

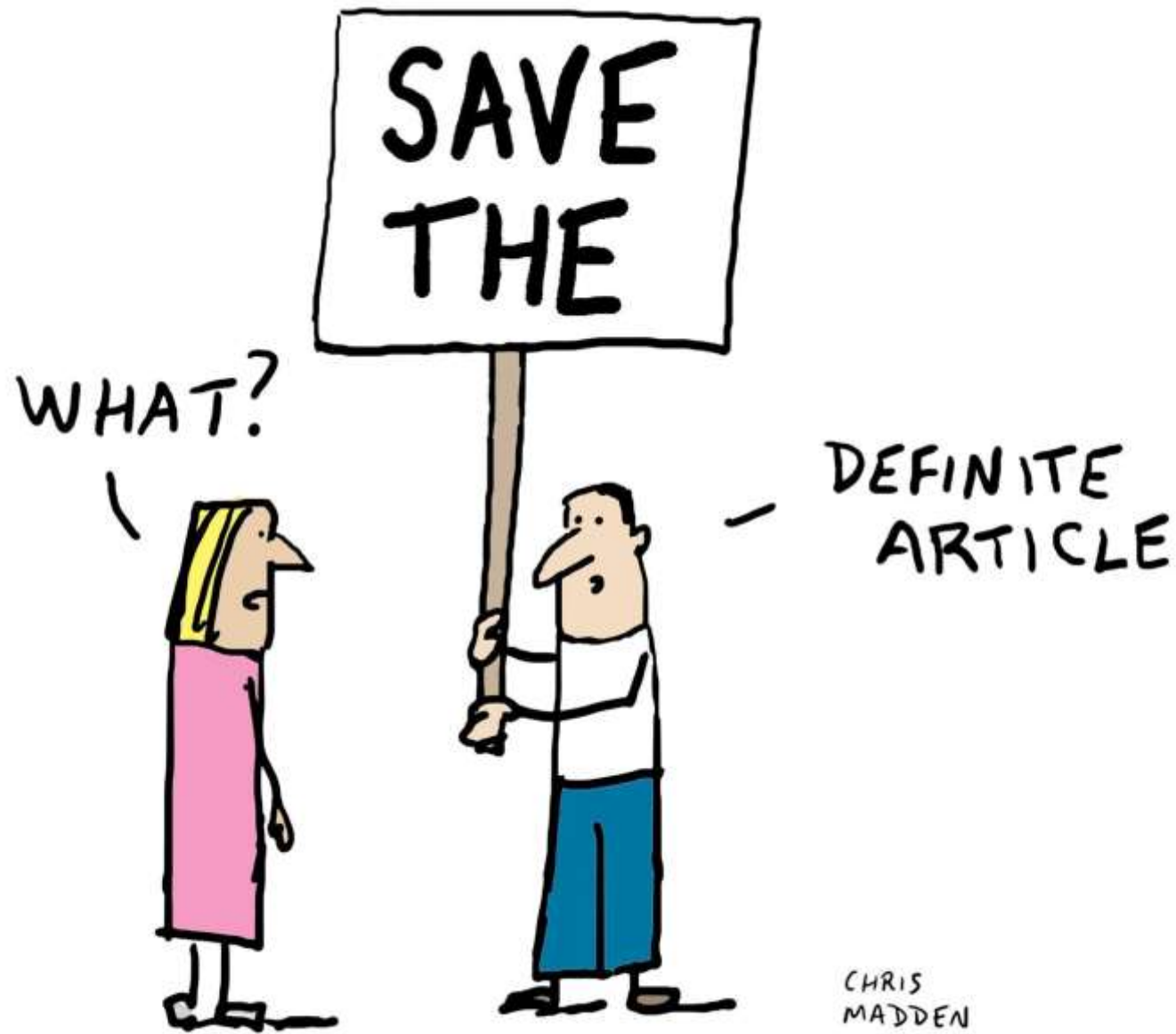
Introduction to Syntax (sentences)

