EBERHARD KARLS
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Faculty of Philosophy
General Linguistics

Syntax & Semantics WS2019/2020

Lecture 7: Government & Binding II (GB)

15/11/2019, Christian Bentz

Overview

Updated Schedule:

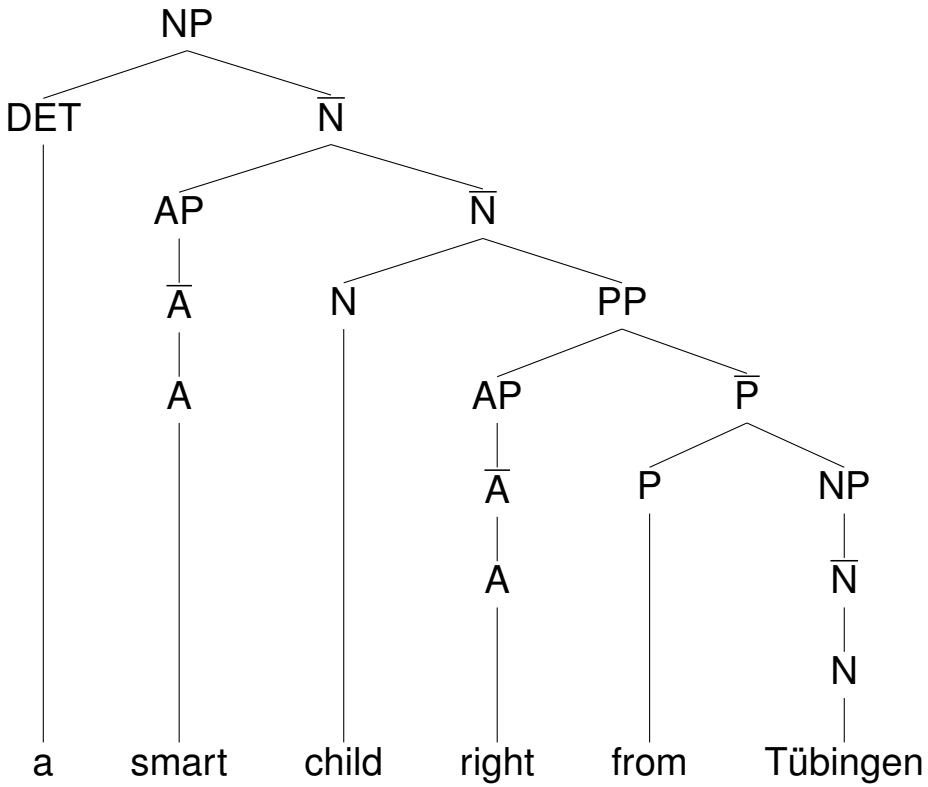
- The next lecture (Lecture 8 on Monday 18th November) is going to be held by Prof. Jäger
- The lecture Next Friday (Lecture 9 on 22nd November) is going to be a summary session of the frameworks discussed so far.
- See also updated schedule on the slides of Lecture 1.

Remarks on Exercises 2:

- In the task description and the solutions “maximal projection” was replaced with *sentence type (transitivity)*, to make it clearer that there can be a difference between transitivity and valency (at least under the passivization test).

Section 1: Recap of Lecture 6

Full Example



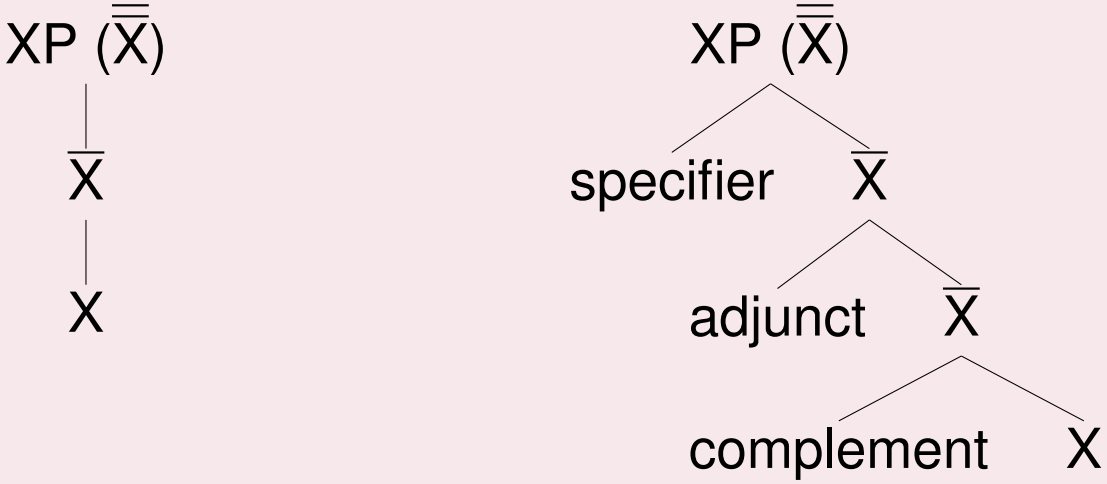
Rewrite Rules

1. NP → DET $\bar{N}$
2. $\bar{N}$ → AP $\bar{N}$
3. $\bar{N}$ → N
4. $\bar{N}$ → $\bar{N}$ PP
5. $\bar{N}$ → $\bar{N}$ REL
7. PP → NP $\bar{P}$
8. PP → AP $\bar{P}$
9. PP → $\bar{P}$
10. $\bar{P}$ → P NP
11. AP → $\bar{A}$
12. AP → AdvP $\bar{A}$
13. $\bar{A}$ → A PP
14. $\bar{A}$ → A

Notes: The rule number two was modified (A → AP). Rule number six is not included here as it was replaced by other rules of the X-bar notation.

Maximal and Minimal $\overline{X}$ phrases

Given all the generalized $\overline{X}$ rules above we get to the **minimal** and **maximal phrase structure** possible within $\overline{X}$ theory:



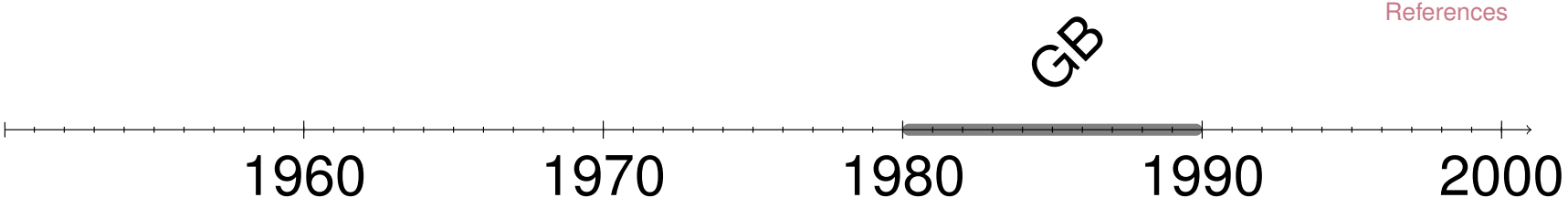
Müller (2019). Grammatical theory, p. 76.

Section 2: Historical Notes

Historical Perspective

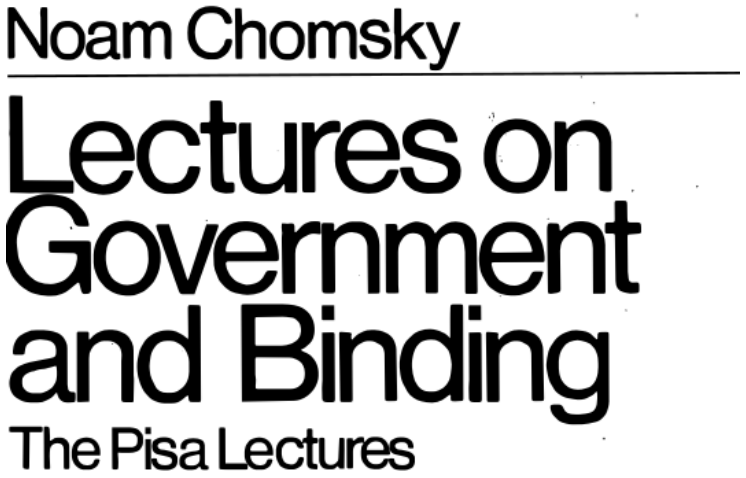
"*Transformational Grammar* and its subsequent incarnations (such as Government and Binding Theory and Minimalism) were developed by Noam Chomsky at MIT in Boston (Chomsky 1957; 1965; 1975; 1981a; 1986a; 1995b). [...] The different implementations of Chomskyan theories are often grouped under the heading *Generative Grammar*. This term comes from the fact that phrase structure grammars and the augmented frameworks that were suggested by Chomsky can generate sets of well-formed expressions [...]"

