Introduction to syntax

LING 20: Introduction to Linguistic Analysis

UCLA · Winter, 2022

The big question

What do you know when you know a human language?

1. a finite set of idiosyncratic, memorized **basic elements**
2. **rules** for combining and manipulating these elements

Overview

- **Phonetics:**
  How are sounds articulated?

- **Phonology:**
  How are sounds organized and manipulated?

- **Morphology:**
  How are words built up from morphemes?

- **Syntax:**
  How are sentences formed from words?

Syntax

- Syntax studies the rules of sentence formation.

- Which arrangements of words make good sentences?

  (1) a.   The dog chased the cat.
       b. *Dog cat the chased the.

Some core properties of syntax

1. Creativity

2. Category dependence

3. Recursion

Some core properties of syntax

1. **Creativity**

2. Category dependence

3. Recursion

Creativity

Speakers can understand and produce sentences that they have never encountered before:

(2) Aardvarks from Eastern South Africa have a special, triangular pocket in their abdomens that they use to store rocks and sometimes small rodents.

Creativity

Speakers can understand and produce sentences that they have never encountered before:

(2) Aardvarks from Eastern South Africa have a special, triangular pocket in their abdomens that they use to store rocks and sometimes small rodents.

(3) In 18th century England, gambling dens employed someone whose job was to swallow the dice if there was a police raid.

Creativity

Not every string of words in a language is a sentence of that language:

(4) a. A shrimp's heart is in its head.

　　b. *Head a heart its shrimp's in is.

Implication:
There are **rules** about these combinations!

Some core properties of syntax

1. Creativity

2. Category dependence

3. Recursion

Syntactic categories

- Words belong to classes, called **GRAMMATICAL CATEGORIES** (or parts of speech).

- Syntactic rules only care about these grammatical categories, not individual words.

⇥ **Category dependence**

A new word

"snerd":
a video game that can be completed in under 10 hours

(5) a. This game is a real snerd.

    b. Don't buy that snerd!

    c. Snerds really annoy me.

    d. *I snerd every weekend.

    e. *I play very snerd.

The role of categories

- You figured out that *snerd* is a noun.

- Because your knowledge of syntax tells you where nouns can and cannot occur, you immediately knew where *snerd* can and cannot go.

N(ouns)

- **Examples:**
  dog, cat, chair, destruction, …

- **Rule-of-thumb test:**
  can occur as X in "I heard about the X".

- In addition, we will assume that proper names (*Alex, Taylor, Pat, …*) and pronouns (*I, you, she, he, they, …*) are also nouns.

V(erbs)

- **Examples:**
  walk, talk, consider, know, say, …

- **Rule-of-thumb test:**
  can have "can" appear directly before them

A(djectives)

- **Examples:**
  big, bad, long, happy, careful, ...

- **Rule-of-thumb test:**
  can appear between *the very* and a N

D(eterminers) + P(repositions)

- **Determiners:**
  the, that, a, some, every, ...

- **Prepositions:**
  to, from, on, after, behind, ...

Summary: Category dependence

- Words belong to different categories:

  - **N**(oun)

  - **V**(erb)

  - **A**(djective)

  - **D**(eterminer)

  - **P**(reposition)

  - …

- Syntactic rules care only about categories.

Some core properties of syntax

1. Creativity

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Sentences are unbounded

Fun fact:
There is **no upper limit** on how long sentences can be.

(6) Rose ate a cheesecake.

Example: Unboundedness

(6)   Rose ate a cheesecake.

(7)   Blanche said that Rose ate a cheesecake.

(6) Rose ate a cheesecake.

(7) Blanche said that Rose ate a cheesecake.

(8) Dorothy thought that Blanche said that Rose ate a cheesecake.

Example: Unboundedness

(6) Rose ate a cheesecake.

(7) Blanche said that Rose ate a cheesecake.

(8) Dorothy thought that Blanche said that Rose ate a cheesecake.

(9) Sophia said that Dorothy thought that Blanche said that Rose ate a cheesecake.

