

The System

Sentences:
Syntax is the study of sentence structure in human language.

1

Increasing length – ad infinitum

6. *The linguist knows that this language has become extinct.*
The biologist believes that the linguist knows that this language has become extinct.
The neuroscientist claims that the biologist believes that the linguist knows that this language has become extinct.
The judge wrote that the neuroscientist claims that the biologist believes that the linguist knows that this language has become extinct.
and so on....

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Syntax

- What do we know when we know the syntax of our language?
- There are several aspects of syntactic knowledge that native speakers have about their language.
- Let's look at some examples and reflect a little.

2

So, we know

- What is grammatical and what is ungrammatical.
- Grammaticality is not dependent on meaningfulness.
- The same string of words can give rise to multiple meanings.
- Structures can look different but mean roughly the same thing.
- Structures can look the same but have completely different meanings.
- Structures can go on ad infinitum, in theory.

5

Reflect on these examples from English

1. *The silly man hit the nice woman.* vs.
**Silly hit man the nice the woman.*
2. *Colorful white morphemes drink surreptitiously.*
3. *Bob hit the elf on the table with the hat.*
4. *The ball broke the window.*
The window was broken by the ball.
5. *The witness is eager to please.* vs.
The witness is easy to please.

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Syntax

- For our theory of grammar to be adequate, it has to account for these different aspects of native speakers' subconscious syntactic knowledge.
- Why do we think that sentences have internal structure? Why do we not see them as strings of words?

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- The boy and the girl's uncle left. *How many people left?*
 - [The boy and the girl]'s uncle left, didn't he?
 - The boy and [the girl]'s uncle left, didn't they?
- OR
- Black cab drivers went on strike.
 - Black [cab drivers] went on strike. (Cab-drivers who are black)
 - [Black cab] drivers went on strike. (Drivers of black cabs)

- Intuitively, we “know” that certain words “hang together” in the sentence to the exclusion of others. We call such strings of words **constituents**.
- And we can actually determine constituency by means of objective or empirical diagnostic tests, since intuitions can be unreliable.
- There are at least five constituency tests:
 - substitution, movement, clefting, conjunction and the stand-alone test.

- A sentence is not a mere sequence of words; rather, every sentence has a structure
- The key notion to understanding syntactic structure is that of **constituency**.
- Core ideas of syntax that underlie sentence structure in all human languages:
 1. Constituency
 2. Subcategorization
 3. Grammatical relations
 4. Movement/long-distance dependency

- If
- a string of words can be replaced by one word
- and the result is a **grammatical sentence**
- while **preserving the original meaning**,
- then it must be that this string of words comprises a **constituent**.

- Consider the following sentence: *The linguist has drawn a tree.*
- If I ask you to, intuitively, divide the sentences into two units, where would you draw the line?
 - The linguist | has drawn a tree.
 - The small dog | climbed up the large tree

- [The linguist] has drawn a tree.
She has drawn a tree
 - The linguist has drawn [a tree].
The linguist has drawn *it*.
 - The linguist has [drawn a tree].
What has the linguist *done*?
 - The [linguist has drawn a tree].
*The ???
 - [The linguist has] drawn a tree.
*??? drawn a tree.
 - [The linguist has drawn a] tree.
*??? tree.
- (* ungrammatical)

"Do you like
my hat?"



It > My Hat

"I do not
like it."

Test 2: Movement

- If a string of words can be moved together in a sentence keeping the meaning intact, then this string of words comprises a "constituent".
- Consider the examples below:
 - We will hold the meeting [**in the SAC office**].
 - In the SAC office**, we will hold the meeting.
 - We will hold [**the meeting in the SAC office**].
 - ***The meeting in the SAC office** we will hold. (meaning change)
 - ***[meeting in the SAC office]** we will hold the.

Another example

- [**The tall child**] ate the sandwich.
She ate the sandwich.
- The tall child ate [**the sandwich**]
The tall child ate **it**.
- The tall child [**ate the sandwich**]
The tall child did **what?**
(Echo question)
- The tall child ate the sandwich
[**in the classroom**].
- The tall child ate the sandwich **there**
- The tall child ate [**the sandwich in the classroom**].
- *The tall child ate **it**
(The sentence may look ok, but we changed the meaning)

Another example

- I know he will [**eat the whole pizza**], and **eat the whole pizza** he will.
*I know he [**will eat the**] whole pizza, and **will eat the** he whole pizza.
- I read [**this book by Chomsky**] before.
This book by Chomsky I read before.
- I read this book [**by Chomsky before**].
***By Chomsky before** I read this book



Two dogs
in a house
on a boat
in the water.