Müller (2019). Grammatical theory, p. 83.



"A more extensive discussion of certain of the more technical notions appears in my paper "On Binding" (Chomsky, 1980a; henceforth, OB). [...] I Will consider a number of conceptual and empirical problems that arise in a theory of the OB type and will suggest a somewhat different approach that assigns a more central role to the notion of government; let us call the alternative approach that will be developed here a "government-binding (GB) theory" for expository purposes."

Chomsky (1981). Lectures on government and binding, p. 1.



Section 3: Basic Definitions

Additional Symbols in GB

Appart from the non-terminal symbols that we have introduced in the lectures on PSG and $\overline{X}$ theory,[1] there are further symbols introduced within GB. These are in particular:

- C: *Complementizer* (subordinating conjunctions such as *that*)
- I: *Finiteness* (as well as Tense and Mood); also *Infl* for *Inflection* in earlier work, and *T* for *Tense* in more recent work.
- D: *Determiner* (article, demonstrative); though this is equivalent to the symbol DET that we used before.

Müller (2019). Grammatical theory, p. 95.

[1] Note that the transition from $\overline{X}$ theory to GB is not clear cut, such that certain notational conventions can be found in both.

Projection Levels

"In $\overline{X}$ theory, one normally assumes that there are at most two projection levels (X' and X''). However, there are some versions of Mainstream Generative Grammar and other theories which allow three or more levels (Jackendoff 1977; Uszkoreit 1987)."

Müller (2019). Grammatical theory, p. 96.

- X^0: same as before (symbol that leads to the terminal symbol).[2]
- X': intermediate projection (equivalent to $\overline{X}$)
- XP: highest projection (X'' or $\overline{\overline{X}}$)

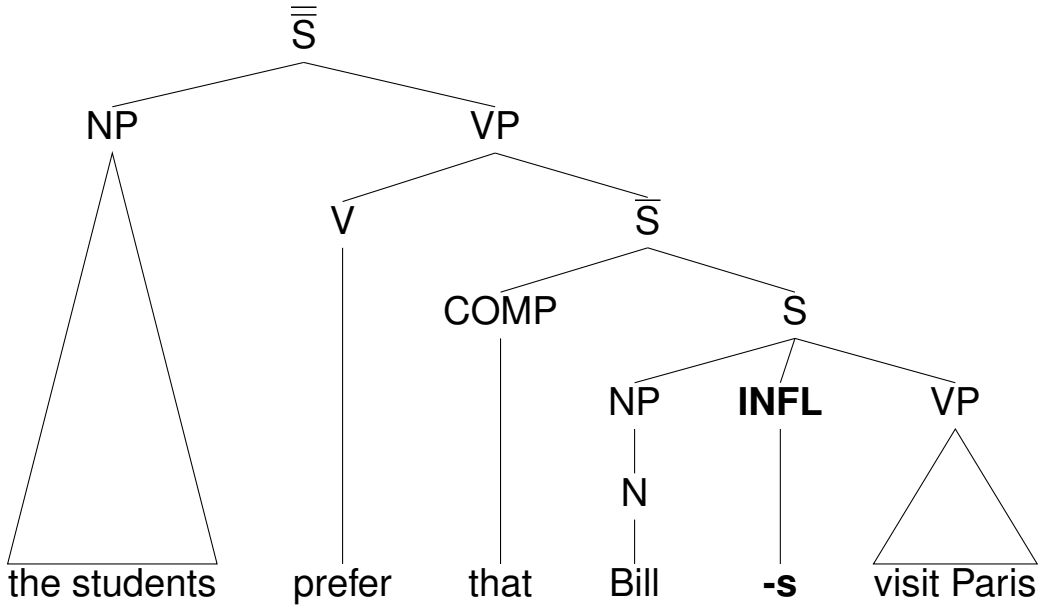
[2] Müller calls this "head". This is only true if we assume that each word by itself always constitutes a phrase that it is heading.

The Inflection Symbol (I)

Chomsky introduces the inflectional symbol (as INFL) in the following sentence in bracket notation:

the students [$_{VP}$ prefer [$_{\overline{S}}$ COMP [$_{S}$ Bill **INFL** [$_{VP}$ visit Paris]]]]

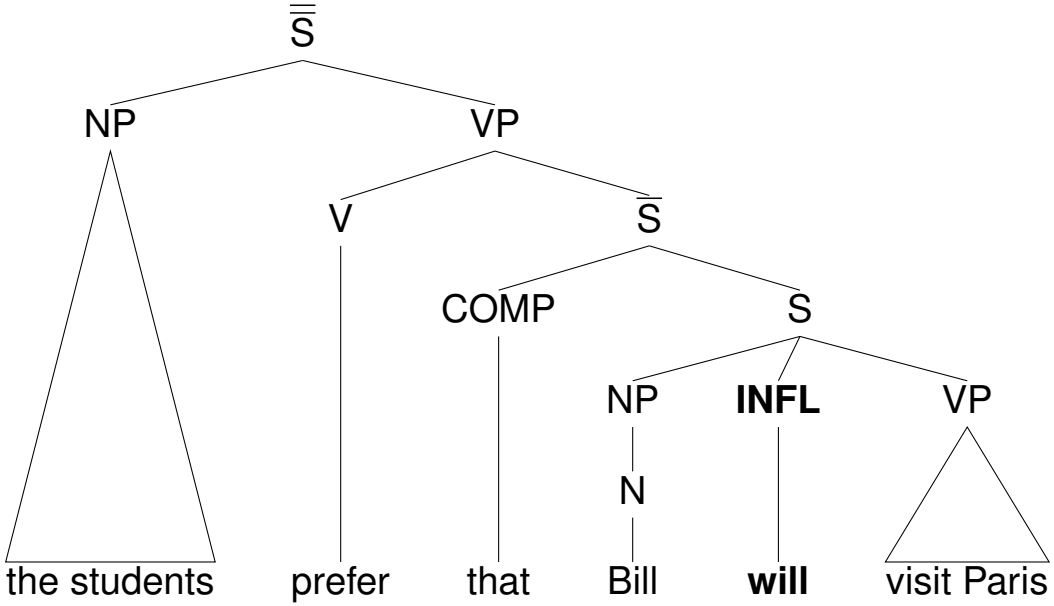
Chomsky (1981). Lectures on government and binding, p. 19.



Note: Don't worry about the tree notation here. For example, $\overline{S}$ and COMP will later be replaced by $\overline{C}$ and C.

The Inflection Symbol (I)

The idea that INFL should be in this position, namely before the verb it is actually attached to in linear order, comes from the fact that (in English) auxiliary verbs also appear in this position, and these are the finite (i.e. inflected) elements of the sentence. Hence, both auxiliary and non-auxiliary constructions can be captured by the same underlying tree structure.



Important Take-Home-Message

As this example of inverted linear order (*-s visit*) shows, syntacticians – in the tradition of generative grammar – have grown accustomed to deviations between so-called *Deep Structure* (e.g. INFL VP) and *Surface Structure* (e.g. *visit-s*). This is seen as a necessary prerequisite for fitting all possible grammatical sentences of a given language into the same underlying mould.

