

Constraining X-Bar: Theta Theory

Carnie, 2013, chapter 8

Learning objectives

- Distinguish between thematic relation and theta role.
- Identify the thematic relations agent, theme, goal, source, experiencer, location, instrument, recipient, benefactor.
- Explain how X-bar theory overgenerates.
- Explain the structure of the lexicon.
- Draw the theta grids for a predicate.

Learning objectives

- Apply the theta criterion to a sentence as a filter to X-bar theory.
- Distinguish sentences with expletive subjects from ones with theta-role-subjects.

X-Bar Theory

- A general theory of phrase structure.
- Accounts for the distinction between adjuncts, complements and specifiers.
- Gives a more articulated view of sentence structure hierarchy .
- Captures cross-categorial generalizations: the fact that all phrases (NPs/DPs, VPs, PPs, CPs, TPs, etc) have the same basic properties.

X-Bar Theory

- Allows us to draw the trees for most of the sentences of any language.

X-bar Theory

- A significant problem of the theory is that apart from generating the grammatical sentences of a language, it also generates ungrammatical sentences.
- Consider the examples below:

X-Bar Theory

1. a. Rosemary hates New York.
b. *Rosemary hates.
2. a. Jennie smiled.
b. *Jennie smiled the breadbox.

X-Bar Theory

- 3) a. Traci gave the whale a jawbreaker.
b. *Traci gave the whale.
c. *Traci gave a jawbreaker.

X-Bar Theory

- Sentence (1b) should be perfectly acceptable (compare it to Rosemary ran). X-bar theory says that complements are optional. Therefore , direct objects , which are complements, should always be optional.

X-Bar Theory

- The opposite type of fact is seen in the pair in (2). X-bar theory optionally allows a complement. So having a direct object here should be fine too.

X-Bar Theory

- The same kind of effect is seen in (3), where both the direct object and indirect object are obligatory contra X-bar theory.

X-Bar Theory

- While certain verbs require objects, others don't and this is a property of the particular verb.
- Information about the peculiar or particular properties of verbs is contained in our mental dictionary or **lexicon**.

X-Bar Theory

- We'll look at how we can use the lexicon to constrain X-bar theory so that it doesn't predict the existence of ungrammatical sentences.

X-Bar Theory

- These facts tell us how different verb types take a different number of arguments. For example, an intransitive verb like *leave* takes a single DP, which is the subject.
- A transitive verb such as *hit* takes a DP subject and a DP object.
- This gives rise to the different subcategories of verbs below:

X-Bar Theory

<i>Subcategory</i>	<i>Example</i>
$V_{[DP _]}$ (intransitive)	<i>leave</i>
$V_{[DP _ _ DP]}$ (transitive type 1)	<i>hit</i>
$V_{[DP _ _ \{DP/CP\}]}$ (transitive type 2)	<i>ask</i>
$V_{[DP _ _ DP DP]}$ (ditransitive type 1)	<i>spare</i>
$V_{[DP _ _ DP PP]}$ (ditransitive type 2)	<i>put</i>
$V_{[DP _ _ DP \{DP/PP\}]}$ (ditransitive type 3)	<i>give</i>
$V_{[DP _ _ DP \{DP/PP/CP\}]}$ (ditransitive type 4)	<i>tell</i>

Selectional restrictions

There are semantic restrictions on what can appear in particular positions:

5) a. #My comb hates raisinettes.

b. #A bolt of lightning killed the rock.

Combs can't hate anything and rocks can't be killed. These semantic criteria are called **selectional restrictions**.

Selectional restrictions

- We'll look at the theory of thematic relations , which is a particular way of representing selectional and subcategorizational restrictions as a way of preventing our theory from generating ungrammatical sentences.

Thematic relations and theta roles

- One way of encoding selectional restrictions is through the use of what are called thematic relations. These are particular semantic terms that are used to describe the role that the argument plays with respect to the predicate.

Agent

- The initiator or doer of an action is called the **agent**.
- In the following sentences, Ryan and Michael are agents.

6) a. Ryan hit Andrew.

b. Michael accidentally broke the glass.

Agents are most frequently subjects, but they can also appear in other positions.

Experiencers

- Arguments that feel or perceive events are called experiencers. Experiencers can appear in a number of argument positions, including subject and object:
 - 7) a. Leah likes cookies.
 - b. Lorenzo saw the eclipse.
 - c. Syntax frightens Kenny.