Three dogs
at a party
on a boat
at night.

Test 3: Clefting (It is X that ...)

May also be used as a constituency diagnostic

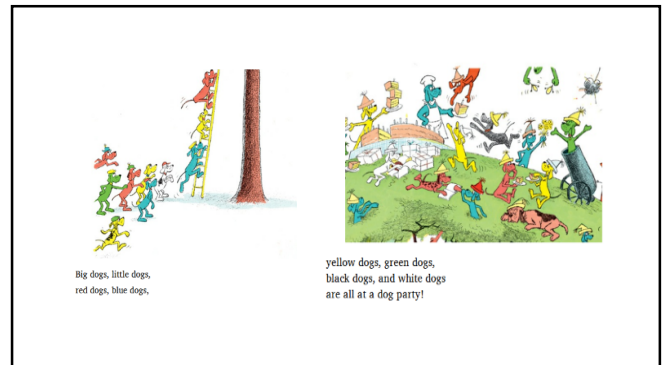
Example: This linguist drew these trees on the board.

Apply clefting to some strings:

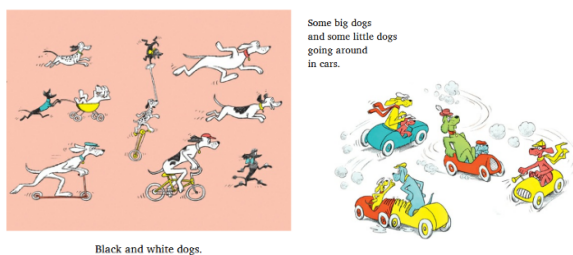
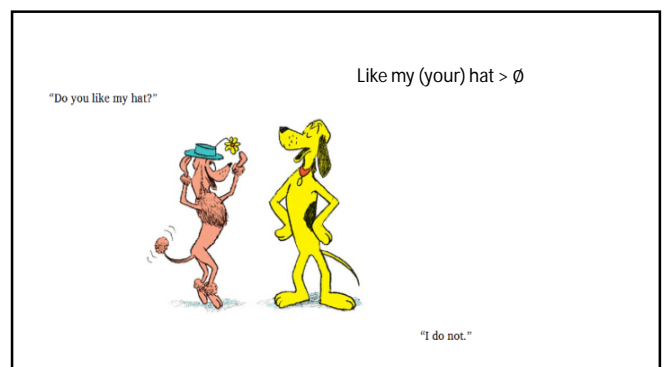
- It is **this linguist** that drew these trees on the board.
- It is **these trees** that this linguist drew on the board.
- It is **on the board** that this linguist drew these trees.
- *It is **trees on** that this linguist drew these the board.
- *It is **linguist** drew that this these trees on the board.
- (Cf. It is **these trees on the board** that the linguist drew)

Test 4: Stand-alone

- If a string of words can stand alone as an answer to a question, then it is a constituent
- | | |
|------------------------------------|------------------------------------|
| • Q: What did he eat? | Q: What did he do? |
| • A: The whole pizza./ *The whole. | A: Eat the whole pizza./ *Eat the. |
| • Q: What has the linguist drawn? | Q: Where will we hold the meeting? |
| • A: The trees. | A: In the SAC office. |



Test: Conjunction/co-ordination



Hierarchy

- A sentence is thus a set of constituents arranged in a hierarchical fashion
- Question: What are the **types of constituents** that exist in sentences?
- Before we list the types, we need some structural categories with which to describe the constituents and constituent types.
 - (a) Head
 - (b) Complement
 - (c) Phrases
 - (d) Specifiers

Phrase structure: Heads and complements

- The **head** of a phrase is the **central word** - the one that requires other elements to be there.
- The **complement** is the part of the phrase that is there because of the head.
- The **label/category of the whole phrase** is identical to that of the head
- So, if the head is a **noun**, then the phrase is a **noun phrase** (syntactic constituents are built up of the same *type*, they are *endocentric*)