Problem: Irregulars

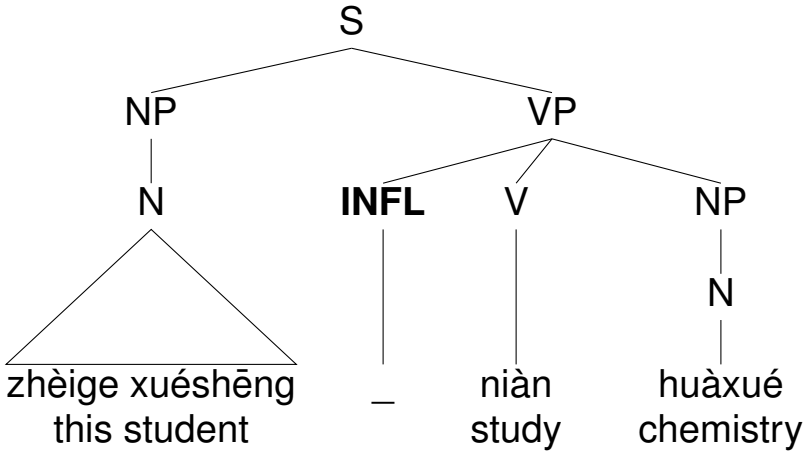
In English, the third person plural *-s* is highly regular, i.e. attaching to any verb stem for ensuring agreement. Similarly, in German, the third person *-t* attaches to the (sometimes modified) verb stem. But how about languages where these inflections do not exist (e.g. Mandarin Chinese), or where the finite forms are derived from roots in more complicated ways (e.g. template morphology in Standard Arabic)?

English (eng, Indo-European)	Mandarin Chinese (cmn, Sino-Tibetan)	Standard Arabic (arb, Afro-Asiatic)
read-**s** (read)	kàn (kàn)	tagra'/yaqra' (qira'atan)
speak-**s** (speak)	shuō (shuō)	tatahDath/yatahDath (tahaDuthan)
see-**s** (see)	kàn (kàn)	tara/yara (ru'yatan)
go-**es** (go)	qù (qù)	tathhab/yathhab (thahaban)
		(p.c. Hebah Ahmed)

Problem: Language Diversity

We can make adhoc assumptions to safe our template, e.g. positing empty elements (e.g. INFL $\rightarrow \epsilon$) in languages (or particular sentences) where the inflectional category does not seem to exist. However, notice that we here essentially shoehorn a language into a structural analysis template that was developed for English.

Mandarin Chinese (cmn, Sino-Tibetan)



Sackmann (1996), p. 261.

Back To English

If we accept the inflectional symbol as a fact of our rewrite rules then they need to be extended in the following way:

1. S $\rightarrow$ NP VP
2. S $\rightarrow$ NP **INFL** VP

Müller (2019). Grammatical theory, p. 96.

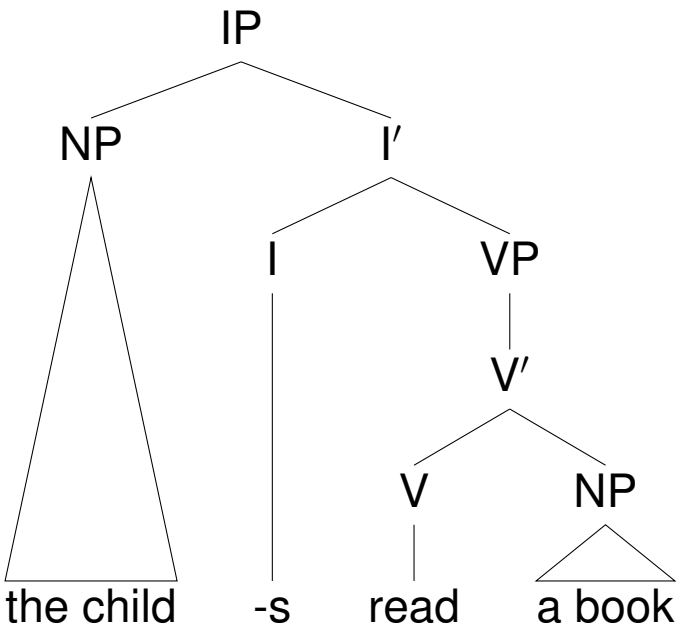
The CP and IP

However, remember from last lecture on X-bar theory that in order to capture the recursive nature of human language there have to be rules with the same category symbol on the left- and right-hand side (e.g. $\overline{\text{N}} \rightarrow \text{A}\ \overline{\text{N}}$). Chomsky therefore introduced the **Complementizer Phrase (CP)** and the **Inflectional Phrase (IP)** as layers *above* the verb phrase such that:

3. $\text{CP} \rightarrow \text{C}'$
4. $\text{CP} \rightarrow \text{NP}\ \text{C}'$
5. $\text{C}' \rightarrow \text{C}\ \text{IP}$
6. $\text{IP} \rightarrow \text{NP}\ \text{I}'$
7. $\text{I}' \rightarrow \text{I}\ \text{VP}$

Inflectional Phrase

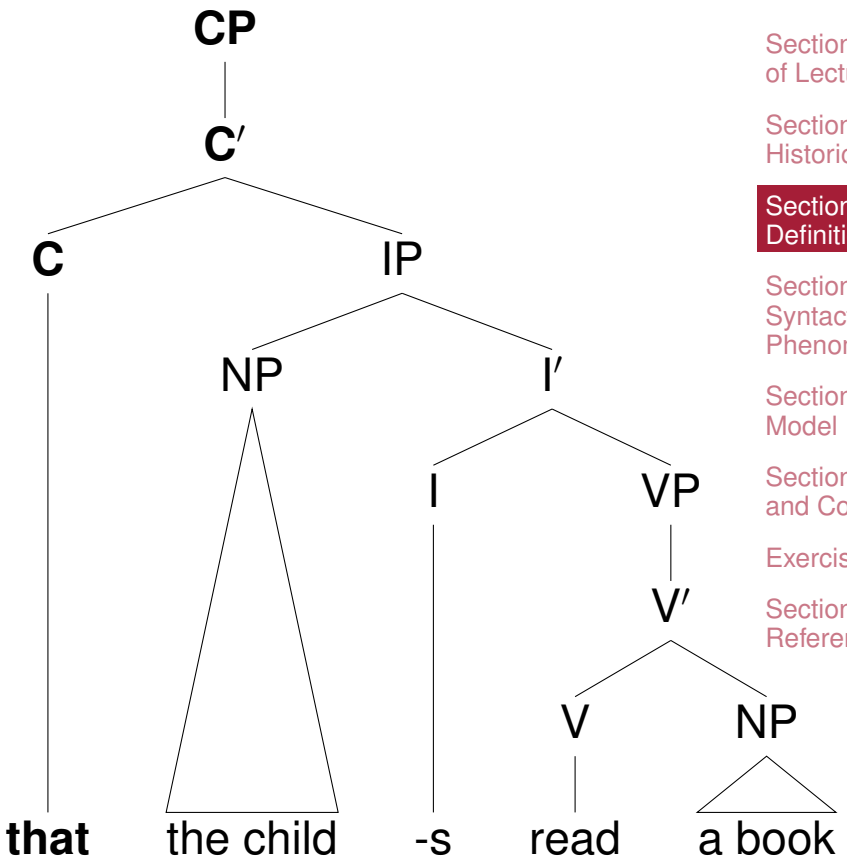
Just as in X-bar theory, we have unary branches from highest level projections to intermediate level projections if there are no other elements involved in the phrase (e.g. VP $\rightarrow$ V′). Also, the subject (the child) is considered the **specifier** of the IP (often referred to as SpecIP), and the object *a book* is the **complement** of the IP.



