# Linguistics

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# Today:

- Linguistics, Language and "Grammar"
- Subfields of Linguistics
  - Phonology
  - Morphology
  - Syntax
  - Semantics

# What is Linguistics?

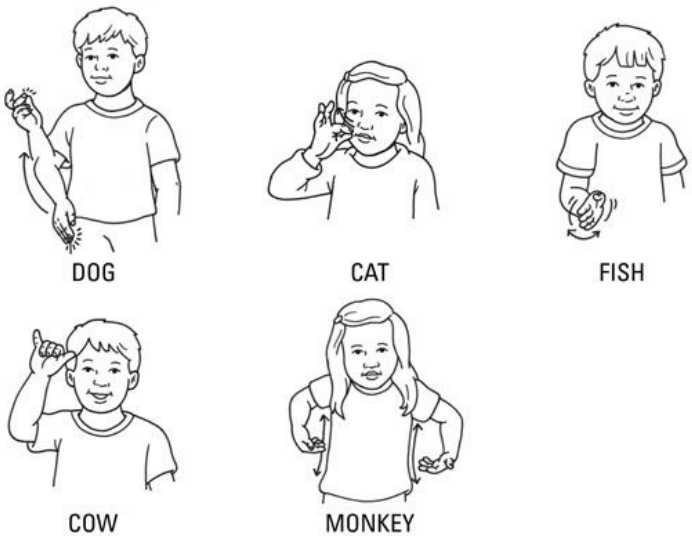
- **Linguistics**: The formal study of language as a system
  - Linguists characterize linguistic knowledge, e.g., phonological, morphological, syntactic knowledge
- **Psycholinguistics**: The study of how people use language and the algorithms that implement linguistic knowledge
  - Psycholinguists study e.g., mental lexicon (representations) and online sentence comprehension (modularity)
- **Neurolinguistics**: The study of the neural mechanisms that realize these algorithms

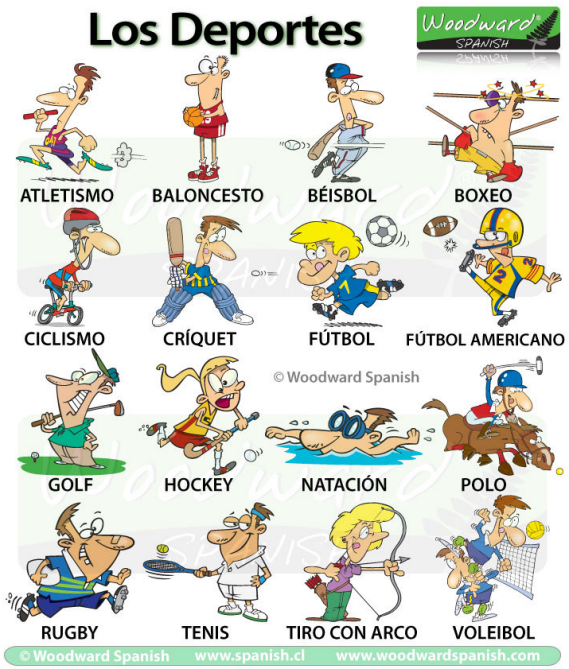
# What do linguists study?

- Linguists study language as a concept
  - How are sounds, words, sentences, and utterances structured in the mind?
  - What are the general principles that all languages tend to follow?
  - How do we relate sound, structure, and meaning?
- Linguistics $\neq$ Translation

# What is Language?

- **Language**: "A shared symbolic system for communication"



# Why is language relevant to cognitive science?

- Language is one of our most complex cognitive functions
- Uniquely human and inevitable
- Basic to understanding how mind works: how we communicate and conceptualize

# Some Language Universals

- **Productivity**: We can create new words, sentences, and meanings based on a small set of basic units and composition rules
- **Flexibility**: The sound-meaning mappings can change (including adding new words)
- **Arbitrariness**: Meaning is not predicted or determined by the pronunciation
- **Displacement**: We can talk about things beyond the here and now

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# Competence vs. Performance

- Linguists generally make a distinction between competence and performance
  - **Competence**: The tacit knowledge all speakers of a language have about the rules of their language
    **The student walk tomorrow.*
  - **Performance**: The actual realization of language, including speech errors, memory lapses, etc.
    *Sally shells sea shells by the sea shore.*
- Linguists are (generally) more concerned with competence
- Psycholinguists are (generally) more concerned with performance

# What is "grammar" to a linguist?

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This is not what linguists mean when they talk about "grammar"

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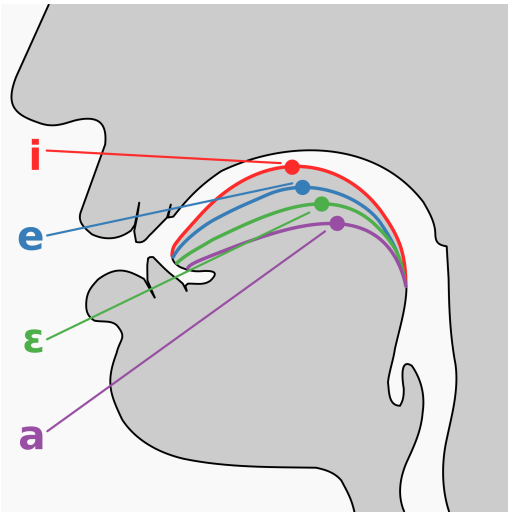
- **Descriptive Grammar**:
  - The grammar that we spontaneously use and understand in everyday speech
  - This is what linguists care about (and what we'll be talking about now!)