Phrase structure rules

We express this head-complement relationship by means of rewrite rules, or **phrase structure rules**, as in the following examples (for languages where the complement follows the head):

NP → N PP

VP → V NP

PP → P NP

AP → A PP

In Hindi, the relative ordering is Complement-Head (the opposite of English)

Phrase structure: Heads and complements

- Remember from the discussion of morphology that there are major lexical categories in human languages (we focus on the first four)
Noun (N), Verb (V), Adjective (A), Preposition (P) and Adverbs (Adv)
- Each one of these categories can be the head of a phrase and thus build NP, VP, AP, AdvP and PP.
- Word structure and sentence structure are quite closely related and syntax uses many of the elements of morphology.

Selection (or subcategorization)

- Notice that **heads** differ as to whether they
 - (a) select complements at all,
 - (b) how many of them and
 - (c) what type
- Technically, we say they have different **selection properties**
- For example, transitive verbs but not intransitive verbs are those that select a complement

The child slept not *The child slept the bed. [No complement]

The politician bought a new car not *The politician bought. [NP complement]

Examples

- **picture of the boys** is a noun phrase (NP) since the head of the string is the N **picture**
- **ate the sandwich**, is a verb phrase (VP) since the head of the string is the V **ate**. (note **the sandwich** is a noun phrase which has the head N, **sandwich**)
- **in the office** is a prepositional phrase (PP) since the head of the string is the P **in** (note **the office** is a noun phrase which has the head N, **office**)
- **fond of chocolate** is an adjectival phrase (AP) since the head of the string is the A **fond** (note **of chocolate** is a prepositional phrase which has the head P, **of**)

More Selection

- Furthermore, some transitive verbs differ in whether they select an NP complement or a PP complement
The commander talked [**PP** to his soldier]
The commander polished [**NP** his rifle].
- and some verbs require more than one complement
The judge put [the gavel] [on the table]. [NP and PP complements]
- Other verbs such as 'say' select a whole clause (sentence) as a complement
- The commander said [**CP that** he would talk to the soldiers in the evening].
(Words like 'that' which introduce clauses are called **complementizers**, and the whole bracketed string is referred to as a Complementizer Phrase (CP). More on this later.)

Summary

- Sentences have internal, hierarchical structure
- Groups or chunks, phrases
- Phrasal type determined by the Head (Lexical heads)
- Head also determines the elements co-occurring with it – Complement (also a phrase) – selectional restrictions apply, are a property of each lexeme or head.

Table 5.7 Some examples of adjective complements

Complement option	Sample heads	Example
Ø	tall, green, smart	very tall ____
PP _{about}	curious, glad, angry	curious [PP _{about} China]
PP _{to}	apparent, obvious	obvious [PP _{to} the student]
PP _{of}	fond, full, tired	fond [PP _{of} chocolate]

Table 5.8 Some examples of preposition complements

Complement option	Sample heads	Example
Ø	near, away, down	(she got) down ____
NP	in, on, by, near	in [NP the house]
PP	down, up, out	down [PP into the cellar]

Table 5.5 Some examples of verb complements

Complement option	Sample heads	Example
Ø	vanish, arrive, die	The child vanished ____.
NP	devour, cut, prove	The professor proved [NP the theorem].
AP	be, become	The man became [AP very angry].
PP _{to}	dash, talk, refer	The dog dashed [PP _{to} the door].
NP NP	spare, hand, give	We handed [NP the man] [NP a map].
NP PP _{to}	hand, give, send	He gave [NP a diploma] [PP _{to} the student].
NP PP _{for}	buy, cook, reserve	We bought [NP a hat] [PP _{for} Andy].
NP PP _{loc}	put, place, stand	He put [NP the muffler] [PP _{loc} on the car].
PP _{to} PP _{about}	talk, speak	I talked [PP _{to} a doctor] [PP _{about} Sue].
NP PP _{for} PP _{with}	open, fix	We opened [NP the door] [PP _{for} Andy] [PP _{with} a crowbar].

Table 5.9 Some verbs permitting CP complements

Complement(s)	Sample heads	Example
CP	believe, know, think, remember	They believe [CP that Mary left].
NP CP	persuade, tell, convince, promise	They told [NP Eric] [CP that Mary had left].
PP _{to} CP	concede, admit	They admitted [PP _{to} Eric] [CP that Mary had left].