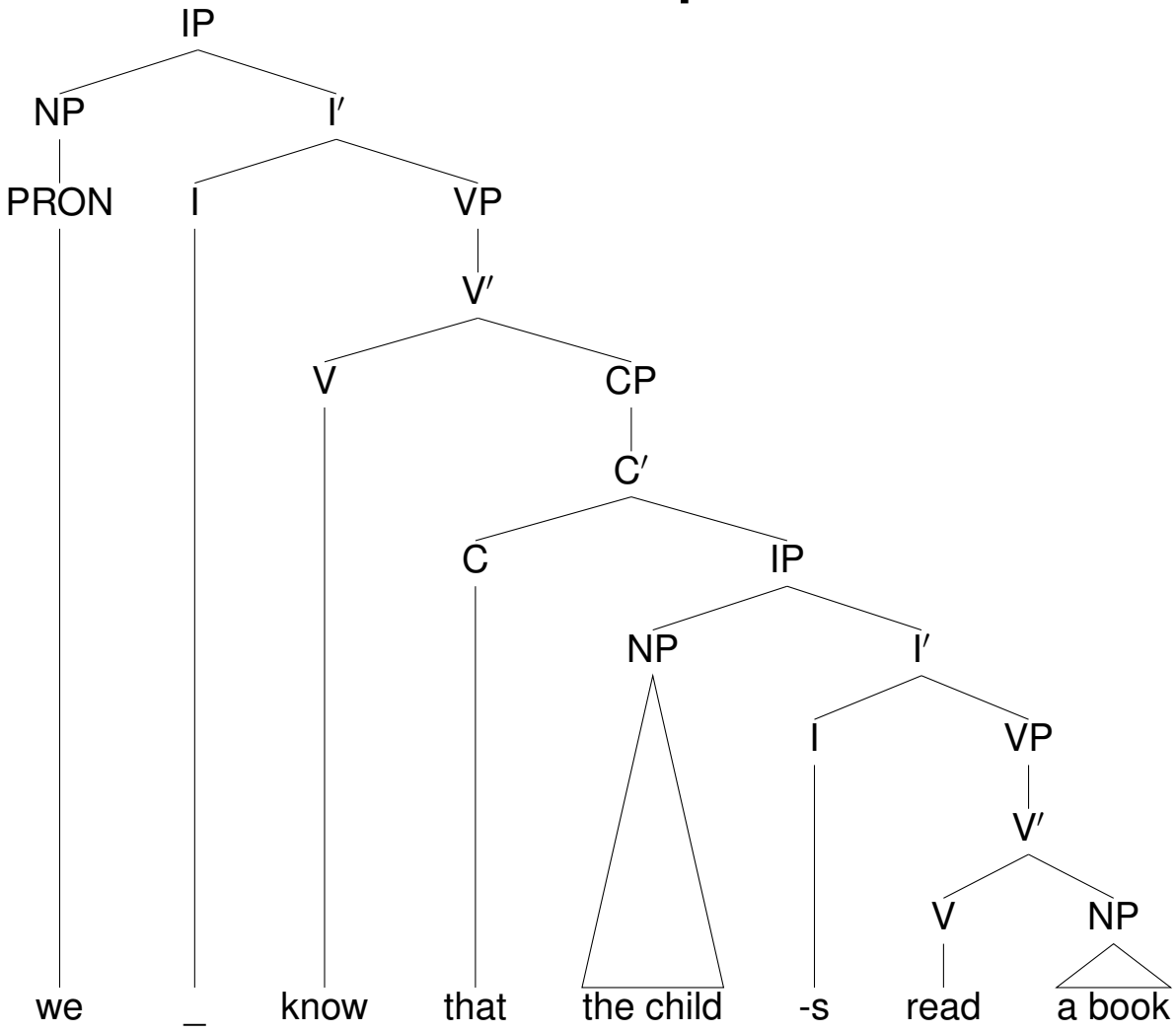
Complementizer Phrase

The CP is yet another level above the VP. It is relevant when a complementizer is used, but also for other syntactic phenomena, as we will see in the next section.

Note: The IP symbol essentially replaces the starting symbol S in GB analyses. Of course, we could keep the starting symbol and rewrite it into IP, but this would be somewhat redundant.



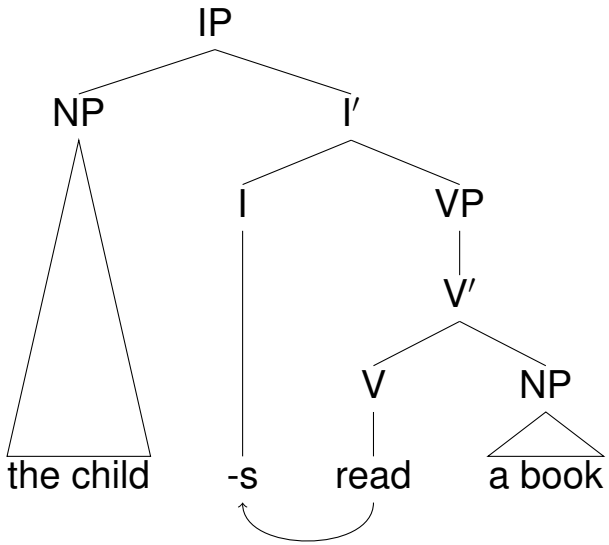
Full Example



Movement

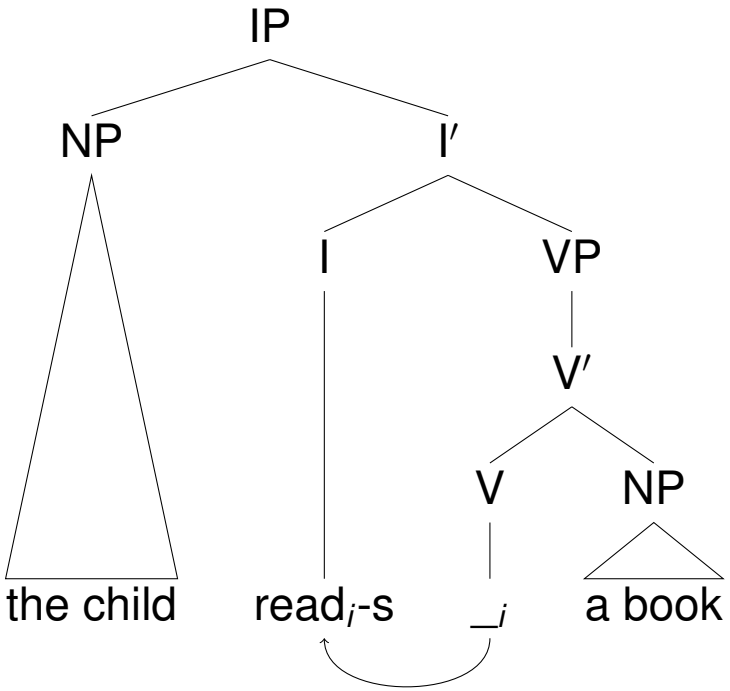
"Since the inflectional affix precedes the verb [in deep structure], some kind of **movement operation** still needs to take place [to derive the actual surface structure]. There are two suggestions in the literature: one is to assume lowering, that is, the affix moves down to the verb [...]. The alternative is to assume that the verb moves up to the affix [...] I [...] assume that the verb moves from V to I in English [...]"

Müller (2019). Grammatical theory, p. 100.



Trace

When an element moves into another position in the tree, it leaves a so-called **trace** in the position where it was before. The trace is an empty element that is typically marked by an underscore <_> and an index (often starting with i, and j, k, etc. for further traces) which is then also found on the moved element.