Experiencers

- Experiencers are normally only found with verbs that involve a psychological component or express a notion that can be felt by a living being. For example, **the subjects of verbs of perception** (*see, perceive, hear, taste, feel, smell, etc.*), **subjects and objects of verbs of emotion** (*frighten, fear, dishearten, etc.*), and **verbs of cognition** (*know, understand, etc.*), among others can be experiencers.

Theme

- Entities that undergo actions or are moved, experienced, or perceived are called **themes**.
10) a. Alyssa kept her syntax book.
 b. The arrow hit Ben.
 c. The syntactician hates phonology.

•

Goal

- The entity towards which motion takes place is called a **goal**. Goals may involve abstract motion.

11) a. Doug went to Chicago.

b. Dave was given the pia colada mix.

c. An evil thought struck Dave.

.

Recipient

- There is a special kind of goal called **recipient**. Recipients only occur with verbs that denote a change of possession:

12) a. Mikaela gave Jessica the book.

b. Daniel received a scolding from
Hanna.

Source

- The opposite of a goal is the **source**. This is the entity from which a motion originates:
13) a. Bob gave Steve the syntax assignment.

b. Stacy came directly from sociolinguistics class.

Location

- The place where the action occurs is called the **location**:

14) a. Andrew is in Tucson's finest apartment.

b. We're all at school.

Instrument

- The object with which an action is performed is called the **instrument**:

15) a. Chris hacked the computer apart with an axe.

b. This key will open the door to the linguistics building.

Beneficiary

- Finally, the one for whose benefit an event took place is called the **beneficiary**:
 - 16) a. He bought these flowers for Aaron.
 - b. She cooked Matt dinner.

Theta roles and thematic relations

Any given DP can have more than one thematic relation.

In the following sentence, the DP *Jason* bears the thematic relations of **agent** and **source** (at the very least).

17) Jason gave the books to Anna.

There is no one-to-one relationship between thematic relations and arguments.

Theta roles and thematic relations

- However , linguists have a special construct called a **theta role (or θ role)** that does map one-to-one with arguments. **Theta roles are bundles of thematic relations that cluster on one argument.**
- In (17) above, Jason gets two thematic relations (agent and source), but only one theta role (the one that contains the agent and source thematic relations).

Theta roles and thematic relations

- Some syntacticians often refer to particular theta roles by the most prominent thematic relation that they contain. So you might hear a syntactician refer to the “agent theta role” of [DP Jason]. Strictly speaking, this is incorrect: Agent refers to a thematic relation, whereas the theta role is a bundle of thematic relations.

Theta roles and thematic relations

- But the practice is common, so we'll do it here.
- **Remember, thematic relations are things like agent, theme, goal, etc., but theta roles are bundles of thematic relations assigned to a particular argument.**

Argument structure of verbs

- We can use these theta roles to represent the argument structure of a verb.
- Take a ditransitive verb like *place*. It requires three arguments: a subject that must be an agent (the placer), a direct object, which represents the theme (the thing being placed), and an indirect object, which represents a location or goal (the thing on which the theme is being placed).

Argument structure of verbs

- Any variation from this will result in ungrammaticality:

Argument structure of verbs

- 18) a) John placed the flute on the table.
b) * placed the flute on the table.
c) * John placed on the table.
d) * John placed the flute.
e) * John placed the flute the violin on the table.²
f) * The rock placed the sky with the fork.
g) * John placed the flute the table.