Table 5.10 Some As, Ns, and Ps permitting CP complements

Items	Example with CP complement
Adjectives	
afraid, certain, aware, confident	They are afraid [CP that Mary left].
Nouns	
claim, belief, fact, knowledge, proof	They lack proof [CP that Mary left].
Prepositions	
over	They argued over [CP whether Mary had left].

Table 5.6 Some examples of noun complements

Complement option	Sample heads	Example
Ø	car, boy, electricity	the car ____
PP _{of}	memory, failure, death	the memory [PP _{of} a friend]
PP _{of} PP _{to}	presentation, description, donation	the presentation [PP _{of} a medal] [PP _{to} the winner]
PP _{with} PP _{about}	argument, discussion, conversation	an argument [PP _{with} Stella] [PP _{about} politics]

Specifiers

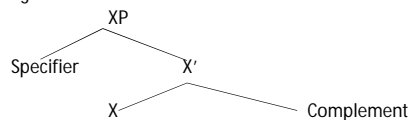
- While complements may be obligatory (depending on the selectional properties of the head), a head may also have non obligatory satellite elements, called **specifiers**

Table 5.4 Some specifiers

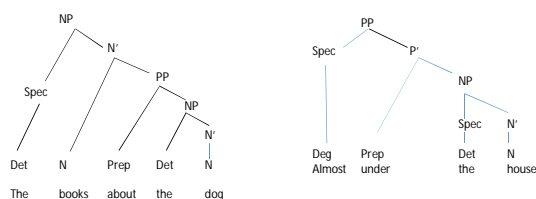
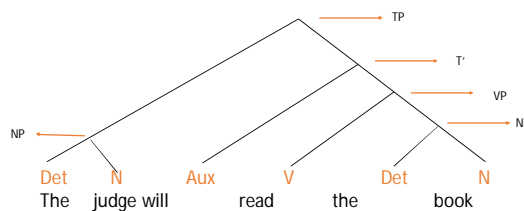
Category	Typical function	Examples
Determiner (Det)	specifier of N	the, a, this, those, no
Qualifier (Qual)	specifier of V	never, perhaps, often, always
Degree word (Deg)	specifier of A or P	very, quite, more, almost

An abstract tree

- To generalize, using X as a variable ranging over all heads, every phrase in English has the internal structure below



(X' pronounced X-bar. We can then apply this X' schema to all heads, whether N, V, Adj or P etc.)



What if there is no auxiliary?

- The judge guards the book OR The judge guard~~ed~~ the book (yesterday)
- s marks the (present) Tense and likewise the -ed marks the (past) Tense
- In parallel with
 - The judge [T **will**] read the book
 - The judge [T **has**] read the book
 - The judge [T **may**] read the book
 - The judge [T **may have**] read the book

Cf. **Does** the judge guard the book? The judge guards the book, **doesn't** she?
(Irregular: read-read, sing-sang, bring-brought, sink-sank, leave-left)

So, what's the head of a Sentence as a whole?

- Consider now sentences such as **The judge will read the book**
- We know that [NP the judge] is a constituent and so is [VP read the book]
- The auxiliary verb **will** has a complement [VP eat the pizza] and a specifier (the subject) [NP the judge].
- We call this the Sentence or a Tense Phrase (whose head is T)
- Rewrite rule: TP → Spec T VP
- In other words, the subject of the sentence is the specifier and the verb phrase, the complement and T is the head.

What are CPs?

- Remember that some verbs take a CP complement.
 - The judge said [CP **that** [TP she would bang the gavel.]]
 - The judge said [CP **∅** [TP she would bang the gavel.]]
 - The judge asked [CP **if/whether** [TP she would bang the gavel.]]
 - The judge outlined [CP **how** [TP the hearing was to proceed]]
- The embedded clause looks identical to the TP except that it has the complementizer, the additional word. Complementizers mark the force of a clause as declarative (said that TP), interrogative (asked whether TP) etc.