Notation Glossary

A: adjective
AP: adjective phrase
Adv: adverb
AdvP: adverbial phrase
C: complementizer (i.e. *that*)
D: determiner
I: finiteness or inflection
IP: inflectional phrase
N: noun
NP: noun phrase
P: preposition
PP: prepositional phrase
PRON: pronoun
REL: relative clause
V: verb
VP: verb phrase

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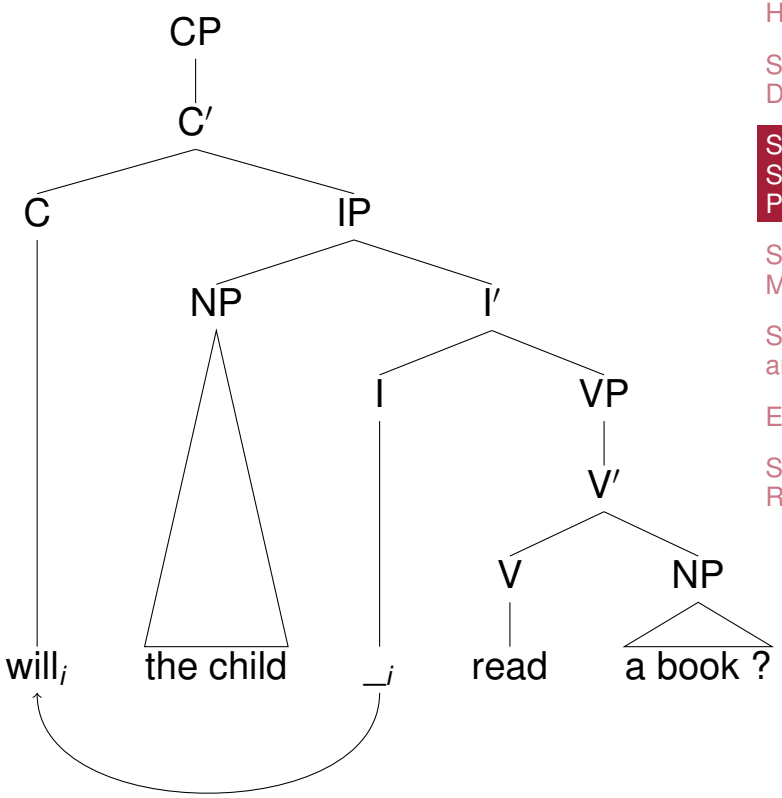
Section 4: Syntactic Phenomena

Yes/No Questions

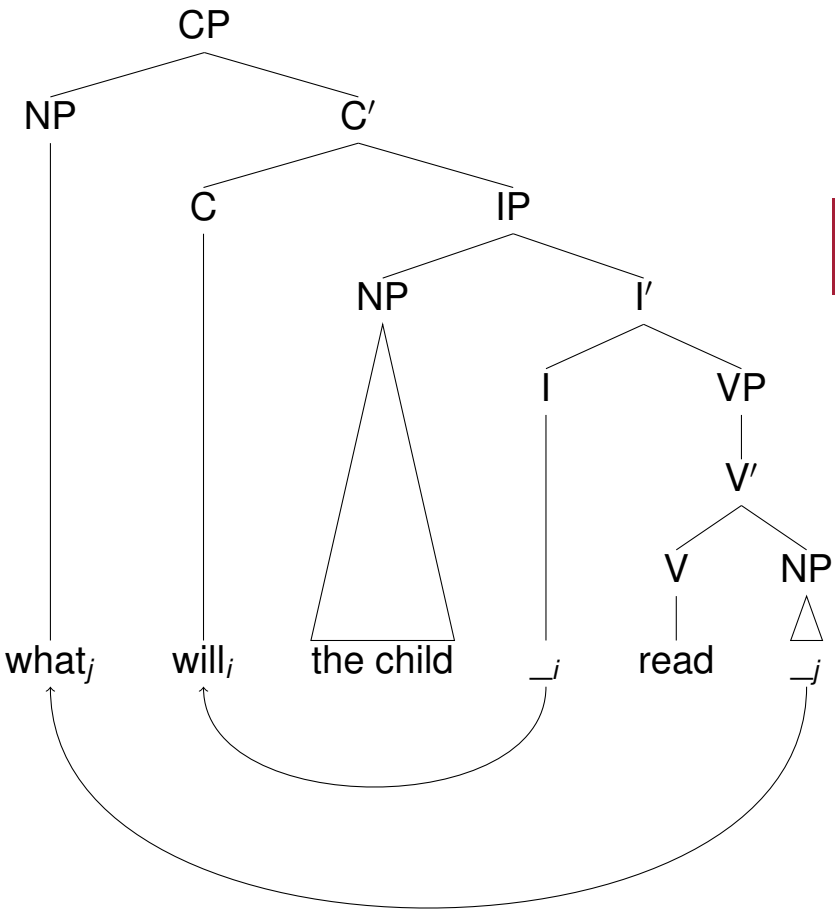
In some languages, including English and German, the finite verb “moves” to the beginning of the sentence to form a yes/no question. In the GB framework, this means that the verb moves into the Complementizer (C) position.

Note: The auxiliary *will* is now under the non-terminal symbol C which actually stands for a different part-of-speech category, i.e. complementizer (*that*). So here the consistency of classing lexical items under the correct POS symbols is now given up in favor of maintining the same deep structure template.



Wh-Questions

In wh-questions, it is assumed that the wh-word is in the complement position of the verb phrase in deep structure (i.e. *what* $\rightarrow$ *the book*). It then moves to the NP position of the CP to form the surface structure realization.



Verb Position

Verb position (initial, medial, final) can be handled in GB theory (similar to other PSG based frameworks) by flexibly changing the order of elements in the re-write rules for the IP and the VP.

Black (1999). A step-by-step introduction to the government and binding framework.

Abaza (abq, Abkhaz-Adyge)

(1) H-pa xsʲı yıǰın
our-son milk **drink**.PRF.3SG
"Our son drank milk."

Tzotzil (tzo, Mayan)

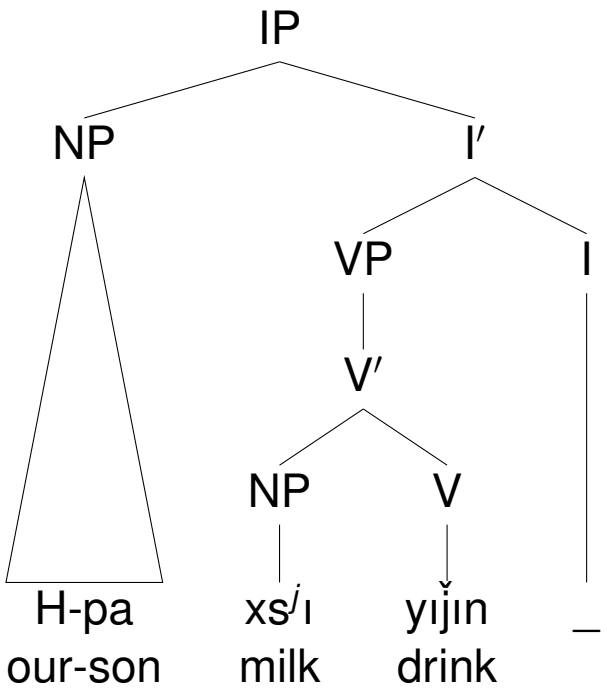
(2) ʔi-s-pet lok'el ʔantz ti t'ul-e.
CP-A3-**carry** away woman the rabbit-CL[3]
"The rabbit carried away the woman."

[3]Abbreviations: CP = completive aspect; CL = clitic; A3 = third person absolutive.

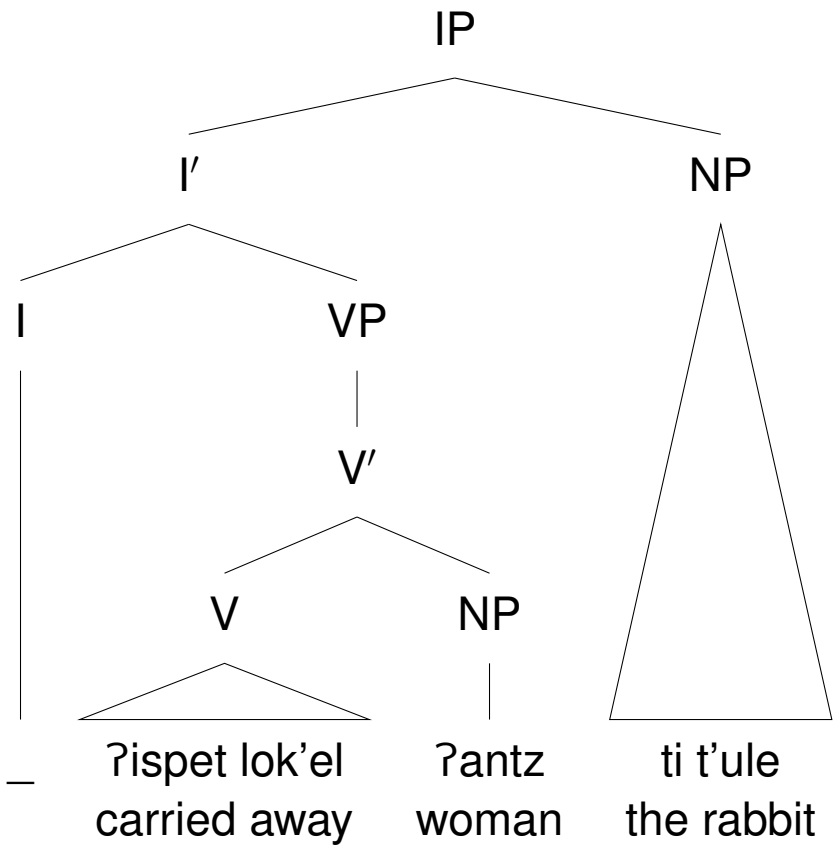
Verb final position (SOV)

