Ch. 4 Syntax: The Sentence Patterns of Language
• The word syntax comes from Ancient Greek: "coordination", which consists of syn, "together," and táxis, "an ordering".

• syntax is the set of rules, principles, and processes that govern the structure of sentences in a given language, usually including word order.
The boy found a dog.

<table>
<thead>
<tr>
<th>S</th>
<th>V, VP</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>NP</td>
<td></td>
<td>NP</td>
</tr>
<tr>
<td>Det+N</td>
<td>V, VP</td>
<td>Det+N</td>
</tr>
<tr>
<td>The boy</td>
<td>Found</td>
<td>A dog</td>
</tr>
</tbody>
</table>
Syntax

• Any speaker of any human language can produce and understand an infinite number of possible sentences

• Thus, we can’t possibly have a mental dictionary of all the possible sentences

• Rather, we have the rules for forming sentences stored in our brains

  • Syntax is the part of grammar that pertains to a speaker’s knowledge of sentences and their structures
What the Syntax Rules Do

• The rules of syntax combine words into phrases and phrases into sentences

• They also specify the correct word order for a language
  • For example, English is a Subject-Verb-Object (SVO) language
    • *President the new Supreme Court a nominated justice
    • The President nominated a new Supreme Court justice

• They also describe the relationship between the meaning of a group of words and the arrangement of the words
  • I mean what I say vs. I say what I mean
What the Syntax Rules Do

• The rules of syntax also specify the grammatical relations of a sentence, such as the subject and the direct object

  • Your dog chased my cat vs. My cat chased your dog

• Syntax rules specify constraints on sentences based on the verb of the sentence

  *The boy found
  *The boy found in the house
  The boy found the ball
  *Disa slept the baby
  Disa slept
  Disa slept soundly

Zack believes Robert to be a gentleman
*Zack believes to be a gentleman
Zack tries to be a gentleman
*Zack tries Robert to be a gentleman
What the Syntax Rules Do

• Syntax rules also tell us how words form groups and are hierarchically ordered in a sentence

“The captain ordered the old men and women off the ship”

• This sentence has two possible meanings:

  • 1. The captain ordered the old men and the old women off the ship
  • 2. The captain ordered the old men and the women of any age off the ship

• The meanings depend on how the words in the sentence are grouped (specifically, to which words is the adjective ‘old’ applied?)

  • 1. The captain ordered the [old [men and women]] off the ship
  • 2. The captain ordered the [old men] and [women] off the ship
What the Syntax Rules Do

• These groupings can be shown hierarchically in a tree

![Syntax Tree Example]

• These trees reveal the structural ambiguity in the phrase “old men and women”
  • Each structure corresponds to a different meaning

• Structurally ambiguous sentences can often be humorous:
  • Catcher: “Watch out for this guy, he’s a great fastball hitter.”
  • Pitcher: “No problem. There’s no way I’ve got a great fastball.”
What Grammaticality Is Not Based On

- People can judge grammaticality without ever having heard the sentence before

  “Enormous crickets in pink socks danced at the prom.”

- Grammaticality is not based on meaningfulness

  “Colorless green ideas sleep furiously.”
  “A verb crumpled the milk.”
  ‘Twas brillig, and the slithy toves
  Did gyre and gimble in the wabe

- Grammaticality is not based on truthfulness
Sentence Structure

• We could say that the sentence

  “The child found the puppy” is based on the template

  Det—N—V—Det—N

• But this would imply that sentences are just strings of words without internal structure

• This sentence can actually be separated into several groups:

  • [the child] [found a puppy]
  • [the child] [found [a puppy]]
  • [[the] [child]] [[found] [[a] [puppy]]
Sentence Structure

- A **tree diagram** can be used to show the hierarchy of the sentence:
Constituents and Constituency Tests

• **Constituents** are the natural groupings in a sentence

• Tests for constituency include:

  1. “stand alone test”: if a group of words can stand alone, they form a constituent

    • A: “What did you find?”
    • B: “A puppy.”

  2. “replacement by a pronoun”: pronouns can replace constituents

    • A: “Where did you find a puppy?”
    • B: “I found him in the park.”