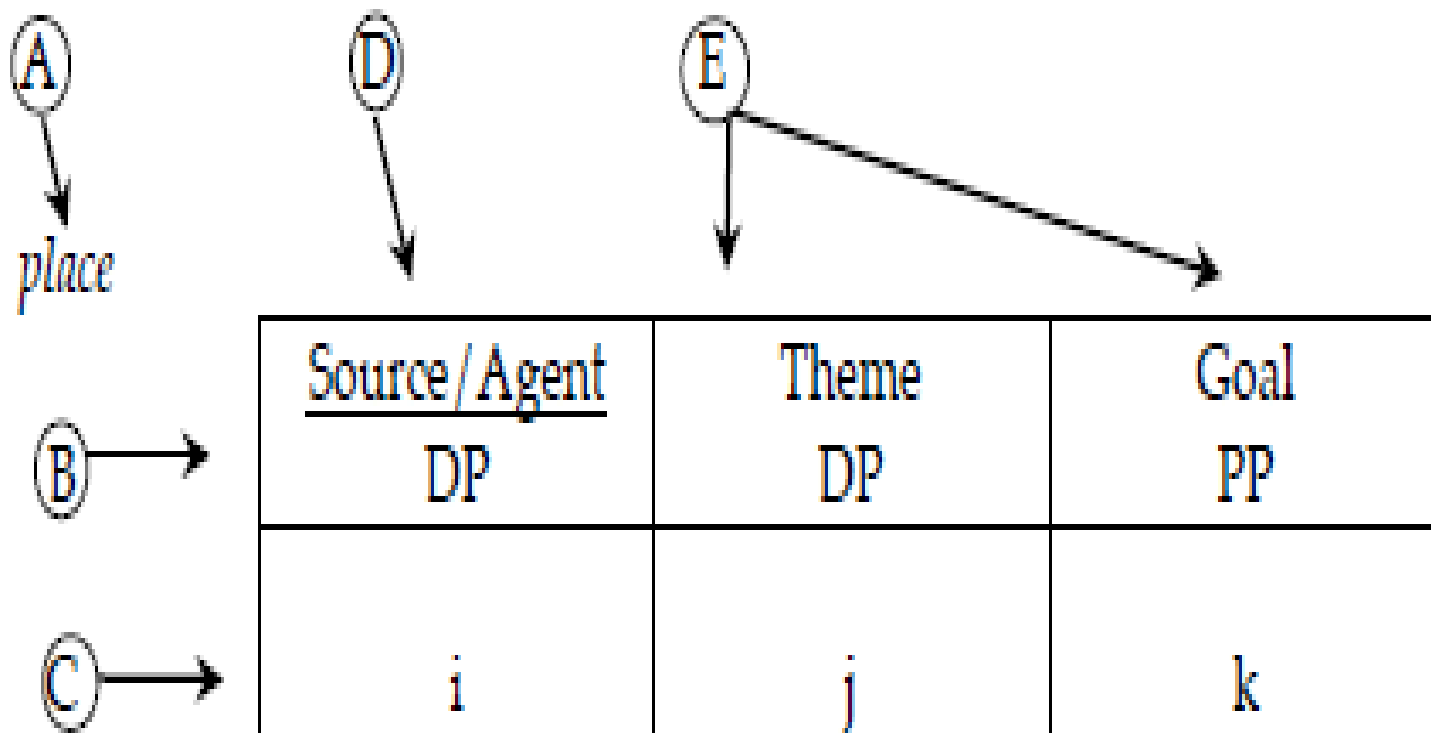
Argument structure of verbs

- Examples (18be) show that having either too many or too few arguments results in ungrammaticality. Example (18f) shows that using DPs with the wrong theta roles does the same (the rock can't be an agent; the sky can't be a theme it can't be given to anyone; and with the fork is an instrument, not a goal). (18g) shows us that the category of the argument is important. The goal argument of the verb *place* must be a PP.

Theta Grids

- We represent this formally in terms of what is called a **theta grid**.

Theta Grids



Theta Grids

- This grid consists of several parts. First of all, we have the name of the predicate (A). Next, for each argument that the predicate requires, there is a column (with two rows). Each of these columns represents a theta role. Notice that a column can have more than one thematic relation in it (but only one theta role). The number of columns corresponds exactly to the number of arguments the predicate requires.

Theta Grids

- The first row (B) tells you the thematic relations and the categories associated with each of these theta roles. The second row (C) gives you what are called indices (singular: index) for each theta role. These are not the same as the indices in binding theory . When a predicate appears in an actual sentence, we mark the DP bearing the particular theta role with that index

Theta Grids

- Applying our grid to sentence (18), we get the following indexed sentence:

20) John_i placed [the flute]_j [on the table]_k.

The *i* index maps the agent theta role to John.

The *j* index maps the theme theta role to the flute, etc.

Theta Grids

- Theta roles actually come in two types. The first is the **external theta role (D)**. This is the one assigned to the subject. External theta roles are usually indicated by underlining the name of the theta role in the theta grid (e.g., Source/ Agent in (19))
- The other kind are **internal theta roles (E)**. These are the theta roles assigned to the object and indirect object.