Note: Black (1999), p. 15 gives an alternative notation where the underscore representing an empty element in I is replaced by a feature matrix which reflects the inflectional features of the verb, i.e.

$$\begin{bmatrix} +past \\ 3pers \\ +sg \end{bmatrix}.$$



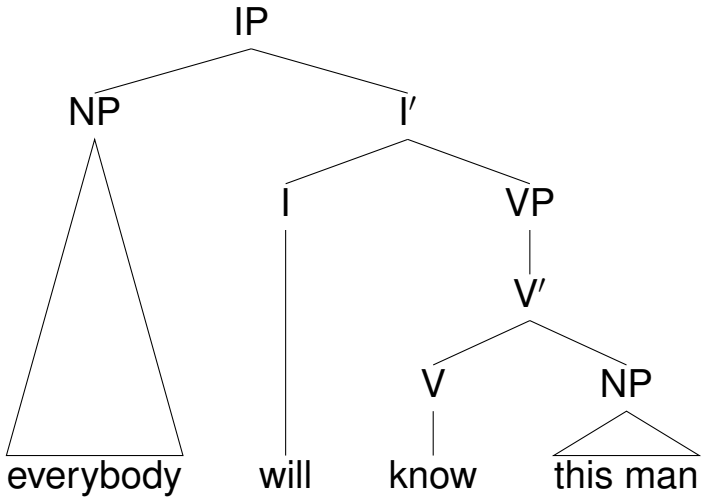
Verb initial position (VOS)



Fronting

Fronting of elements that are topicalized is handled similar to other types of movement such as wh-movement or movement of auxiliaries in questions (see examples above). Namely, the fronted element(s) can move into positions of higher level phrases (CP and IP).

Regular Structure



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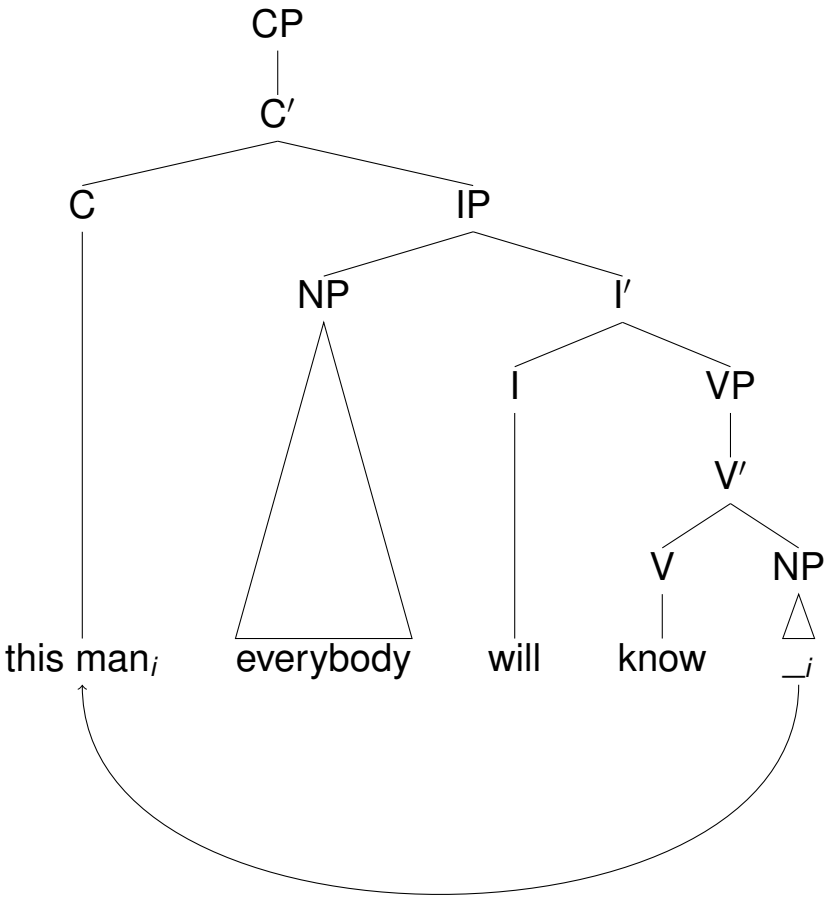
Fronted Structure



Passive

Passive constructions are handled in GB with the same underlying deep structure as **active constructions**. Note that this is an important deviation from traditional PSGs. In a traditional PSG you would have to formulate different phrase structure rules for active and passive senttences, while within GB active and passive sentences are connected, i.e. the active sentence is **transformed** into a passive sentence.

Early example of a transformational rule going back to Chomsky (1957):

$NP_1\ V_2\ NP_3 \rightarrow 3\ [_{AUX}$ be] 2en $[_{PP}\ [_P$ by] 1]
John sees Mary $\rightarrow$ Mary $[_{AUX}$ is] seen $[_{PP}\ [_P$ by] John]

Müller (2019). Grammatical theory, p. 85.

Interlude: Case assignment

In order to fully understand the passive transformation in GB we need to know the following principle about case assignment:

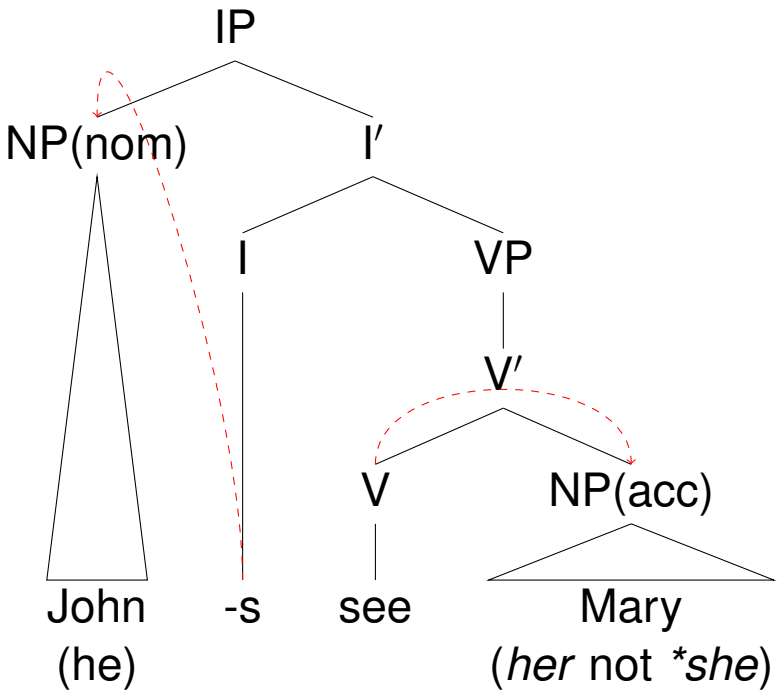
Case Principle

- V assigns objective case (accusative) to its complements if it bears structural case.
- When finite, INFL assigns case to the subject.

Note: The difference between *structural case* and *lexical case* is discussed in Müller (2019), p. 109-110. However, it is generally controversial whether such a distinction is actually valuable, or if all case should be considered lexical case.