Recursion

- A sentence can itself contain another sentence.

  → **Recursion**

- Because of this property, sentences can be unboundedly long.

  → There is no longest sentence of English.

  → There is an infinite number of English sentences.

Another example of recursion

(10)   Alex ate muffins and cookies.

Another example of recursion

(10)   Alex ate muffins and cookies.

(11)   Alex ate muffins and cookies **and cupcakes**.

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(10)   Alex ate muffins and cookies.

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(12)   Alex ate muffins and cookies and cupcakes **and pies**.

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(13)   Alex ate muffins and cookies and cupcakes and pies **and chips**.

Another example of recursion

(10) Alex ate muffins and cookies.

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(13) Alex ate muffins and cookies and cupcakes and pies **and chips**.

(14) Alex ate muffins and cookies and cupcakes and pies and chips **and pickles**.

Recursion in general terms

- **Recursion (informal definition):**
  something contains a version of itself

- **Consequence:**
  Syntactic rules must be recursive.

- In other words, it must be possible for syntactic rules to apply to their own output.

Recursion is not limited to linguistics: fractals, Droste effect, romanesco broccoli, sourdough bread, infinity mirrors

Phrase-structure rules

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Reminder: Some core properties of syntax

- Creativity

- Category dependence

- Recursion

➜ We will develop **phrase-structure rules** to capture these properties.

Our first phrase-structure rule

- **Observation:**
  You can form a sentence in English by combining a noun and a verb.

  (1) a. Syntax rocks.

      b. Durians stink.

      c. Dorothy sleeps.

- **Phrase-structure rule:**
  S → N V
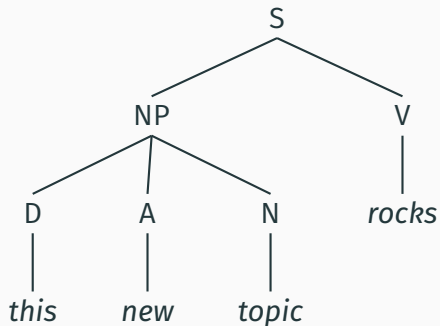 ("a sentence can consist of a noun and a verb")

$S \rightarrow N\ V$
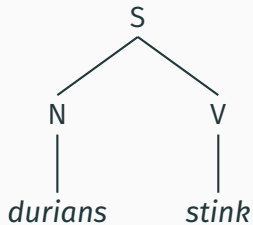
Noun phrases

- The subject can be more complex than just a single word:

  (2) a. **This topic** rocks.

  b. **This new topic** rocks.

  c. **Every cat in the room** sleeps.

- The bolded words form a syntactic unit.

- We call this unit a **Noun Phrase (NP)**.

- **S → NP V**
  ("a sentence can consist of a noun phrase and a verb")

- **NP → (D) (A) N (P NP)**
  ("a noun phrase consists of a noun and optionally a determiner, adjective, preposition and noun phrase")

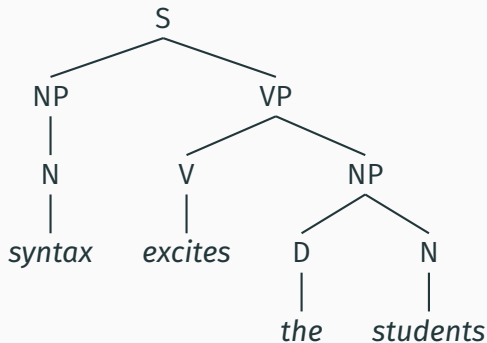- Elements in "( )" are optional.

A new tree

Verb phrases

- A subject NP can combine with more than just a verb:

  (3) a. Syntax **excites the students**.

        b. The cat **likes Blanche**.

- We call this unit a **VERB PHRASE (VP)**.

Some new rules

- **S → NP VP**
  ("a sentence consists of a noun phrase and a verb phrase")

- **VP → V (NP)**
  ("a verb phrase consists of a verb and optionally a noun phrase")

Another tree

Prepositional phrases

- In English, prepositions are usually followed by a NP:

  (4) a. The students **in the class** rock.

  b. Blanche walked **into the porch**.