A complete tree

[NP The judge] [VP said [CP that [TP [NP the witness] should [VP speak [NP the truth] [PP in [NP the courtroom]]]]]]
 [NP The judge] [VP said [CP that [NP the witness] should [VP speak [NP the truth] [PP in [NP the courtroom]]]]
 [NP The judge] [VP said that [NP the witness] should [VP speak [NP the truth] [PP in [NP the courtroom]]]]
 [NP The judge] said that [NP the witness] should speak [NP the truth] [PP in [NP the courtroom]]
 [NP The judge] said that [NP the witness] should speak [NP the truth] in [NP the courtroom]

- The judge said that the witness should speak the truth in the courtroom

Syntactic ambiguity

- The clown hit the lion-tamer with the umbrella
- The clown [VP hit [NP the lion-tamer] [PP with [NP the umbrella]]]
- The clown [VP hit [NP the lion-tamer [PP with the umbrella]]]

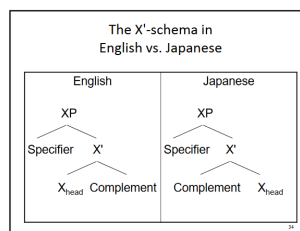
Syntactic ambiguity is two parses or two-trees that underlie a single surface string – each parse yields a different meaning.

So, we know from PSR

- Tree diagrams show three aspects of speakers' syntactic knowledge:
 - a. the linear order of the words in the sentence
 - b. The groupings of words into particular syntactic constituents (NP, VP, etc.), and
 - c. the hierarchical structure in which these constituents re held (that is, the fact that constituents contain constituents inside them, which in turn contain other constituents, and so on and so forth) – the property of Recursion.

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Cross-linguistic variation in word order



Other possibilities

- $XP \rightarrow X' \text{ Spec}$
- $X' \rightarrow X \text{ Comp}$ (VOS order)
- $XP \rightarrow X' \text{ Spec}$
- $X' \rightarrow \text{Comp } X$ (OVS order)

Revisiting recursion

1. *This language has become extinct.*
2. *[The linguist knows [CP that this language has become extinct]].*
3. *The biologist believes that [CP the linguist knows that this language has become extinct].*
4. *The neuroscientist claims [CP the biologist believes that the linguist knows that this language has become extinct].*
5. *The judge wrote that [CP the neuroscientist claims that the biologist believes that the linguist knows that this language has become extinct].*

and so on....

Each time, a TP on top embeds (chooses as its complement) the CP below

Word order typology - SOV

Ainu, Akkadian, Amharic, Armenian, Assamese, Aymara, Azerbaijani, Basque, Bengali, Burmese, Burushaski, Dakota, Dogon languages, Elamite, Ancient Greek, Hajong, Hindi, Hittite, Hopi, Hungarian, Ijoid languages, Itelmen, Japanese, Kazakh, Korean, Kurdish, Classical Latin, Lakota, Manchu, Mande languages, Marathi, Mongolian, Navajo, Nepali, Newari, Nivkh, Nobiin, Pali, Pashto, Persian, Punjabi, Quechua, Senufo languages, Seri, Sicilian, Sindhi, Sinhalese and most other Indo-Iranian languages, Somali and virtually all other Cushitic languages, Sumerian, Tibetan and nearly all other Tibeto-Burman languages, Kannada, Malayalam, Tamil, Telugu and all other Dravidian languages, Tigrinya, Turkic languages, Turkish, Urdu, almost all Uto-Aztecan languages, Uzbek, Welsh, Yukaghir, and virtually all Caucasian languages.

SVO

- Albanian, Chinese, English, Estonian, Finnish, French, Kurdish, Ganda, Greek, Hausa, Icelandic (with the V2 restriction), Italian, Javanese, Khmer, Latvian, Macedonian, Modern Hebrew, Polish, Kashubian, Portuguese, Quiche, Romanian, Rotuman, Russian (but see below), Serbo-Croatian, Slovene, Spanish, Swahili, Thai, Vietnamese, Yoruba and Zulu.

So, we know

- What is grammatical and what is ungrammatical.
- Grammaticality is not dependent on meaningfulness.
- The same string of words can give rise to multiple meanings. (ambiguity)
- Structures can go on ad infinitum, in theory.
- Structures can look different but mean roughly the same thing.
- Structures can look the same but have completely different meanings.