  3. “move as a unit” test: If a group of words can be moved together, they are a constituent

    • A: “The child found a puppy.” → “A puppy was found by the child.”
Constituents and Constituency Tests

• Experimental evidence shows that people perceive sentences in groupings corresponding to constituents

• Every sentence has at least one constituent structure

  • If a sentence has more than one constituent structure, then it is ambiguous and each constituent structure corresponds to a different meaning
Syntactic Categories

• A **syntactic category** is a family of expressions that can substitute for one another without loss of grammaticality

  - *The child* found a puppy.
  - *A police officer* found a puppy.
  - *Your neighbor* found a puppy.
  - The child *found a puppy.*
  - The child *ate the cake.*
  - The child *slept.*

• All the underlined groups constitute a syntactic category known as a **noun phrase (NP)**
  - NPs may be a subject or an object of a sentence, may contain a determiner, proper name, pronoun, or may be a noun alone

• All the bolded groups constitute a syntactic category known as a **verb phrase (VP)**
  - VPs must always contain a verb but may also contain other constituents such as a noun phrase or a **prepositional phrase (PP)**
Syntactic Categories

• Phrasal categories: NP, VP, PP, AdjP, AdvP

• Lexical categories:
  • Noun: puppy, girl, soup, happiness, pillow
  • Verb: find, run, sleep, realize, see, want
  • Preposition: up, down, across, into, from, with
  • Adjective: red, big, candid, lucky, large
  • Adverb: again, carefully, luckily, very, fairly

• Functional categories:
  • Auxiliary: verbs such as have, and be, and modals such as may, can, will, shall, must
  • Determiners: the, a, this, that, those, each, every
Phrase Structure Trees and Rules

• A phrase structure (PS) tree (or constituent structure tree) is a tree diagram with syntactic category information:

```
S
  /  
NP   VP
  /  |
Det N V NP
 /   /   |
The child found Det N
 /   /    |
a   puppy
```
Phrase Structure Trees and Rules

- In a PS tree, every higher node **dominates** all the categories beneath it
  - S dominates everything

- A node **immediately dominates** the categories directly below it
  - The VP immediately dominates the V and the NP

- **Sisters** are categories that are immediately dominated by the same node
  - The V and the NP are sisters
Phrase Structure Trees and Rules

- Phrase structure rules specify the well-formed structures of a sentence
  - A tree must match the phrase structure rules to be grammatical
- This tree is formed using the following rules:

\[
\begin{align*}
S & \rightarrow NP \ VP \\
NP & \rightarrow Det \ N \\
VP & \rightarrow V \ NP
\end{align*}
\]
Phrase Structure Trees and Rules

• But, a VP could also contain:
  • A verb only: *The woman laughed.*
  • A PP: *The woman laughed in the garden.*
  • A CP: *The man said that the woman laughed.*

• We therefore have to account for these possible sentences in our phrase structure rules and need the following rules so far:

1. \( S \rightarrow NP \ VP \)
2. \( NP \rightarrow \text{Det} \ N \)
3. \( VP \rightarrow V \ NP \)
4. \( VP \rightarrow V \)
5. \( VP \rightarrow V \ PP \)
6. \( PP \rightarrow P \ NP \)
7. \( VP \rightarrow V \ CP \)
8. \( CP \rightarrow C \ S \)
The professor said that the student passed the exam.
Phrase Structure Trees and Rules

- Phrase structure rules are used as a guide for building trees.

- To build a tree you expand every phrasal category until only the lexical categories remain.

- By following the guidelines in the phrase structure rules, we can generate all the possible grammatical sentences in a language.

  - Any tree that violates the phrase structure rules will represent an ungrammatical sentence.
The Infinity of Language: Recursive Rules

- **Recursive** rules are rules in which a phrasal category can contain itself

  - Such as an NP containing another NP...
    - NP \(\rightarrow\) NP PP allows for the sentence: *I saw the man with the telescope in a box.*

  - ...or a VP containing a VP...
    - VP \(\rightarrow\) VP PP allows for a sentence like: *The girl walked down the street in the rain.*

  - ...or a CP containing a S...
    - CP \(\rightarrow\) C S allows for embedding sentences inside sentences such as: *The children hope that the teacher knows that they are good students.*

- Recursive rules allow a grammar to generate an infinite number of sentences (in this case by adding PPs indefinitely)
Heads and Complements

- Phrase structure trees also show the relationships among the elements in a sentence
  - The NP immediately dominated by the S is the subject
  - The NP immediately dominated by the VP is the direct object

- Another relationship is between the head of a phrase and its sisters
  - The head of a phrase names the phrase (e.g. the noun is the head of a noun phrase, a verb is the head of a verb phrase, etc.)
  - Every phrase has a head, but may or may not take a complement, or sister category
    - For example, a VP will have a head (a verb) and may take a complement such as an NP or a CP
Heads and Complements: Selection