- We call the unit that consists of the preposition and the NP that follows it a **PREPOSITIONAL PHRASE (PP)**.

Rules for PPs

- **Internal structure of PPs:**
  PP → P NP
  ("a prepositional phrase consists of a preposition and an NP")

- **Placement of PPs:**
  NP → (D) (A) N (PP)
  VP → V (NP) (PP)

Our rules so far
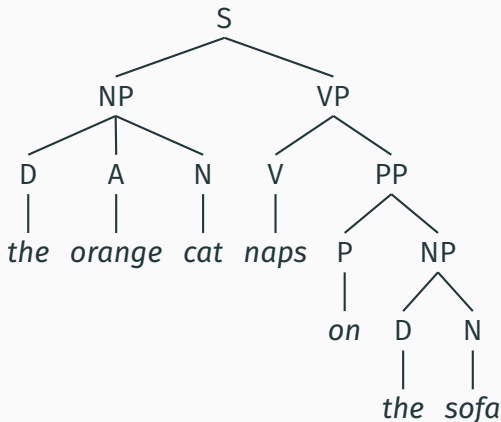
S → NP VP
NP → (D) (A) N (PP)
VP → V (NP) (PP)
PP → P NP

```
                        S
              ┌─────────┴─────────┐
             NP                   VP
          ┌───┼───┐          ┌────┴────┐
          D   A   N          V         PP
          │   │   │          │      ┌──┴──┐
         the orange cat     naps    P     NP
                                    │   ┌──┴──┐
                                    on  D     N
                                        │     │
                                       the   sofa
```
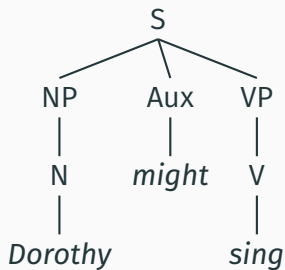
Auxiliaries

- Sentences can contain more than one verb:

  (5) a. The cat **can** sleep.

      b. Blanche **is** eating cheesecake.

      c. Dorothy **might** sing.

- These verbs are called **AUXILIARY VERBS (AUX)**:
  can, be, have, do, should, will, …

- **A new rule:**
  S → NP Aux VP

Auxiliary example

Complementizer phrases

- Subjects and objects do not have to be NPs, they can be clauses too:

  (6) a. **That Dorothy sings** annoys Sophia.
      b. I think **that syntax rocks**.

- The bolded words form a unit.

- We call this unit a **COMPLEMENTIZER PHRASE (CP)** because they start with a complementizer.

- **Complementizers:**
  that, if, whether

Some new rules

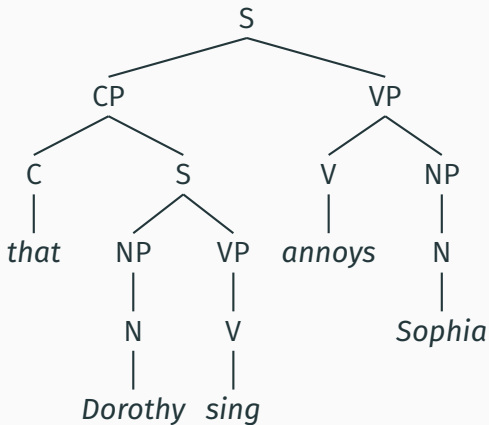- **S → CP VP**
  ("a sentence can consist of a CP and a VP")

- **VP → V (NP) (PP) (CP)**
  ("a VP consists of a verb and optionally an NP and/or a PP and/or a CP")