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Word Order Distribution of Languages

Basic Word Order	Proportion of Languages	Examples
Subject-[Verb-Object]	42%	English, Indonesian
Subject-[Object-Verb]	45%	Japanese, Turkish
Verb-Subject-Object	9%	Welsh, Zapotec
[Verb-Object]-Subject	3%	Malagasy
[Object-Verb]-Subject	1%	
Object-Subject-Verb	0%	

Russell Tomlin, *Basic Word Order: Functional Principles*, (Croom Helm, London, 1986) page 22

Structures can look the same superficially but have completely different meanings

- The witness is easy/eager to please

Easy, the witness is the **object** of the verb *please*

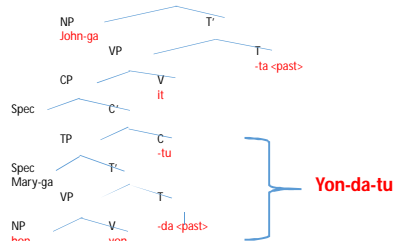
- The witness is easy [CP *someone* to please *the witness*]
- [It is easy [PRO to please the witness] (PRO = someone)]

Eager, the witness is the **subject** of the verb *please*

- The witness is eager [the witness to please someone]
- [The witness is eager [the witness to please PRO]]

A Japanese tree

John-ga Mary-ga hon-o yon-da-tu it-ta
JOHN-SUB MARY-SUB book-OBJ read-PAST-COMP say-PAST



Hindi tree will be similar, since the PSRs are the same for Japanese and Hindi

Yon-da-tu

Structures can look different but mean roughly the same thing.

- The hammer hit the nail
- The nail was hit by the hammer. (Passive)
- Was the nail hit by the hammer? (Question)

Sentence Structure

Transformations

Structures can look different but mean roughly the same thing.

- | | |
|-----------------------------------|---------------------------|
| • The hammer hit the nail | Active |
| • Did the hammer hit the nail? | Question from the Active |
| • The nail was hit by the hammer. | Passive |
| • Was the nail hit by the hammer? | Question from the passive |

Recall 1

- Sentences have internal 'structure'.
- The main unit of the structure is the constituent.
- Constituents are phrases.
- Phrases follow the X'-schema.
- Phrase structure rules tell us the internal structure of constituents, across languages.

Transformation/Movement

- To capture the relatedness between the two sentences, we rely on a new kind of rule: a transformation
- A transformational rule is a syntactic operation that takes one structure (called D-structure) as input and operates on it producing a modified syntactic structure (called S-structure) as output.
- D-structures are derived by phrase structure rules, whereas S-structures are derived through the application of transformational rules.
- Transformations are powerful theoretical tools which we will constrain by restricting the movement by place of origin, target position, distance etc.

Recall 2

- Phrase structure rules can also account for recursion which is the fundamental way in which human languages are able to create novel messages – infinite output from finite means (productivity, duality of patterning)
- Phrase structure rules enable us to account for attachment ambiguity in a sentence.
- They can also explain to us regular variation in word order (cross-linguistically).
- Languages choose from two options of a parameter: head-initial vs. head-final.
- The result is massive diversity on the surface, even though the difference is very simple at the core.

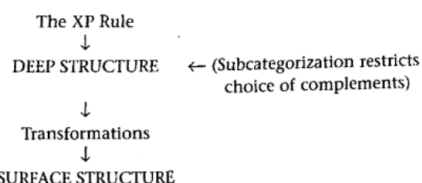


Figure 5.23 The syntactic component of the grammar

Evidence for transformations?

- He asked if your friend could play the piano.
*He asked [**if could** your friend play the piano].
- Since IF already occupies the COMP, the could cannot move in there and the sentence with both there is ungrammatical.
- **What could** your friend play?
- Subcategorization (tells us that play is a transitive verb and requires an object, NP)
- Relatedness between the question and the statement – all native speakers understand that the statement and the yes-no question are related, the question is a slight modification of the statement.
- The CP, as a phrase has positions (head and Spec) which if empty can house the moved elements.

Questions

- Yes-no questions of English are formed by
 - Moving the T to COMP position, yielding the surface order Auxiliary verb - Subject-VP
- Wh-questions are formed by doing two things,
 - Moving the T to COMP as above AND
 - Moving the wh-phrase to Spec, CP
- Restrictions on movement
 - Head moves to Head (auxiliary in T to C)
 - Phrases to Spec, CP.
- This process is seen in English, French etc. but not in Hindi.
- Transformations are *optional* in the grammar.

Note: Tree branches are not cut off as a result of movement. The tree in all respects has to observe the PSRs. Only contents are moved around.