Active (D-Structure)

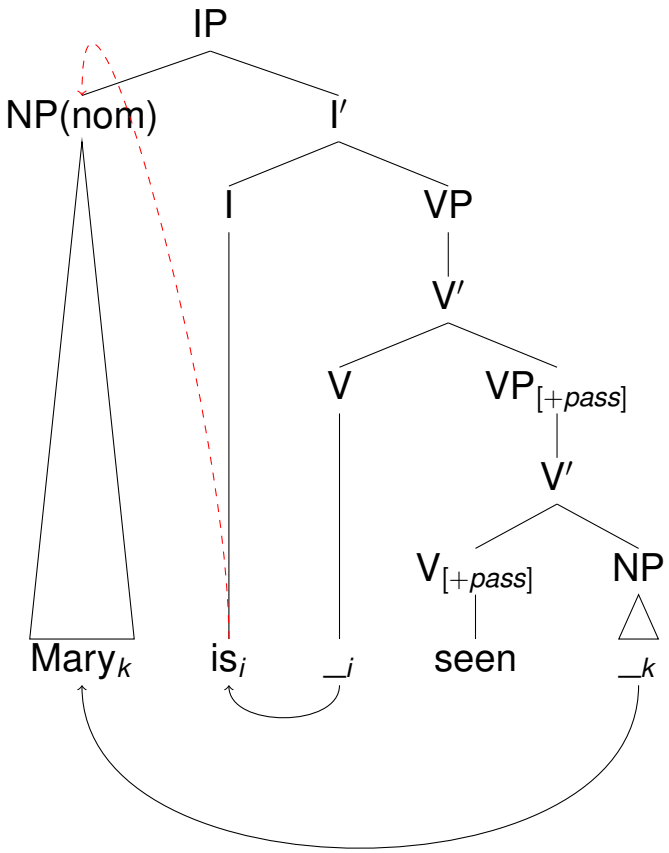
Given the case principle, in an active phrase, I assigns nominal case to the NP in the specifier position of IP (aka SpecIP), while V assigns accusative case to its complements.



Passive (S-Structure)

In the corresponding passive sentence, firstly, the subject of the active sentence is cancelled. This allows for the accusative object of the active sentence to move into the NP position of the IP. Also, a new verb (is) is "recruited" from the lexicon. This is enabled by the rewriting rule: $V' \rightarrow V\ VP$. Hence, nominative case is then assigned by the auxiliary *is* to the new subject. Accusative case is "absorbed", i.e. not assigned anymore.

see also Black (1999), p. 30-31



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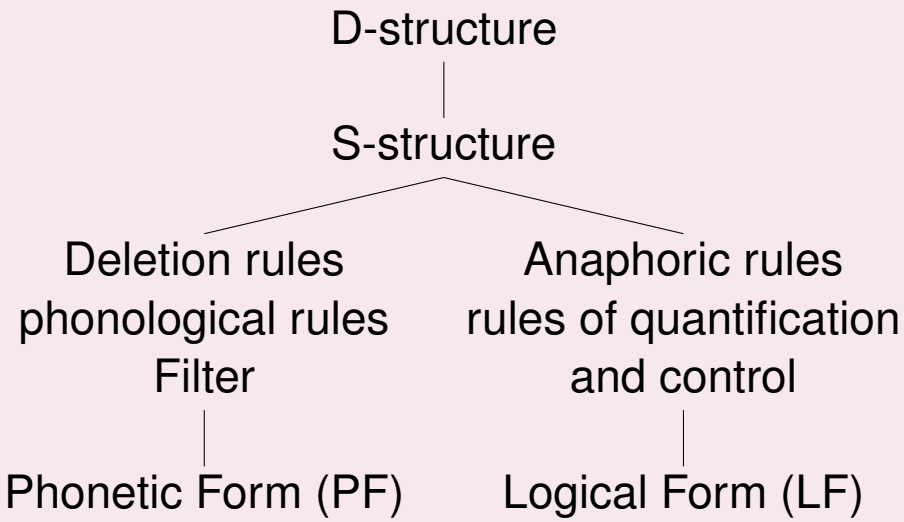
Section 5: The T Model

The T Model

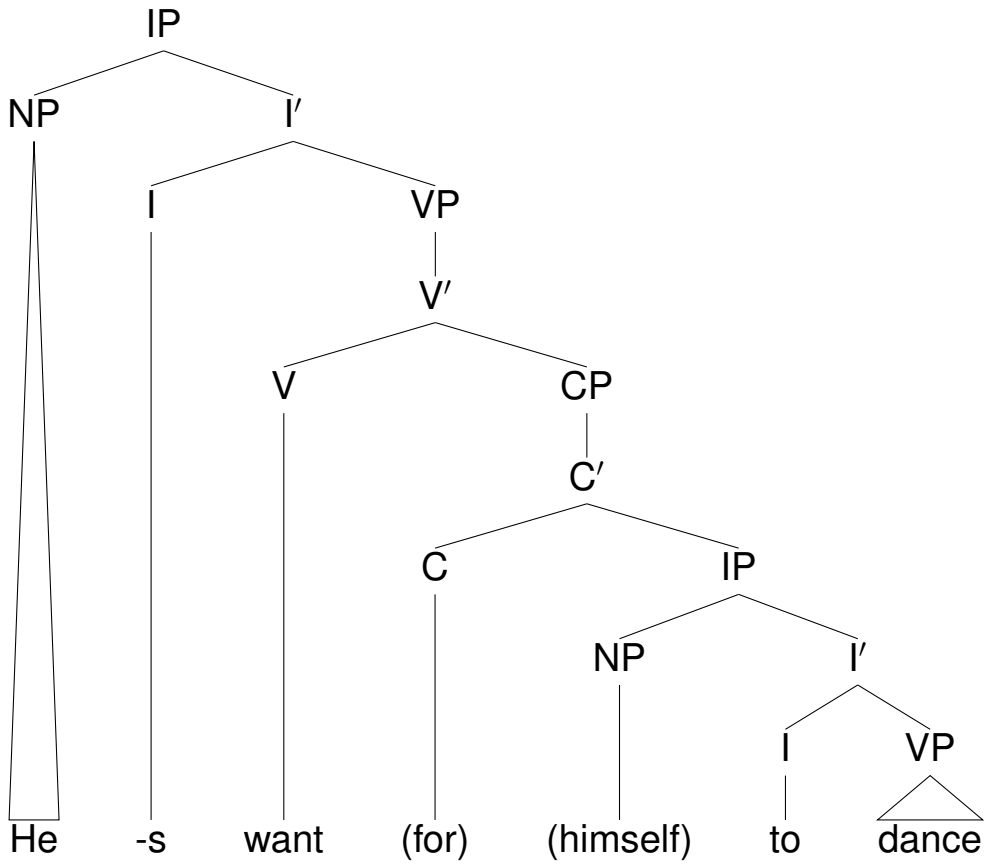
The T (Y) model (called by its shape when you invert it) is a schematic representation of all the underlying processes assumed for generating well formed sentences in GB theory.



Müller (2019). Grammatical theory, p. 88.