- **CP → C S**
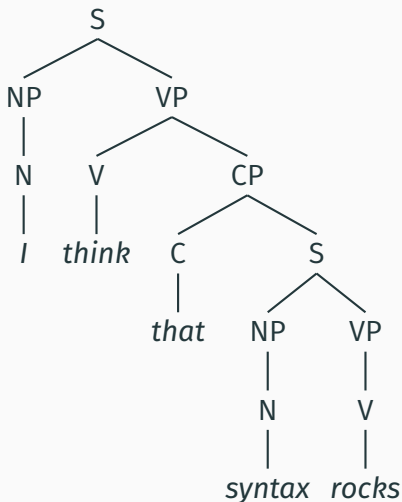 ("a CP consists of a complementizer and a sentence")

Tree:

```
                    S
          ┌─────────┴─────────┐
         NP                   VP
          │            ┌───────┴───────┐
          N            V               CP
          │            │        ┌───────┴───────┐
          I          think      C               S
                       │        │        ┌───────┴───────┐
                      that     that     NP               VP
                                         │                │
                                         N                V
                                         │                │
                                       syntax           rocks
```

- CPs can also occur inside NPs:

  (7) The rumor **that Rose snores** amuses Blanche.

- **A new rule:**
  NP → (D) (A) N (PP) (CP)

Tree: CP inside NP
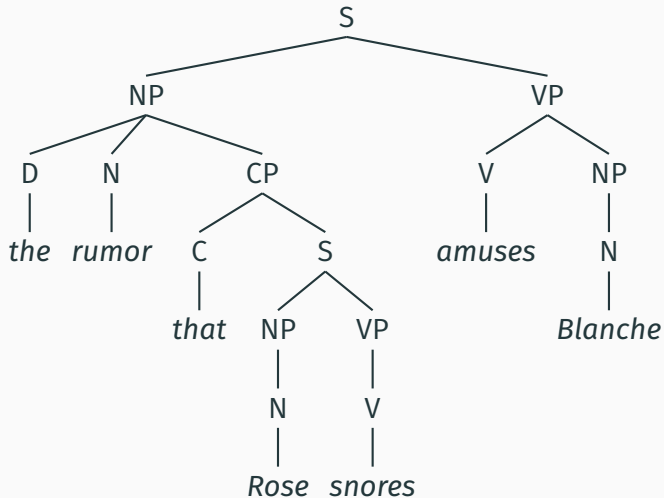
Taking stock

These are the rules that we have so far (these are **not** yet final, though):

S → NP (Aux) VP
S → CP (Aux) VP
NP → (D) (A) N (PP) (CP)
VP → V (NP) (PP) (CP)
PP → P NP
CP → C S

Recursion

Reminder:
There is **no upper limit** on how long sentences can be.

Recursion

(8)   Rose ate a cheesecake.

(9)   Blanche said that Rose ate a cheesecake.

(10)   Dorothy thought that Blanche said that Rose ate a cheesecake.

(11)   Sophia said that Dorothy thought that Blanche said that Rose ate a cheesecake.

Recursion

- **Consequence:**
  A sentence can itself contain another sentence.

- Because of this, English sentences can be **unboundedly long**.

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  something contains a version of itself

Recursion in phrase-structure rules

- *Some of our rules:*
  S → NP VP
  VP → V (CP)
  CP → C **S**

- This set of rules is recursive because it produces a **sentence within a sentence**.

Recursion

Key consequence:
English has a limited number of words and a limited number of syntactic rules, but thanks to recursion, we can form an infinite number of sentences.

More recursion: PP

- Our VP rule allows us to put exactly one PP into a VP.

- But VPs can contain **more than one PP**:

  (12) She walked [into the room] [past the table].

More recursion: PPs

In fact, you can have as many PPs inside a VP as you want:

(13) She walked **[into the room] [past the table] [behind the sofa] [over the rug] [through the curtain] [around the dog] [under the chandelier] [beside the settee]**.

More recursion: PPs

- **Question:**
  How do we allow our phrase structure rules to generate an unbounded number of PPs within a VP?

- **Answer: Recursion!**
  A rule that introduces one PP but can apply to its own output.