Linguistics Module

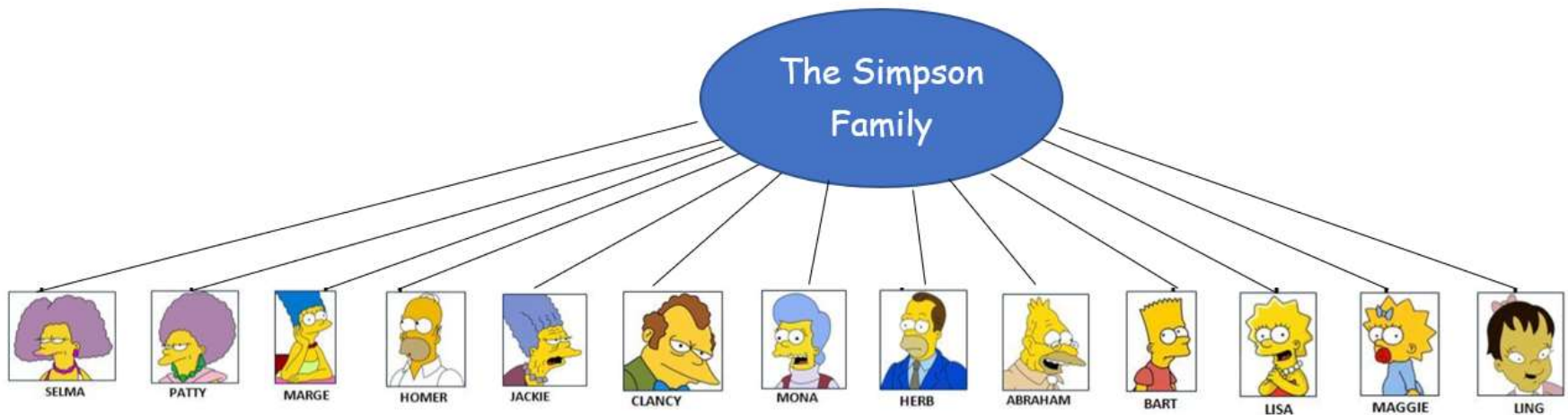


Overview of this Linguistics Module

- Topic 1 Introduction to areas of linguistics and problem solving
- Topic 2 Historical Linguistics
- Topic 3 Phonetics
- Topic 4 Sociolinguistics
- Topic 5 Writing systems
- Topic 6 Language Acquisition
- Topic 7 Morphology
- **Topic 8 Syntax**
- Topic 9 Psycholinguistics / Neurolinguistics
- Topic 10 Machine Translation



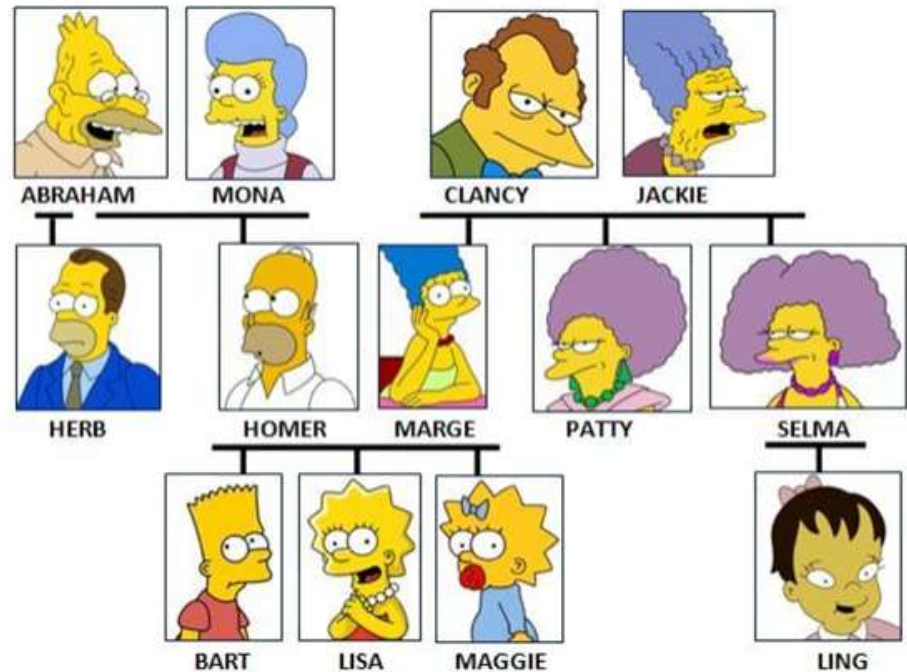
How do we represent family relations?



- Does this linear representation show all the family relations?
- Can you think of another way to show the internal structure of the Simpson Family?

How do we represent family relations?

- We use a tree structure to show how the members of a family are related.
- The family tree shows who is higher in the hierarchy and who is lower.
- It also shows relationships (e.g. daughter/sister/mother)



Task 8.1: Constituents and diagnostic tests



Task 8.1: Constituents and diagnostic tests

- Just as families, sentences can also be represented in form of trees in order to show their internal structure.
- In this section, we are going to work out the structure of the following sentence:

The cat will chase the mice.

- The sentence contains the following words:

the: **D**eterminer – definite article)

cat: **N**(oun)

