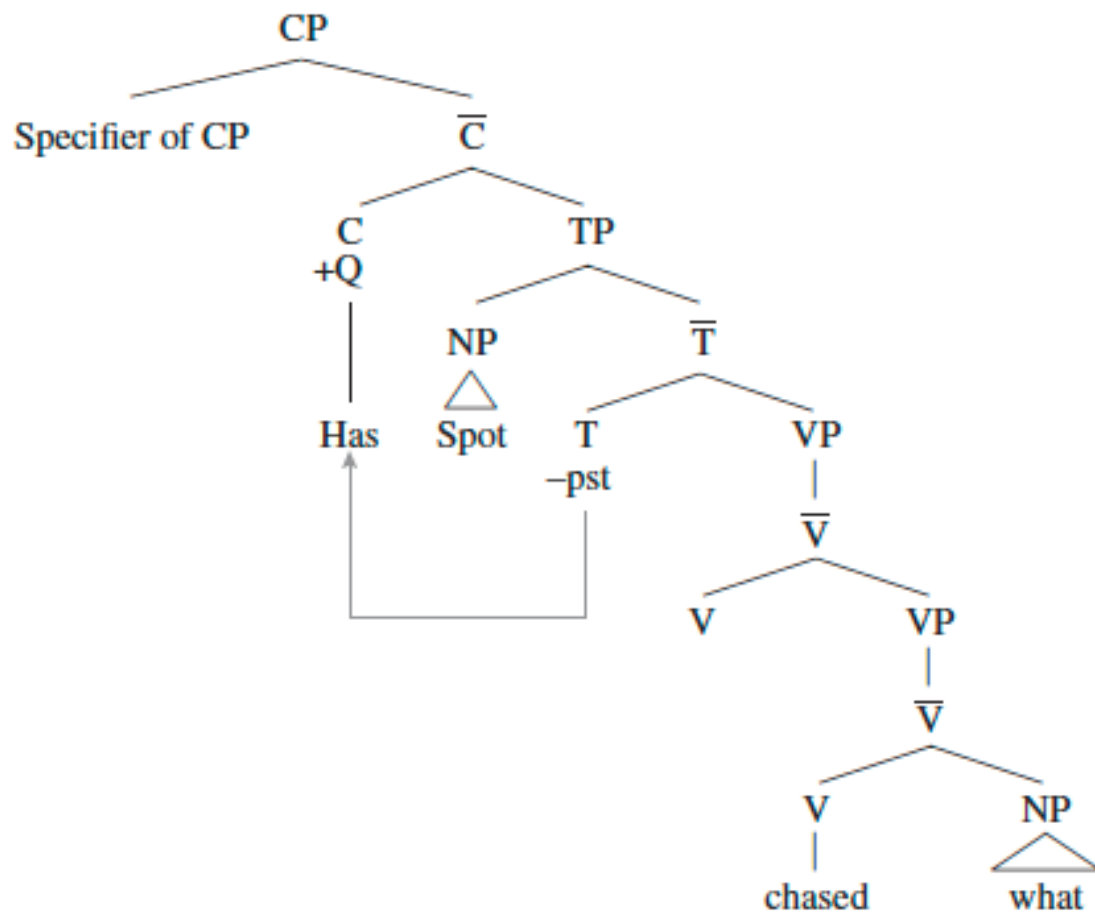




# V->T

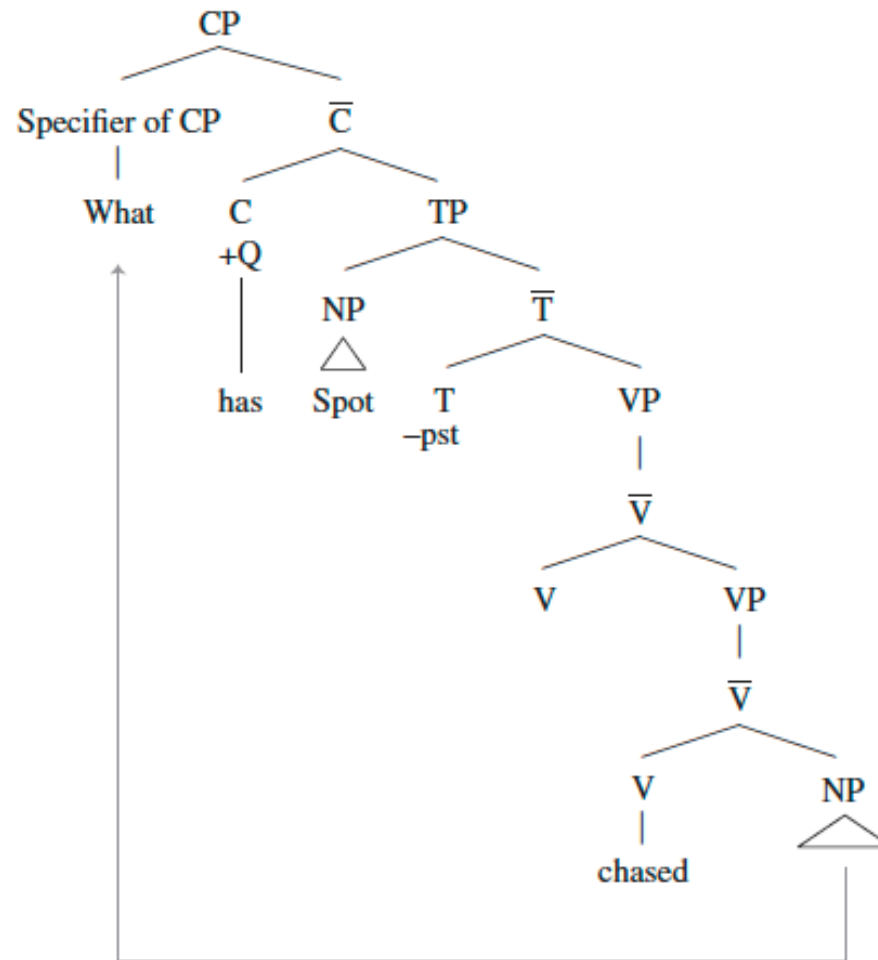


# T->C



# Wh-move

- We see that V->T feeds T->C, which allows wh move.



PS rules – **Warning**, these are textbook PS rules.

For ones recommended by me see my  
additional text

- 1.  $S \rightarrow NP VP$
- 2.  $NP \rightarrow Det \bar{N}$
- 3.  $\bar{N} \rightarrow N$
- 4.  $VP \rightarrow \bar{V}$
- 5.  $\bar{V} \rightarrow V NP$
- 6.  $\bar{V} \rightarrow V PP$
- 7.  $\bar{V} \rightarrow V AP$
- 8.  $\bar{N} \rightarrow N PP$
- 9.  $PP \rightarrow \bar{P}$
- 10.  $\bar{P} \rightarrow P NP$
- 11.  $AP \rightarrow \bar{A}$
- 12.  $\bar{A} \rightarrow A$
- 13.  $\bar{A} \rightarrow A PP$
- 14.  $\bar{N} \rightarrow A \bar{N}$
- 15.  $\bar{A} \rightarrow Int \bar{A}$
- 16.  $\bar{V} \rightarrow \bar{V} PP$
- 17.  $\bar{N} \rightarrow \bar{N} PP$
- 18.  $\bar{V} \rightarrow AdvP \bar{V}$
- 19.  $\bar{V} \rightarrow \bar{V} Adv$
- P20.  $\bar{V} \rightarrow V VP$

# 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 structures that conform to X-bar schema
  - All phrases consist of specifiers, heads, and complements
  - All sentences are headed by 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

# 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.