More recursion: PPs

- **Question:**
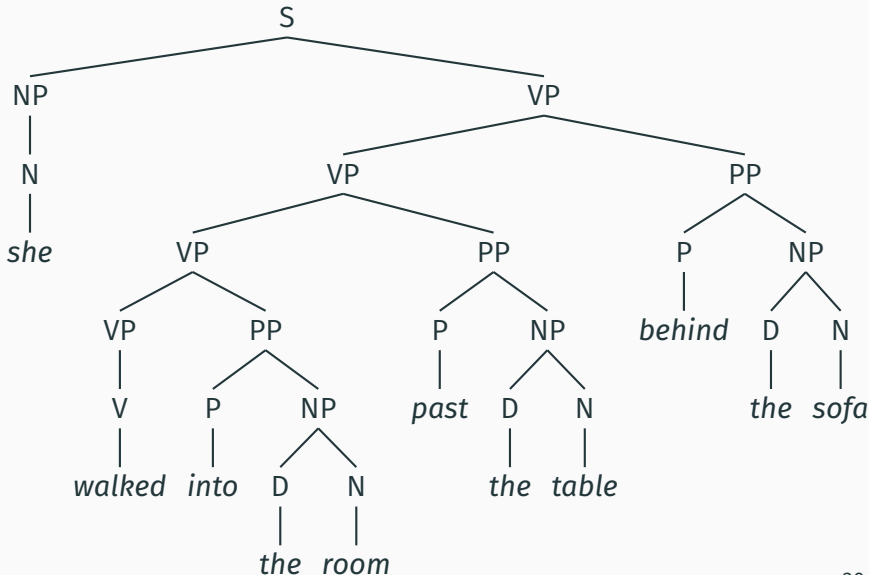 How do we allow our phrase structure rules to generate an unbounded number of PPs within a VP?

- **Answer: Recursion!**
  A rule that introduces one PP but can apply to its own output.

- **Rule:**
  VP → VP PP

The new VP rule in action

More recursion: PPs

- **Key characteristic:**
  - Each application of the VP rule introduces one PP.
  - But because the VP rule can apply to its own output, it can apply over and over again.
  - This allows for an unbounded number of PPs in a sentence.

- Rules that can apply to their own output are **recursive**.

- The rule "VP → VP PP" is recursive.

Types of recursion

- If a single rule can apply to its own output, the recursion is **direct**:

    VP → **VP** PP

- If a sequence of rules can apply to its own output, the recursion is **indirect**:

    S → NP VP
    VP → V (CP)
    CP → C **S**

Adverbs

- Adverbs look similar to adjectives, but often end in a *-ly*. They modify VPs.

- **Examples:**
  often, probably, beautifully, quietly, ...

(14)   a.   Alex **often** played the guitar.

        b.   Alex played the guitar **beautifully**.

        c.   Alex **often** played the guitar **beautifully**.

        d. *Alex played **often** the guitar.

Adverbs

- **Adverbs and PP:**

  (15) a. Alex sang **[to her parents] beautifully.**

        b. Alex sang **beautifully [to her parents].**

- **Recursion:**

  (16) Alex **probably often** sang to her parents.

Adverb rules

Rules for adverbs:
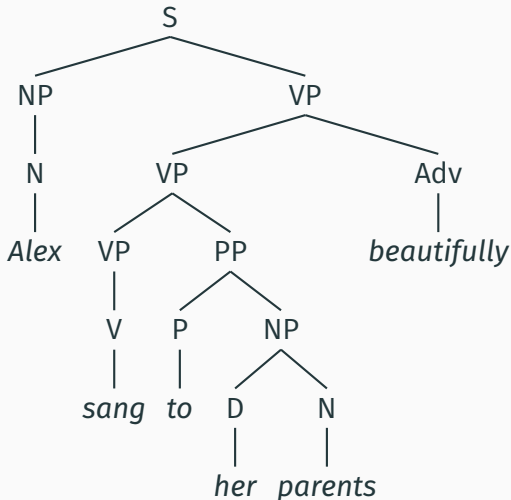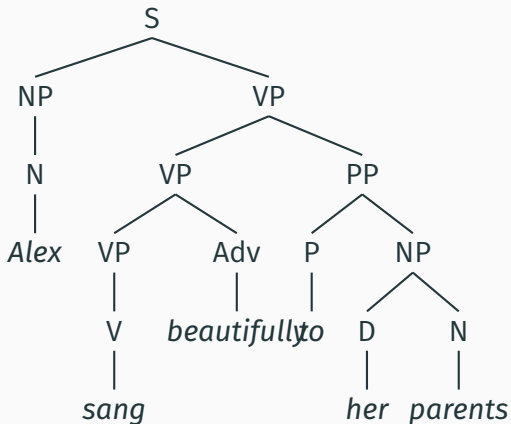
VP → VP Adv