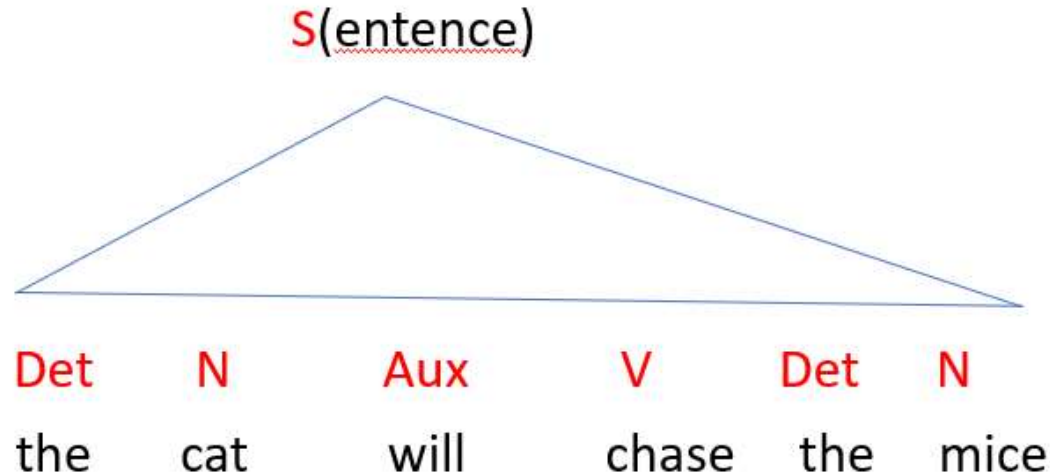
will: **Aux/T**(ense): [Future]

chase: **V**(erb)

the: **Det**(eterminer – definite article)

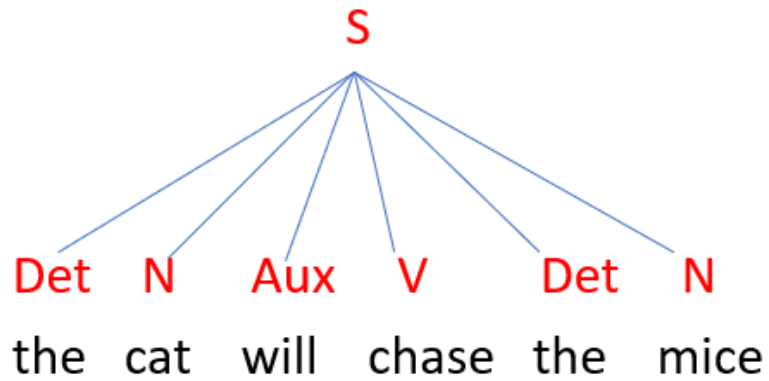
mice: **N**(noun)

- **S**entence: [s *the cat will chase the mice*]



- What is the internal structure of **S** and how do we go about finding out?

- The flat structure (theory)



- Remember the Simpsons Family tree!
- The flat structure above does not indicate the hierarchical relations.

How can we determine the internal structure of sentences?



How can we determine the internal structure of sentences?

- Various diagnostic tests, criteria have been developed for the purpose of figuring out the internal structures of phrases and sentences.
- They include one known as **Pro-form Replacement**, which exploits small words that have the function of replacing (= standing in for) long phrases in sentences in conversation contexts.
- The pro-form words include **pronouns**, which replace (indefinitely) long noun phrases understood in conversation such as

the mice (that live in the house that Jack built) ? they, them
the cat (that lives in the house that Jack built) ? it

Pro-form Replacement

- Applying the Pro-form Replacement test to the group of words [*the mice*] in our target example:

The cat will chase [the mice]

*The cat will chase **them**.*

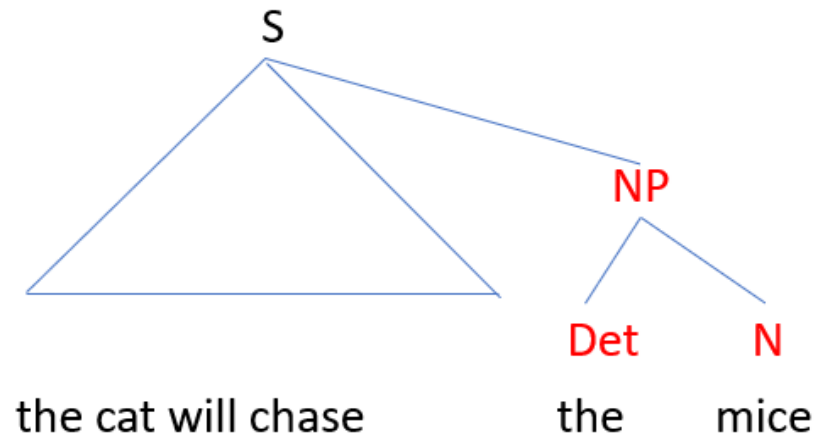
- As pronouns can only replace/stand in for Noun Phrases (NPs), it follows that

[the mice] = **Noun Phrase (NP)**

Pro-form Replacement

- Mapping the test result onto the developing structure of S (i.e. the internal structure we are working out):

[_S the cat will chase [_{NP} the mice]]



Worksheet 8.1: Problem Set 1

- The reasoning above re [*the mice*] generalises to the similar group [*the cat*] in our target sentence.

The cat will chase [**NP** *the mice*].

- Apply the Proform Replacement test to [*the cat*]

AND

- Try to map the test result onto our embryonic structure of the sentence.

Feedback Problem Set 1

- Applying the test

[The cat (that lives in the house that...)] will chase the mice.