Theta Grids

- We will have use for the external/ internal distinction when we do DP movement.
- For now, however, you should simply indicate which argument is the subject by underlining its name.

Theta Grids

- A careful look at the theta grid in (19) will show that it only contains a specifier (subject) and complements (direct object and indirect object). There are no adjuncts listed in the theta grid.

Adjuncts seem to be entirely optional:

Theta Grids

- Adjuncts seem to be entirely optional:
21) a. John put the book on the table (with a pair of tongs). (*Instrument*)
b. (In the classroom) John put the book on the table. (*Location*)

Adjuncts are never arguments, and they never appear in theta grids.

The Theta Criterion

- In order to stop X-bar rules from over-generating, we need a constraint. Constraints are like filters. They take the output of rules, and throw away any that don't meet the constraint's requirements.

The theta criterion

In essence , we are going to allow the X-bar rules to wildly over-generate, and produce ungrammatical sentences. Those sentences, however, will be thrown out by our constraint.

The constraint we are going to use is called the **theta criterion**. The theta criterion ensures that there is a strict match between the number and types of arguments in a sentence and the theta grid.

The theta criterion

- **22) The Theta Criterion**
 - a. Each argument is assigned one and only one theta role.
 - b. Each theta role is assigned to one and only one argument.

The theta criterion

- This constraint requires that there is a **strict one-to-one match between argument DPs and theta roles**. You can't have more arguments than you have theta roles, and you can't have more theta roles than you have DPs.

The theta criterion

- Furthermore, since theta roles express particular thematic relations, the arguments will have to be of appropriate semantic types for the sentence to pass the constraint.

The theta criterion

23) *love*

<u>Experiencer</u> DP	Theme DP

The theta criterion

- When a sentence containing the predicate love is produced, we apply indices to each of the arguments and match those arguments to theta roles in the grid. The sentence in (22) is grammatical with the correct number of arguments. It is matched to the theta grid in (23).

The theta criterion

- There is a one-to-one matching between arguments and theta roles. So the theta criterion is satisfied, and the sentence is allowed to pass through the filter and surface.
24) Megan_i loves Kevin_j.

The theta criterion

25) *love*

<u>Experiencer</u> DP	Theme DP
i	j

The theta criterion

- Contrast this with the ungrammatical sentence in (24):

26) *Megan_i loves.

This sentence lacks a theme argument, as seen in the following theta grid:

The theta criterion

27) *love*

<u>Experiencer</u> DP	Theme DP
i	

The theta criterion

- The theme theta role is not assigned to an argument. This violates the condition that ‘Every theta role is assigned to an argument’. There is not a one-to-one matching of the theta roles to the arguments in this sentence. Since the theta criterion is violated, the sentence is filtered out as ungrammatical. **Notice: The X-bar rules can generate this sentence; it is ruled ungrammatical by our constraint.**

The theta criterion

- The opposite problem: A sentence with too many arguments.

28) *Megan_i loves Jason_j Kevin_k.

The theta criterion

29) *love*

<u>Experiencer</u> DP	Theme DP	
i	j	k

The theta criterion

- Here, the argument Kevin doesn't get a theta role. There are only two theta roles to be assigned, but there are three arguments. This violates the first part of the theta criterion: the requirement that every argument have a theta role. Again, the theta criterion filters out this sentence as ungrammatical.

The theta criterion

- To summarize, we can constrain the output of the X-bar rules using a semantic tool: theta roles. The theta criterion is a constraint or filter that rules out otherwise well-formed sentences. The theta criterion requires that there be a strict one-to-one matching between the number and kind of theta roles and the number and kind of arguments.

The Lexicon

- We have developed a model of grammar where we have three simple rules (the X-bar rules) that can generate a hierarchical constituent structure. These rules are constrained by the theta criterion, which uses the semantic notion of theta roles.

The Lexicon

- This theory of syntax is meant to be a cognitive theory, so let's consider the question of where these rules and these theta roles are stored in the mind.
- Chomsky proposes that the part of the mind devoted to language is essentially divided into two parts. One part, which he calls the **computational component**, contains all the rules and constraints.