VP → Adv VP

Adverb rules

Rules for adverbs:

VP → VP Adv

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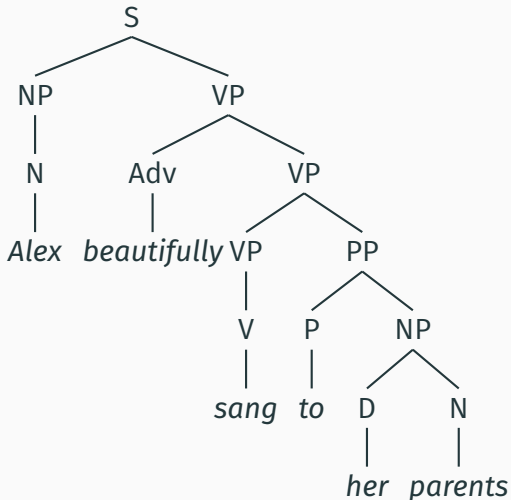
Adverb rules

Rules for adverbs:

VP → VP Adv

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More on NPs

- Thus far, we have a fairly simple picture of NPs: They consist of an N and possibly a determiner, an adjective, and a PP.

- Based on recursion, we will now see that this picture is a bit too simplistic. NPs are a tad more complex.

More on recursion: Adjectives

Just as there can be infinitely many PPs inside a VP, there can be infinitely many adjectives inside an NP:

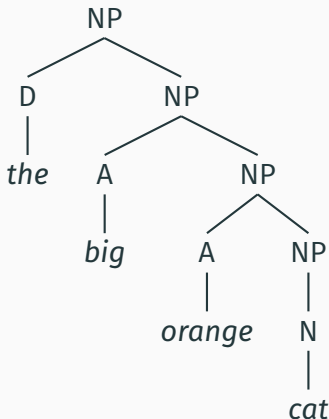(17)   The **[big] [fat] [lazy] [smelly] [orange]** cat sleeps.

Adjective recursion

- **A wrong idea:**
  NP → (D) NP (PP) (CP)
  NP → A NP
  NP → N

- This would allow us to produce:
  the big orange cat

Adjective recursion

- **A wrong idea:**
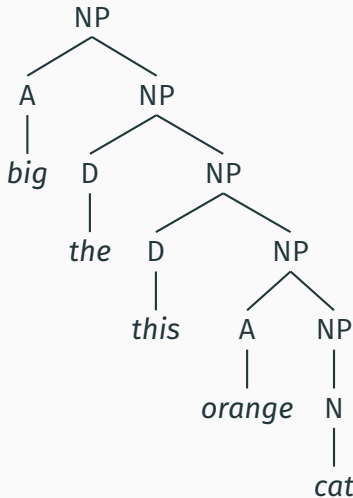 NP → (D) NP (PP) (CP)
  NP → A NP
  NP → N

- **Problem:**
  These rules would also allow to produce many structures that are ungrammatical in English.