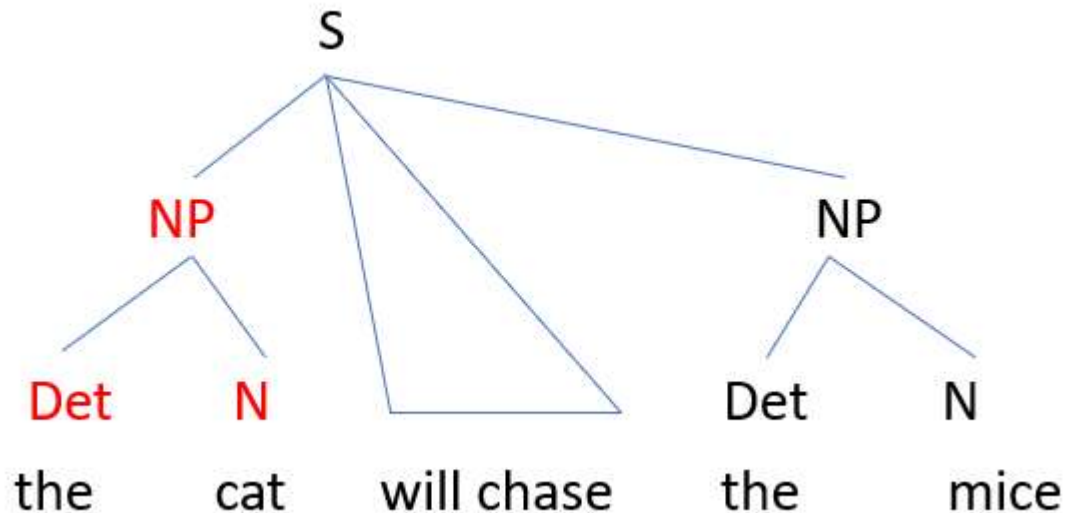
It will chase the mice.

- Therefore,

[the cat] = **NP**

Feedback Problem Set 1

- Mapping the test result onto the embryonic structure of the sentence:
[_{NP} The cat] will chase [_{NP} the mice].



Pro-form Replacement: Verb Phrases

- There are also pro-form words that replace/stand in for **Verb Phrases**.

*The cat will chase the mice and **so** will the dog.*
so = [*chase the mice*]

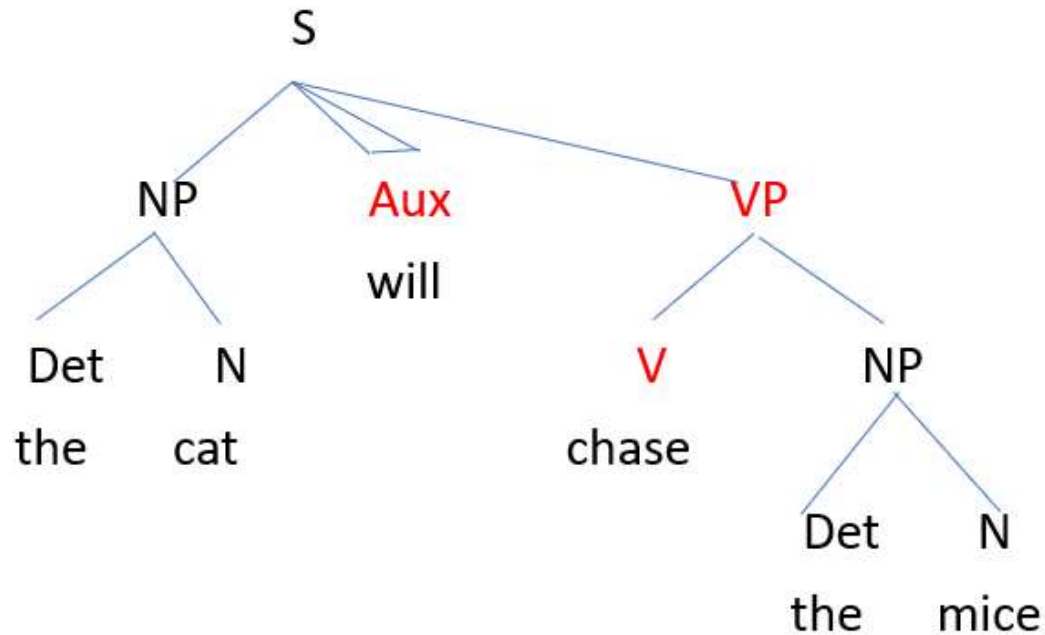
- As **so** replaces verb phrases, it follows that