The Lexicon

- This part of the mind does the work of building sentences and filtering out any ill-formed ones. The computational component can't work in a vacuum, however. It needs access to information about theta roles and the like.

The Lexicon

- Chomsky claims that this information is stored in **the lexicon**, the other part of the human language faculty. The lexicon is your mental dictionary or list of words (and their properties). If you think about it, this is the obvious place for theta grids to be stored. Which theta role is assigned to which argument is a property of each predicate .

The Lexicon

- Which theta role is assigned to which argument is a property of each predicate. It is information that must be associated with that predicate and that predicate only. The obvious place to store information about particular words (or more properly lexical items) is in the lexicon.

The Lexicon

- The lexicon contains all the irregular and memorized parts of language. Each lexical entry (dictionary entry) must contain at least the following information):

The Lexicon

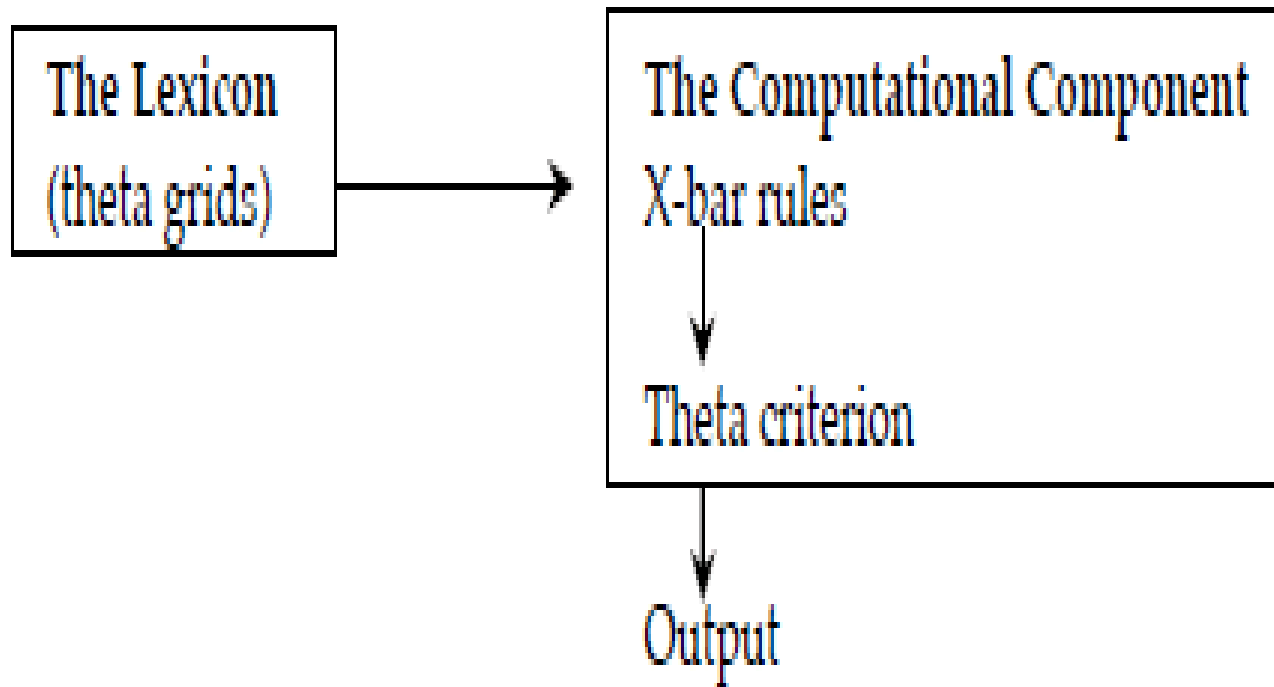
- The lexicon contains following information:
- the meaning of the word
- the syntactic category of the word (N, V, A, P, T, C, etc.)
- the pronunciation of the word exceptional information of all kinds (such as morphological irregularities)
- the theta grid (argument structure).

The Lexicon

- When you learn a new word, you memorize all this information.
- On an abstract level we can diagram the grammatical system as looking something like:

The Lexicon

30)



The Projection Principle

- The lexicon feeds into the computational component, which then combines words and generates sentences.
- The fact that lexical information affects the form of the sentence is formalized in what we call the **Projection Principle**.

The Projection Principle

- **31) The Projection Principle**

Lexical information (such as theta roles) is syntactically represented at all levels.