Adjective recursion

- **Generalizations:**
  - Adjectives have to come between the noun and the determiner.
  - There can be many adjectives but only a single determiner.
→ We want adjectives to come into the structure below the determiner but before the noun.
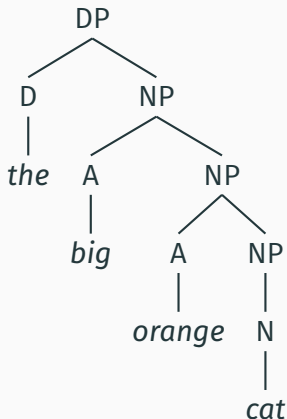
- **Idea:**
  Phrases like 'The big orange cat' aren't really noun-phrases, but *Determiner* phrases, or **DP**

- **DP → (D) NP**
  NP → A NP
  NP → N

```
            DP
           /  \
          D    NP
          |   /  \
         the A    NP
             |   /  \
            big A    NP
                |    |
            orange   N
                     |
                    cat
```

More recursion in NPs

As it turns out, adjectives are not the only element that can occur multiple times within an NP. PPs can as well:

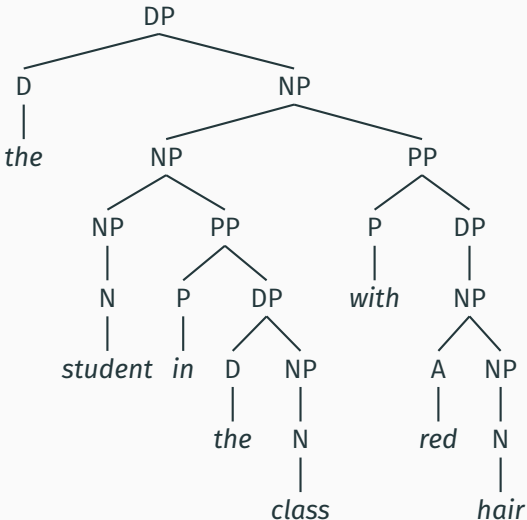(18) The student **[in the class] [with red hair] [from Finland]** was sleeping.

PP-recursion structure

DP → (D) NP
NP → NP PP
NP → N
PP → P DP

More on DP's

Calling phrases like 'the big orange cat' DP instead of NP means that it's a **DP** that's the subject of a sentence, and not an NP:

S → DP VP
S → DP Aux VP

All of these are DP's:

The big cat swam.
She swam.
Cats don't swim.
Big orange cats don't swim.

More on DP's

Pronoun DP's are special:

She swam.
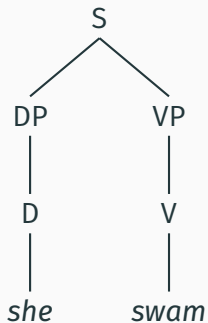**Cats** don't swim.
Big orange cats don't swim.
***Big orange she** swam.

Pronouns are Determiners, not nouns!

DP → D

More on DP's

DP → D

```
              S
            /   \
          DP     VP
          |      |
          D      V
          |      |
         she    swam
```

More on DP's

We cannot use the following rule anymore:
NP → (D)(A) N (PP) (CP)

So, what rule derives sentences like:

The rumor **that Rose snores** amuses Blanche.

More on DP's

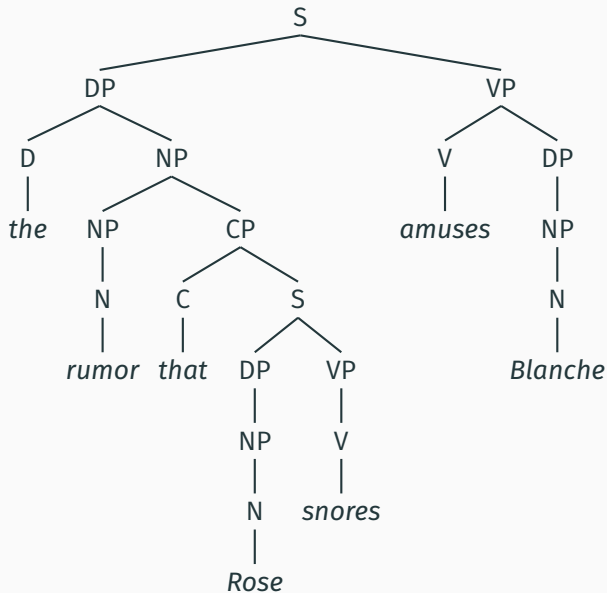We cannot use the following rule anymore:
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So, what rule derives sentences like:

The rumor **that Rose snores** amuses Blanche.