• Some heads require a certain type of complement and some don’t
  
  • The verb *find* requires an NP: *Alex found the ball.*
  • The verb *put* requires both an NP and a PP: *Alex put the ball in the toy box.*
  • The verb *sleep* cannot take a complement: *Alex slept.*
  • The noun *belief* optionally selects a PP: *the belief in freedom of speech.*
  • The adjective *proud* optionally selects a PP: *proud of herself*

• **C-selection** or **subcategorization** refers to the information about what types of complements a head can or must take
Heads and Complements: Selection

• Verbs also select subjects and complements based on semantic properties (S-selection)

  • The verb murder requires a human subject and object

    *The beer murdered the lamp.*

  • The verb drink requires its subject to be animate and its optional complement object to be liquid

    *The beer drank the lamp.*

• For a sentence to be well-formed, it must conform to the structural constraints of PS rules and must also obey the syntactic (C-selection) and semantic (S-selection) requirements of the head of each phrase
What Heads the Sentence

• The category of Auxiliary verbs (such as will, has, is, and may as well as modals might, could, would, and can) heads a sentence because a sentence is about a situation of state of affairs that happens at some point in time

• Particular kinds of auxiliaries go with certain kinds of VPs

  • be selects the progressive form of the verb
    • The baby is eating.
  • have selects the past participle form of the verb
    • The baby has eaten.
  • The modals select the infinitival form of the verb
    • The baby must eat.
What Heads the Sentence

• Many linguists use the symbols \( T \) (tense) and \( TP \) (tense phrase) instead of Aux and S, with the TP having an intermediate \( T' \) category.

• **X-bar theory** is the theory that all XPs have three levels of structure:
  1. the XP
  2. the specifier (modifier)
  3. \( X' \) with head \( X \) and a complement
What Heads the Sentence

- We can now add the rule VP $\rightarrow$ Aux VP into our PS rules
- However, not all sentences seem to have auxiliaries
  - *Sam kicked the soccer ball.*
- But, this sentence does have the past tense morpheme –*ed*, and in sentences without an auxiliary, the tense is the head of the S
  - Instead of having a word under Aux, there is a tense specification
  - The tense specification must match the inflection on the verb
Structural Ambiguities

• The following sentence has two meanings:

The boy saw the man with the telescope

• The meanings are:

  • 1. The boy used the telescope to see the man
  • 2. The boy saw the man who had a telescope

• Each of these meanings can be represented by a different phrase structure tree

  • The two interpretations are possible because the PS rules allow more than one structure for the same string of words
Structural Ambiguities

- The boy used a telescope to see the man
- The boy saw the man who had a telescope
Other Structures

• Thus far we have fourteen phrase structure rules in our inventory

• However, this set is not complete and cannot account for sentences such as:

  • 1. *The dog completely destroyed the house.*
  • 2. *The cat and the dog are friends.*
  • 3. *The cat is coy.*

  1. $S \rightarrow NP\ VP$
  2. $NP \rightarrow Det\ N'$
  3. $Det \rightarrow NP\ poss$
  4. $NP \rightarrow N'$
  5. $NP \rightarrow NP\ PP$
  6. $N' \rightarrow Adj\ N'$
  7. $N' \rightarrow N$
  8. $VP \rightarrow V$
  9. $VP \rightarrow V\ NP$
  10. $VP \rightarrow V\ CP$
  11. $VP \rightarrow Aux\ VP$
  12. $VP \rightarrow VP\ PP$
  13. $PP \rightarrow P\ NP$
  14. $CP \rightarrow C\ S$
Sentence Relatedness

- Recognizing that some sentences are related to each other is another part of our syntactic competence

  *The boy is sleeping.*  
  *Is the boy sleeping?*

- The first sentence is a **declarative sentence**, meaning that it asserts that a particular situation exists

- The second sentence is a **yes-no question**, meaning that it asks for confirmation of a situation

- The difference in meaning is indicated by different word orders, which means that certain structural differences correspond to certain meaning differences
  - For these sentences, the difference lies in where the auxiliary occurs in the sentence
Transformational Rules

• Yes-no questions are generated in two steps:

  1. The PS rules generate a declarative sentence which represents the basic structure, or **deep structure (d-structure)** of the sentence
  2. A **transformational rule** then moves the auxiliary before the subject to create the **surface structure (s-structure)**

• The “Move Aux” rule: Move the highest Aux to adjoin to (the root) S.

• When the Aux is moved, this results in a gap in the tree, which is represented by a “___”

• The gap represents the position from which a constituent has been moved