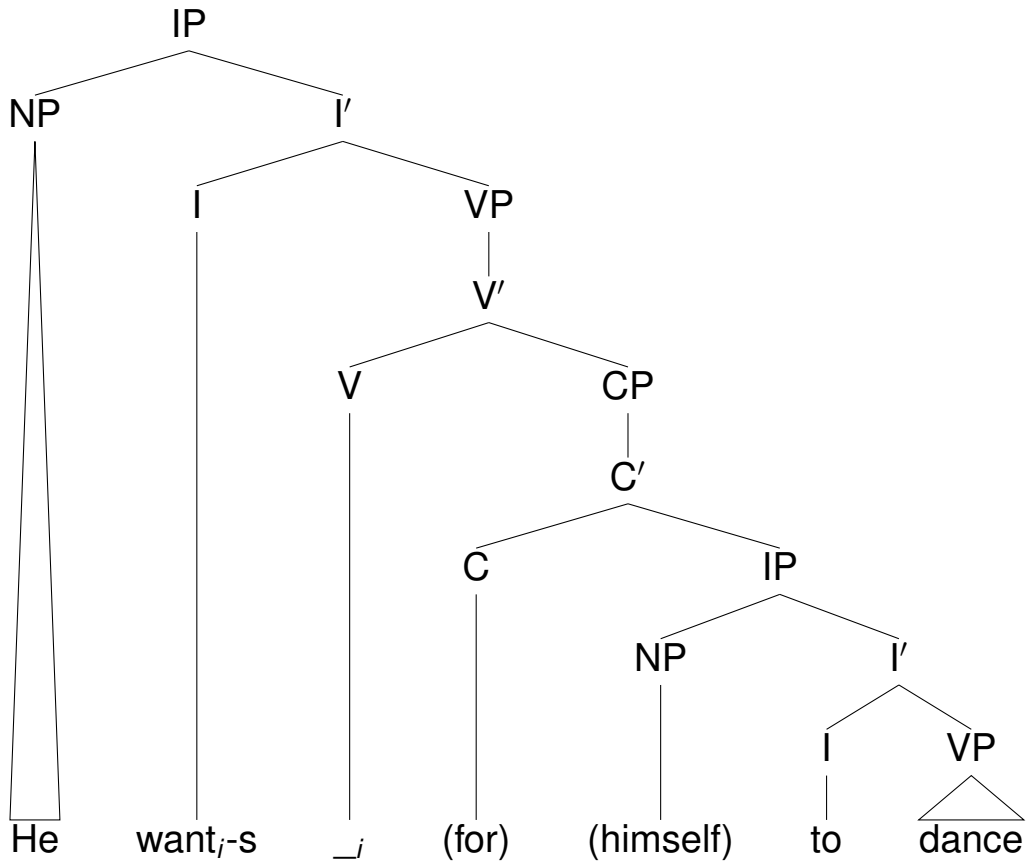
D-Structure

Deep structure in GB theory refers to the underlying template or mould that is used to build all grammatical sentences in a given language.



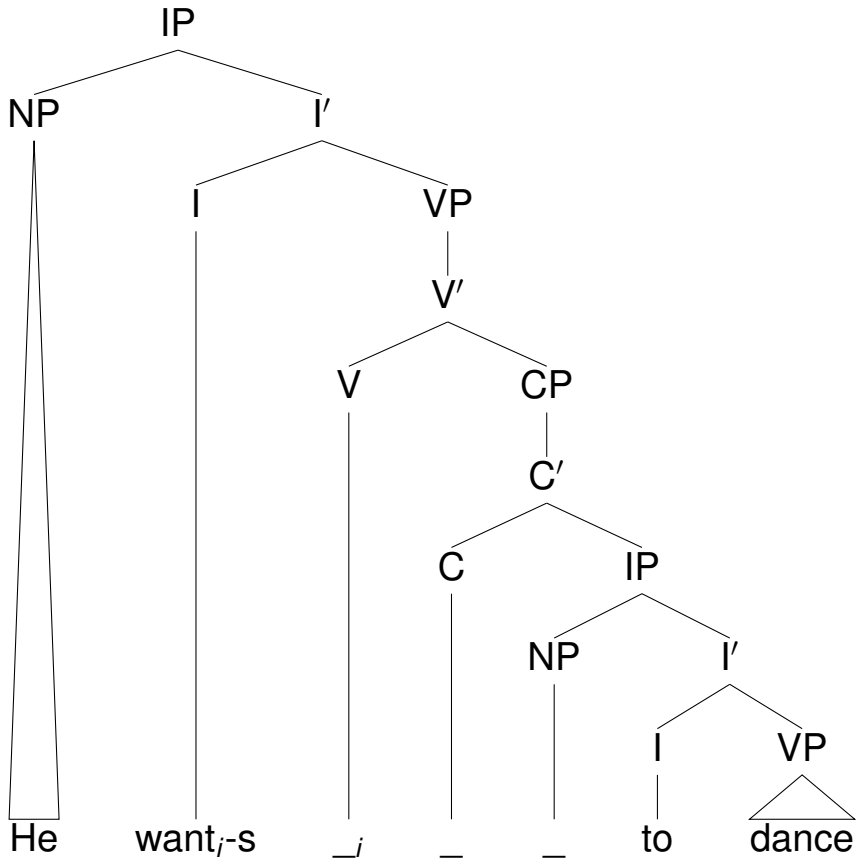
S-Structure

Surface structure is then derived by transformations which allow to move elements around (move α) and reassign cases.



Deletion Rules

Furthermore, deletion rules can be applied to the surface structure. Note that the underscores here represent deletions, not movement.



Phonetic Form

Finally, there are certain regular changes to the surface structure based on phonetic processes. An example of such a change is given by Chomsky (1981, p. 21) as *want + to* $\rightarrow$ *wanna*.

He wants to dance $\rightarrow$ (?) He *wanna* dance

Important Take-Home-Message

What is called *S-structure* or *surface structure* in GB theory is not necessarily the actual string of characters or phonemes that you might read or hear. Rather, there are two further levels which intervene between S-structure and the actual phonetic realization. For instance deletions and phonetic rules might still apply.

Logical Form

Logical Form is not further discussed here, as the underlying concepts are part of the semantics lectures. Just note that in the GB framework questions of LF (i.e. semantics) are adressed at a later stage than D-Structure and S-structure, which again reflects the “primacy” of syntax within this framework.

Why is the framework called **Government & Binding**?

Remember from the simplified example of case assignment above that there are rules of which elements (e.g. I and V) assign case (e.g. nom, acc) to which other elements (e.g. NPs). Black (1999, p. 37) now states that: “every maximal projection (XP) that dominates the NP that receives Case also dominates the head that assigns it [...]”. This obervation then leads to the defnition of **Government**:

α GOVERNS β iff

1. α is a head, and
2. every XP that dominates α also dominates β, and
3. every XP (other than IP) that dominates β also dominates α

Why is the framework called **Government & Binding**?

"Case Theory determines whether a nominative pronoun, such as *she* or *he*, is used instead of an accusative pronoun, *her* or *him*, or a genitive pronoun like *his*. It is **Binding Theory's** job to determine when a reflexive anaphor, for example, herself, is used instead of one of the pronouns, *she* or *her*."

Black (1999), p. 40.

1. She/*her/*herself shuddered.
2. Sally enjoyed *she/*her/herself at the party.
3. Sally left a note for *she/her/herself.

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Section 6: Pros and Cons of GB

Pros (Advantages)

- Formulates a highly abstract and general template (D-Structure) which can be used to model all types of sentences and syntactic phenomena (at least that is the aim)

Cons (Disadvantages)

- This highly abstract template requires many complicated mechanisms (movement, empty elements, case assignment, etc.) to derive the set of possible sentences of a language
- The lack of precise formulizations of these mechanisms has resulted in GB theory – and other so-called Mainstream Generative Grammar approaches – being largely ignored by computational linguists. See the discussion in Müller (2019, p. 120).

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Exercises

Exercise 1: X-bar Theory

Take the following English phrase: *the very diligent student that Peter knows*. Note: the *that* is a relative pronoun rather than a complementizer, hence use REL as the symbol for the whole relative clause and PRON for *that*. Hence, the highest level rewrite rule for the relative clause is: REL $\rightarrow$ PRON VP.

1. Give the X-bar theoretic tree for this phrase. Don't use triangles, i.e. always fully specify the branches, also unary branches. You don't need to give the rewrite rules. Apply the binarization constraint.
2. Give a tree according to a traditional PSG as we have discussed in lecture 5. Apply the binarization constraint. You don't have to give the rewrite rules here either, but it is useful thinking about them.
3. Discuss the differences between the two.

Exercise 2: Government & Binding Theory

Assume the following English sentence: *The woman sees the moon.* Do the following tasks:

1. Give the D-structure of this sentence according to the GB framework discussed in the lecture. Use the tree notation. You can collapse the NPs under triangles.
2. Give the S-structure of the corresponding yes/no question derived from this sentence. Note that you need so-called *do-support* here. Indicate movements by traces with indices.
3. Give the S-structure of the passive transformation of this sentence. Indicate case assignment(s) with arrow(s). Spell out the by-phrase.
4. Give the S-structure of the question derived from the passive transformation.

Section 7: References

References

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Thank You.

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