The Extended Projection Principle

- Two classes of special predicates present an interesting case.
- One of them is “weather” verbs. These predicates don’t seem to assign any theta roles:

32) a. It rained.

b. It snowed.

c. It hailed.

The Extended Projection Principle

- What theta role does the pronoun *it* get in these sentences?
- What does *it* refer to in the above sentences?

The Extended Projection Principle

- It appears as if it doesn't refer to anything.
- In syntax, we refer to pronouns like this as **expletive or pleonastic pronouns**. These pronouns don't get a theta role (which of course is a violation of the theta criterion a point we will return to below). The theta grid for weather verbs is empty. They don't assign any theta roles.

The Extended Projection Principle

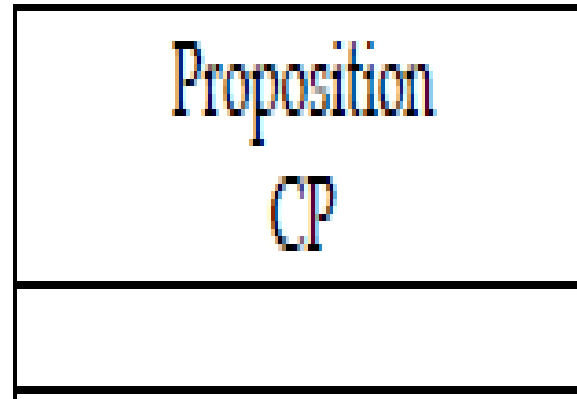
- There is another class of predicates that take expletive pronouns . These are predicates that optionally take a CP subject:

33) [CP That Bill loves chocolate] is likely.

The predicate is likely assigns one theta role. It takes one argument (the clause). (We will tentatively notate these clausal arguments with the theta role *proposition*, but will refine this later.

The Extended Projection Principle

34) is likely



The Extended Projection Principle

- You'll note that in (34) the theta role is not underlined. This is because the clause bearing the theta role of proposition is a complement. This can be seen in the following example:

35) It is likely that Bill likes chocolate.

In this sentence, we again have an expletive *it*, which gets no theta role.

The Extended Projection Principle

- In order to maintain the theta criterion , we need to account for these expletive DPs without theta roles . Expletive pronouns usually appear in subject position . When it appears in other positions, it usually bears a theta role:
36) a. I love it. (it is a theme)
 b. I put a book on it. (it is a goal or location)

The Extended Projection Principle

- Expletives seem to appear where there is no theta marked DP (or CP) that fills the subject position.
- This is encoded in a revised version of the Projection Principle: **The Extended Projection Principle (EPP).**

The Extended Projection Principle

- 37) Extended Projection Principle (EPP)
All clauses must have subjects (i.e. the specifier of TP must be filled by a DP or CP) and lexical information is expressed at all levels.

The EPP works like the theta criterion. It is a constraint on the output of the X-bar rules. It requires that every sentence have a subject.

The Extended Projection Principle

- Next, we must account for the fact that expletives violate the theta criterion. One way of doing this is by claiming that expletives are not generated by the X-bar rules. Instead, they are inserted by a special expletive insertion rule.

The Extended Projection Principle

- 38) Expletive insertion rule

Insert an expletive pronoun into the specifier of TP.