[chase the mice] = **Verb Phrase (VP)**

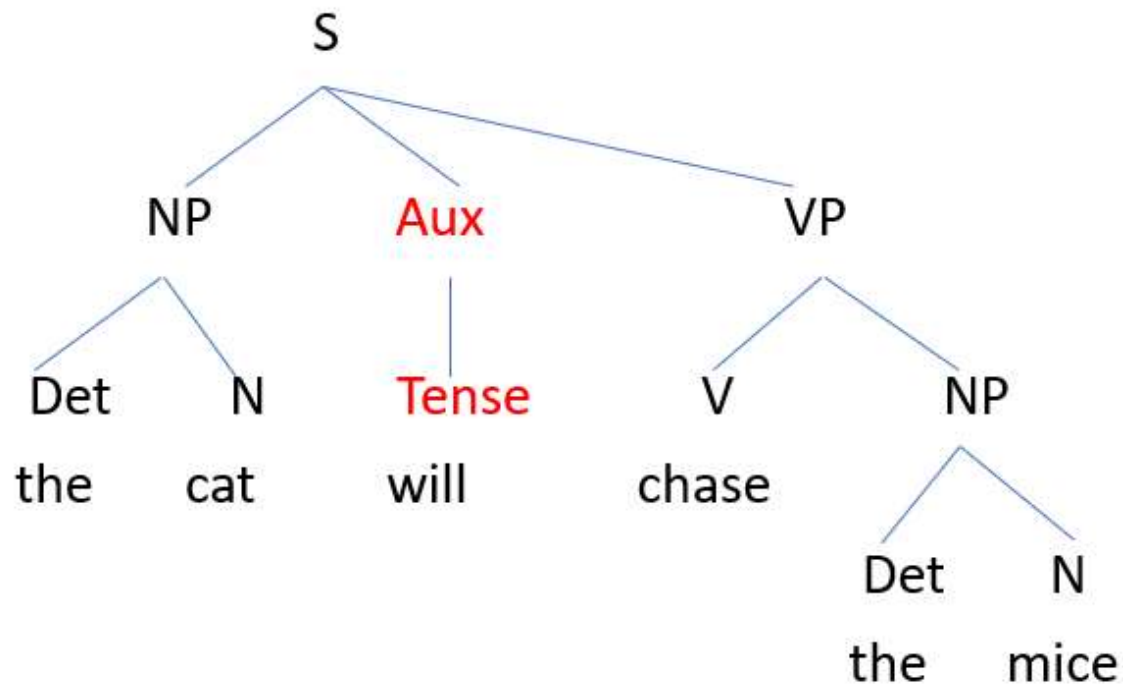
- It also follows that the VP has the internal structure

*[**VP** [**V** chase] [**NP** the mice]]* = **Verb Phrase (VP)**

- Mapping the test result of VP onto the tree-structure of the sentence



- The test results applied above imply that **Aux** is an independent constituent of S. **Aux** specifies **Tense**.



Worksheet 8.1: Problem Set 2

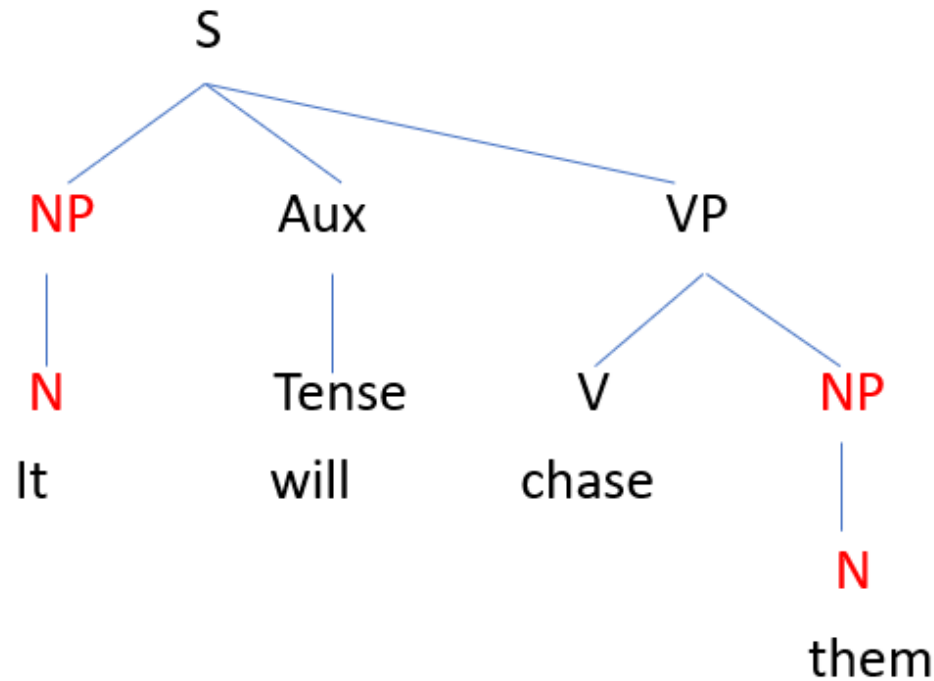
- Assign a tree-structure to the example below.

It will chase them.

- Treat the pronouns *it* and *them* as **N(ouns)**.