NP → NP CP

More on DP's

A final rule: coordination

English allows coordinating elements with *and*:

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*[**the cats**] and [**the dogs**]*   **DP**

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*the [**cats**] and [**dogs**]*   **N**

A final rule: coordination

English allows coordinating elements with *and*:

*[**the cats**] and [**the dogs**]*   **DP**

*the [**cats**] and [**dogs**]*   **N**

*the [**orange cats**] and [**brown dogs**]*   **NP**

A final rule: coordination

English allows coordinating elements with *and*:

*[**the cats**] and [**the dogs**]*	**DP**
*the [**cats**] and [**dogs**]*	**N**
*the [**orange cats**] and [**brown dogs**]*	**NP**
*the [**orange**] and [**brown**] cats*	**A**

A final rule: coordination

English allows coordinating elements with *and*:

*[**the cats**] and [**the dogs**]*	**DP**
*the [**cats**] and [**dogs**]*	**N**
*the [**orange cats**] and [**brown dogs**]*	**NP**
*the [**orange**] and [**brown**] cats*	**A**
*He [**eats toast**] and [**drinks coffee**].*	**VP**

A final rule: coordination

English allows coordinating elements with *and*:

*[**the cats**] and [**the dogs**]*	**DP**
*the [**cats**] and [**dogs**]*	**N**
*the [**orange cats**] and [**brown dogs**]*	**NP**
*the [**orange**] and [**brown**] cats*	**A**
*He [**eats toast**] and [**drinks coffee**].*	**VP**
*He sings [**gently**] and [**quietly**].*	**Adv**

A final rule: coordination

English allows coordinating elements with *and*:

*[**the cats**] and [**the dogs**]*	**DP**
*the [**cats**] and [**dogs**]*	**N**
*the [**orange cats**] and [**brown dogs**]*	**NP**
*the [**orange**] and [**brown**] cats*	**A**
*He [**eats toast**] and [**drinks coffee**].*	**VP**
*He sings [**gently**] and [**quietly**].*	**Adv**
*[**He sang**] and [**they danced**].*	**S**

A final rule: coordination

English allows coordinating elements with *and*:

*[**the cats**] and [**the dogs**]*	**DP**
*the [**cats**] and [**dogs**]*	**N**
*the [**orange cats**] and [**brown dogs**]*	**NP**
*the [**orange**] and [**brown**] cats*	**A**
*He [**eats toast**] and [**drinks coffee**].*	**VP**
*He sings [**gently**] and [**quietly**].*	**Adv**
*[**He sang**] and [**they danced**].*	**S**
*He ate [**in a rush**] and [**with a fork**].*	**PP**

- **Conclusion:**
  Coordination can combine any elements that are of the same type.

- **Coordination rule:**
  α → α and α,
  where "*α*" can be any category, but has to be the same in all three places
  (e.g. NP → NP *and* NP; S → S *and* S, ...)

Overview: Our phrase structure rules

S → DP (Aux) VP

S → CP (Aux) VP

DP → (D) NP

DP → D

NP → A NP

NP → NP PP

NP → NP CP

NP → N

PP → P DP

CP → C S

VP → V (DP) (CP)

VP → VP PP

VP → VP Adv

VP → Adv VP

α → α and α

"Rewrite" rules

Phrase structure rules are also called 'rewrite' rules

The idea: To say an **S**, you can use either a DP VP sequence, or a CP VP sequence
To say a **DP** you can use a D NP sequence, a D, or an NP
...and so on

S → DP (Aux) VP	PP → P DP
S → CP (Aux) VP	CP → C S
DP → (D) NP	VP → V (DP) (CP)
DP → D	VP → VP PP
NP → A NP	VP → VP Adv
NP → NP PP	VP → Adv VP
NP → NP CP	*α → α and α*
NP → N	