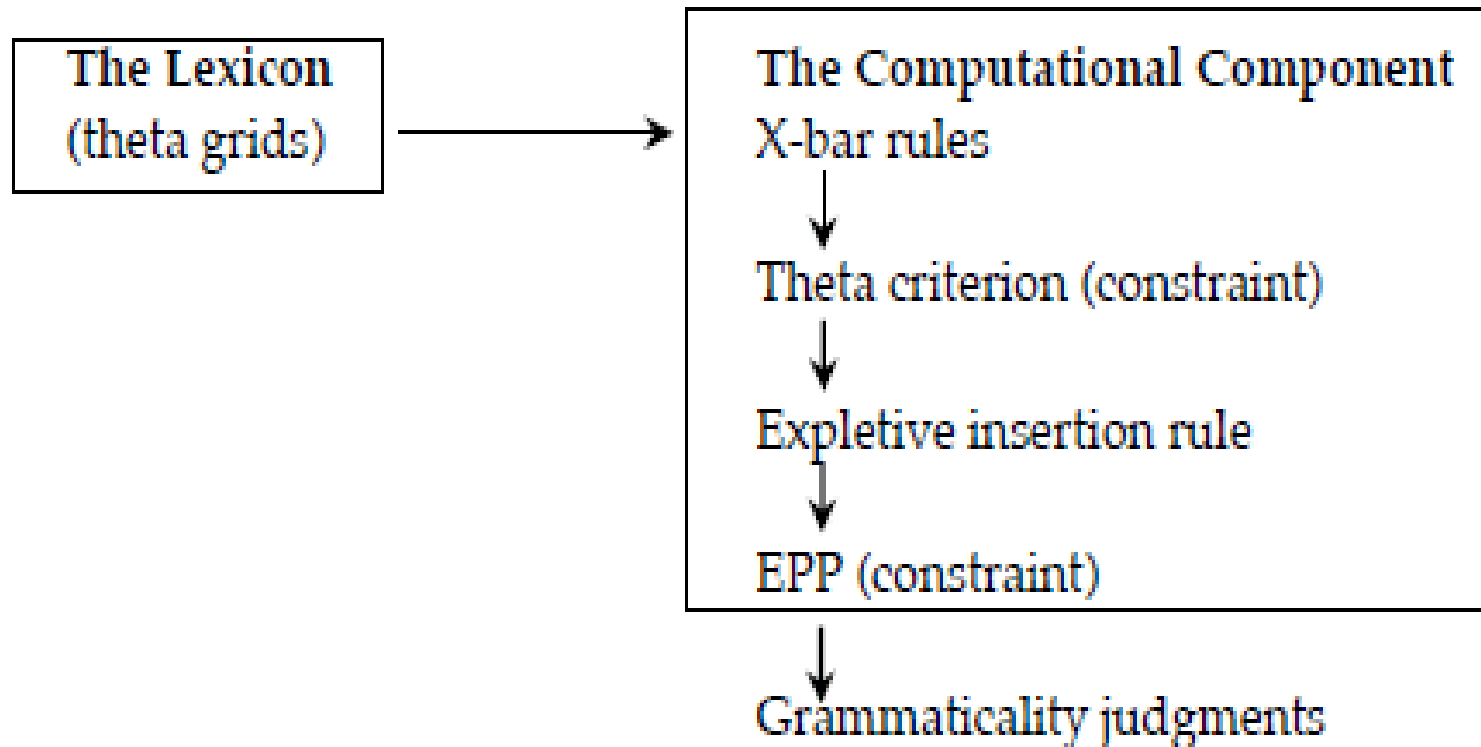
This rule applies when there is no other subject.
If there is no other subject.

The Extended Projection Principle

- If there is no theta marked subject and no expletive subject, then the EPP will filter the sentence out.

The way in which we get around the theta criterion is by ordering the expletive insertion rule after the theta criterion has applied.

The Model



The Model

- Since expletives are inserted after the theta criterion has applied, they can't be filtered out by it.
- The model we've drawn here is very preliminary. In the next lecture, we will introduce a new kind of rule (the transformation - of which expletive insertion is a very special case) that will cause us to significantly revise this diagram.

Summary

- We've made the observation that while X-bar rules capture important facts about constituency and cross-categorial generalizations, they over-generate.
- One way of constraining X-bar theory is by invoking lexical restrictions on sentences, such that particular predicates have specific argument structures, in the form of theta grids.

Summary

- The theta criterion rules out any sentence where the number and type of arguments don't match up one to one with the number and type of theta roles in the theta grid.

Summary

- We also looked at one apparent exception to the theta criterion: theta-role-less expletive pronouns. These pronouns only show up when there is no other subject, and are forced by the EPP. They escape the theta criterion by being inserted after the theta criterion has filtered out the output of X-bar rules.

Summary

- By using lexical information (like theta roles) we're able to stop the X-bar rules from generating sentences that are ungrammatical . Unfortunately, as we'll see in the next chapter, there are also many sentences that the X-bar rules cannot generate . In order to account for these, we'll introduce a further theoretical tool: the movement rule.

Acknowledgements

These slides were prepared from:

Carnie, Andrew (2013). *Syntax: A Generative Introduction* (Introducing Linguistics) (Kindle Locations 6209-6212). Wiley. Kindle Edition.

The End