Feedback Problem Set 2

- Same structure, except that both NPs have only one constituent each.



Task 8.2: Terminology

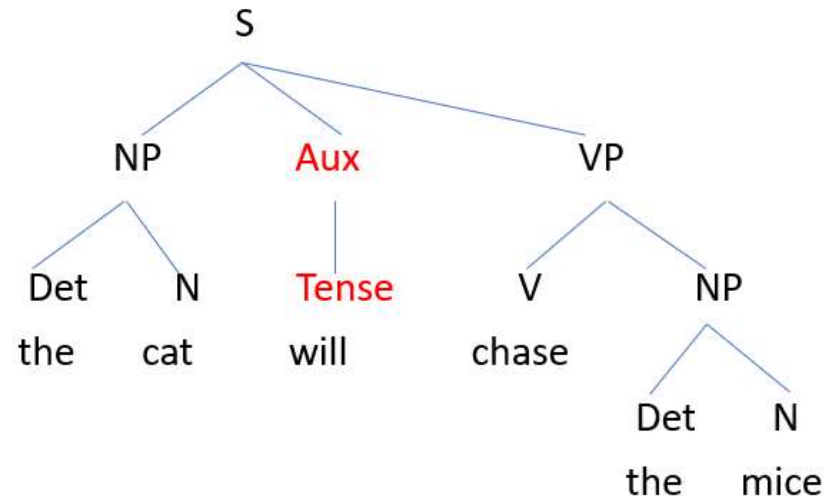


Task 8.2: Terminology

- A phrase is a family of (one or more) constituents with a **head**.
 - The head of **NP** is **N**.
 - The head of **VP** is **V**.
 - S counts as a phrase, the head of which is **Aux**.
- A head implies a phrase such that N implies NP and V implies VP.
- The reverse is equally true. A phrase implies a head such that NP implies N and VP implies V.

Types of node in the structure

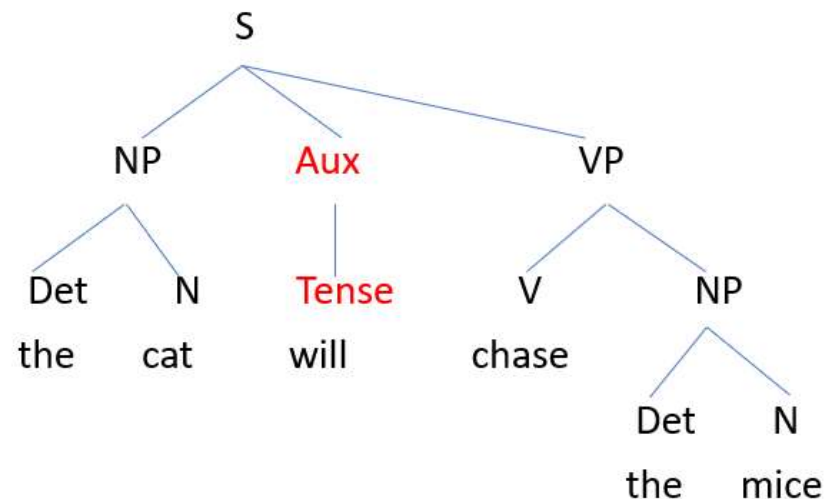
- **Root node:** Highest node (S in the sentence structure)
- **Phrasal nodes** (internal nodes): NP, VP (in the sentence structure). S(sentence) counts as a phrasal node even though its label does not feature P.
- **Terminal nodes:** Det, N and V (in the sentence structure).



Types of node in the structure

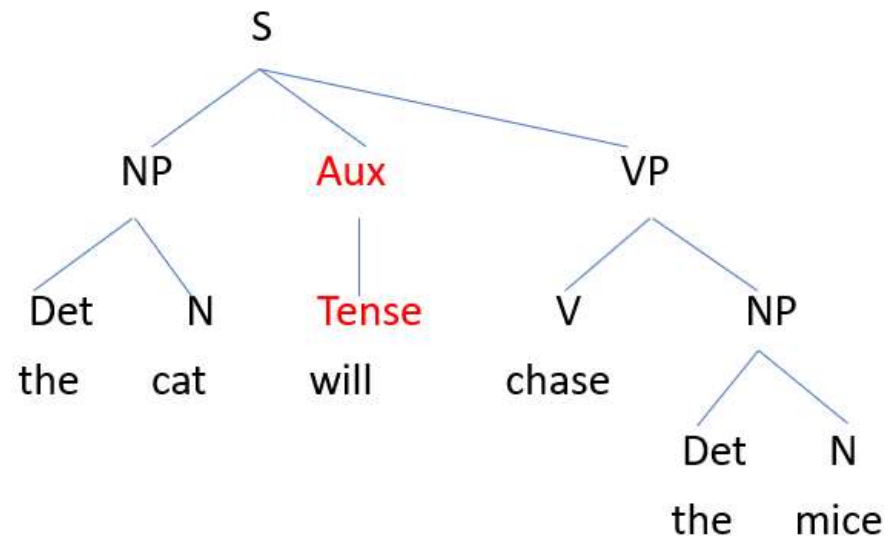
- In the structure of the sentence arrived at above,

- S is the mother of NP, Aux and VP.
- NP, Aux and VP are therefore sisters.
- NP has two daughters of its own: Det and N.
- VP has two daughters of its own: V and NP (junior).



Grammatical functions, relations are structurally based

- The subject of the sentence 'the cat' is the NP-daughter-of-S (and sister of Aux and VP).
 - The cat will chase the mice.
- The direct object (of the verb) 'the mice' is the NP-sister-of-V and daughter-of-VP.
 - The cat will chase the mice.

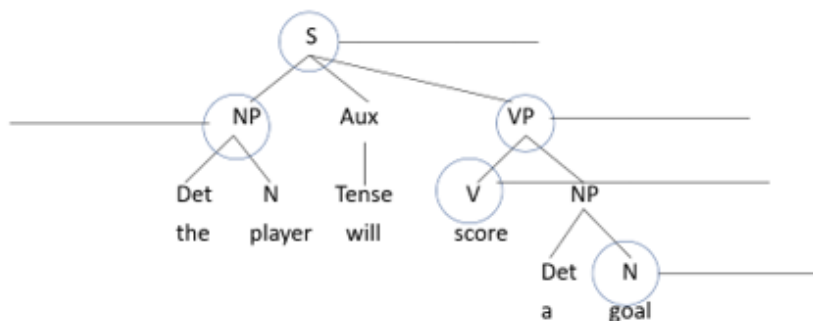


Worksheet 8.2: Problem Set 3

The tree diagram below is a structural representation of the sentence *The player will score a goal*.

- a) Label the parts circled in the tree diagram. Use the following terminology:

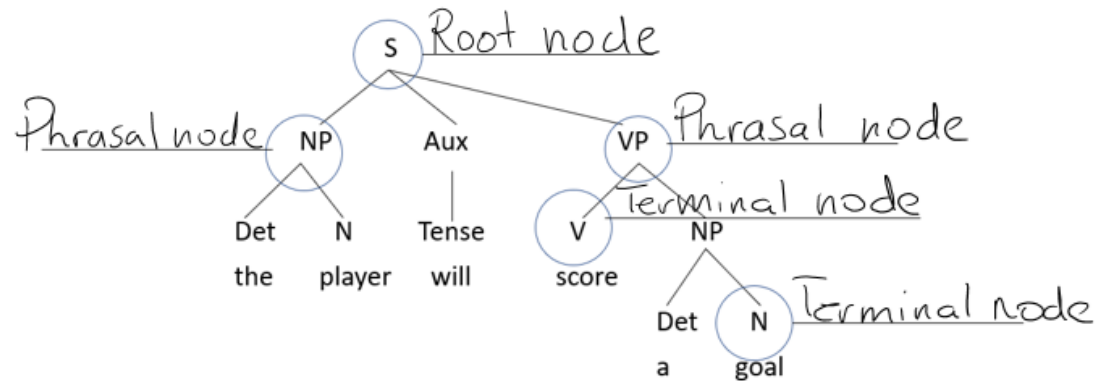
Root node – phrasal node – terminal node



- b) In relation to the tree diagram above, indicate whether the following statements are True or False:

	True	False
VP is the mother of S.		
AUX is the daughter of VP.		
S has three daughters: NP, Aux and VP.		
The subject of the sentence <i>the player</i> is the sister of the direct object <i>a goal</i> .		
The VP has two daughters: V and N.		
Aux is a sister of S.		

Feedback Problem Set 3



c) In relation to the tree diagram above, indicate whether the following statements are True or False:

	True	False
VP is the mother of S. (VP is the daughter of S)		✓
AUX is the daughter of VP. (Aux is the sister of VP)		✓
S has three daughters: NP, Aux and VP.	✓	
The subject of the sentence <i>the player</i> is the sister of the direct object <i>a goal</i> . (The subject NP is the sister of VP)		✓
The VP has two daughters: V and N. (False: V and NP)		✓
Aux is a sister of S. (Aux is the daughter of S)		✓

Task 8.2: AILO Puzzle

- Dogs and Cats on Trees puzzle and solution

Task 8.3: Phrase Structure (PS) Rules



Task 8.3: Phrase Structure (PS) rules

- The tree-diagrams above are visual representations of structures generated by rules known as **Phrase Structure (PS)** rules.
 - PS rules are rewrite rules that rewrite symbols as a sequence of other symbols (think of rewriting code as natural language sentences).
 - The set of PS rules that generates the structures arrived at above is provided in the next slide.
 - The arrow in the middle is read as ‘**goes to**’

Phrase Structure (PS) rules

S	→	NP Aux VP
NP	→	Det N (<i>the cat, the mice</i>)
NP	→	N (<i>it/them</i>)
Aux	→	Tense (<i>will</i>)
VP	→	V NP (<i>chase the mice</i>)

Worksheet 8.3: Problem Set 4

- The set of PS rules in the previous slide includes two instances that generate the same phrase, namely NP.
- Try to think of a standard notation that makes it possible to reduce the two rules repeated below to one rule that generates both patterns.

$NP \rightarrow Det N$

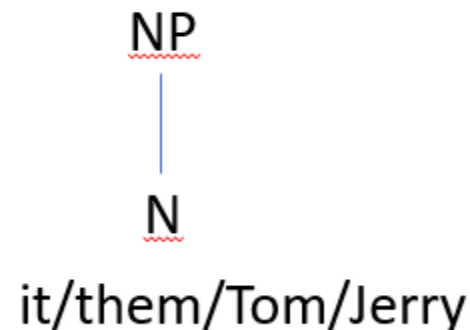
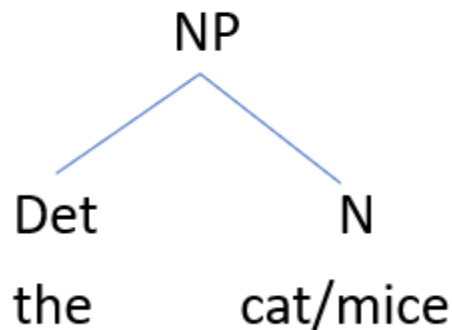
$NP \rightarrow N$

Feedback Problem Set 4

- The required notation is one that encodes **optionality** of occurrence.

NP \rightarrow (Det) N

- The single rule above generates NPs that consist of Det and N as well as NPs that consist of N alone.



Worksheet 8.3: Problem Set 5

- Make up simple sentences generated by the PS rules. Use **only** the PS rules below and the words given below. Don't use any other words that are not listed for each example.

S → NP VP N = dogs, birds, cows
NP → Adj N Adj = curious, cute, nervous
VP → V V = bark, fly, sleep

- Give three sentences which can be generated by the rules and words above:

1. _____

2. _____

3. _____

Feedback Problem Set 5

Any adjective – Noun – Verb combination allowed from a syntax point of view:

- Some examples:
- Nervous dogs bark.
- Cute cows sleep.
- Curious birds fly.

Worksheet 8.3: Problem Set 6

Write the PS rules needed for the following examples (they all translate to 'the big dog'):

English	French	German	Italian	Spanish
the big dog	le grand <u>chien</u>	der <u>große</u> Hund	il cane <u>grande</u>	<u>el perro</u> <u>grande</u>

Feedback Problem Set 6

English	French	German	Italian	Spanish
the big dog	le grand <u>chien</u>	der <u>große</u> Hund	il cane <u>grande</u>	<u>el perro</u> <u>grande</u>
NP → Det Adj N	NP → Det Adj N	NP → Det Adj N	NP → Det N Adj	NP → Det N Adj

Puzzle: Grammar Rules!

- Grammar Rules!
- <https://www.nacloweb.org/resources/problems/2013/N2013-F.pdf>
- Solution:
- <https://www.nacloweb.org/resources/problems/2013/N2013-FS.pdf>

More Puzzles

- A Matter of Horn Clauses:
 - <https://nacloweb.org/resources/problems/2016/N2016-P.pdf>
 - Solution:
 - <https://nacloweb.org/resources/problems/2016/N2016-PS.pdf>
- Intergalactic Grammars:
 - <https://nacloweb.org/resources/problems/2018/N2018-D.pdf>
 - Solution:
 - <https://nacloweb.org/resources/problems/2018/N2018-DS.pdf>

More Puzzles

- Peeled Potato Act with Annie:
 - <https://nacloweb.org/resources/problems/2018/N2018-L.pdf>
 - Solution:
 - <https://nacloweb.org/resources/problems/2018/N2018-LS.pdf>
- A Makeshift Code:
 - <https://nacloweb.org/resources/problems/2018/N2018-R.pdf>
 - Solution:
 - <https://nacloweb.org/resources/problems/2018/N2018-RS.pdf>

More Puzzles

- **Orwellspeak:**
<https://www.nacloweb.org/resources/problems/2009/N2009-M.pdf>
- **Solution:**
<https://www.nacloweb.org/resources/problems/2009/N2009-MS.pdf>
- **Use the Force:**
<https://nacloweb.org/resources/problems/2015/N2015-E.pdf>
- **Solution:**
<https://nacloweb.org/resources/problems/2015/N2015-ES.pdf>
- **CCG:**
<https://nacloweb.org/resources/problems/2014/N2014-O.pdf>
- **Solution:**
<https://nacloweb.org/resources/problems/2014/N2014-OS.pdf>
- **Combining Categories in Tok Pisin:**
<https://nacloweb.org/resources/problems/2014/N2014-P.pdf>
- **Solution:**
<https://nacloweb.org/resources/problems/2014/N2014-PS.pdf>

Thank you



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