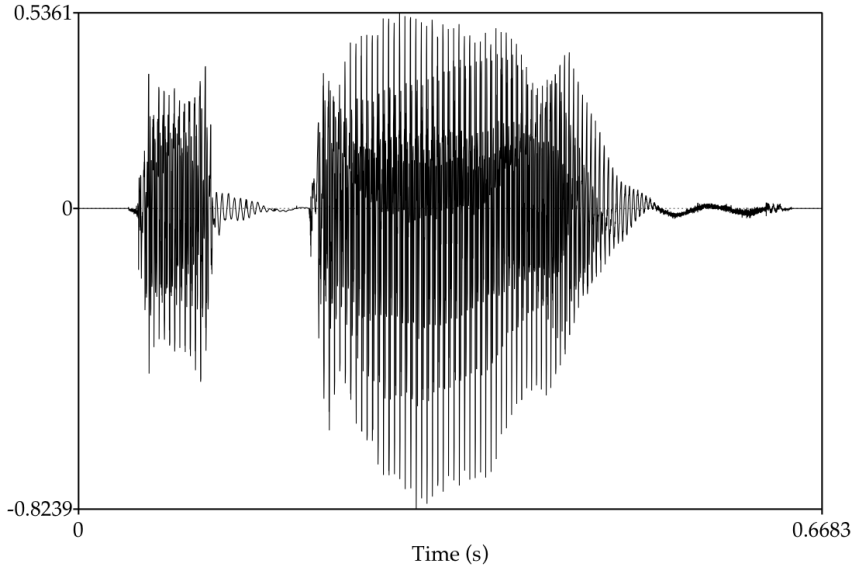
# Linguistic Subfields — Levels of Analysis

| | |
|---|---|
| Phonetics | Physical sounds |
| Phonology | Sound systems |
| Morphology | Words (roots + affixes) |
| Syntax | Phrases, sentences |
| Semantics | Word/sentence meaning |
| Pragmatics | Discourse meaning (context) |

# Phonetics & Phonology: Sounds & Organization

- **Phonetics**: How sounds are produced and perceived




- **Phonology**: How sounds are organized and differentiated

# Clicker Poll

- How many instances of the first consonant in the word *talk* (the 't' sound from that word) are there in the following sentence?
  *Hit the water tap three times and then stop.*
  a) 8
  b) 5
  c) 4
  d) 2
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This ties into the problem of invariance.

# Phonemes

- **Phonemes** are the basic units of phonology
  - Phonemes are the abstract representations of contrastive sounds in a language
  - E.g., *hi**t*** [t˺] vs. ***t**ap* [t$^{h}$] vs. *s**t**op* [t] vs. *wa**t**er* [ɾ] are all realizations of the phoneme /t/ in English

# Phonemic Competence

- The tacit knowledge of which phonemes can occur in which environments is called **phonemic competence**
- It's what tells us that *trab* and *glump* are possible words of English, but *rtab* and *puglm* are not.

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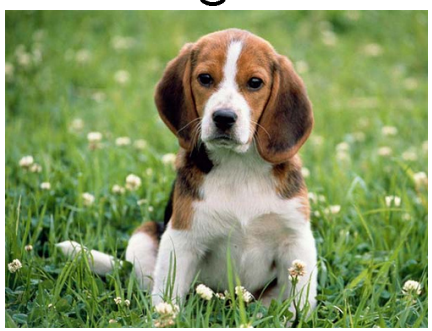

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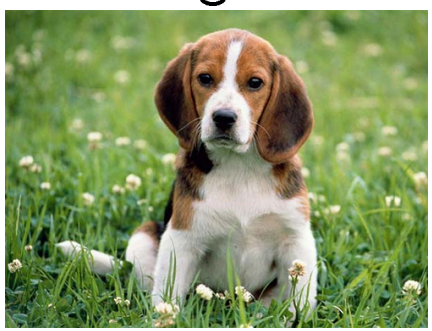

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- What about onomatopoeia?
  *bow-wow* (English) vs. *guau guau* (Spanish) vs. *wan wan* (Japanese)
  - These are less arbitrary, but still not entirely predictable

# Clicker Poll

- How many words do you know?
  a) Under 10,000
  b) Between 10,000 and 50,000
  c) Between 50,000 and 100,000
  d) Between 100,000 and 250,000
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The average American knows around 60,000 words!

Morphology

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This is a difficult question. The concept of wordhood is very vague.

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- Morphological processes are **productive**

# Units of Meaning: Roots

- Roots/Stems:
  - Primary lexical unit of a word
  - Can stand alone
  - Cannot break into smaller units
  - Carries the most significant aspect of meaning
- Examples:
  - *lock* (v.), *sleep* (v.), *cat* (n.), *house* (n.), *green* (adj.), *quick* (adj.)

# Units of Meaning: Affixes

- Affixes:
  - Have predictable patterns of combination with other morphemes
  - Cannot stand alone
  - Usually do not carry the bulk of a word's meaning

# Affixes, continued.

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    These last two are often quite common in other languages

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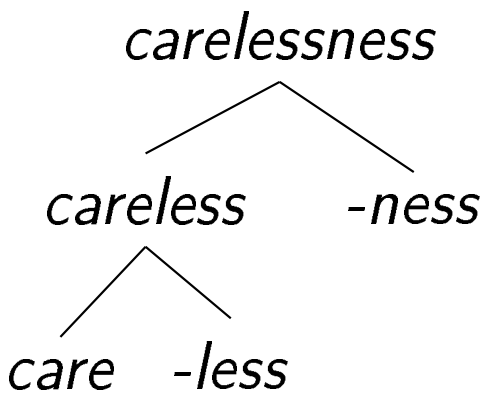
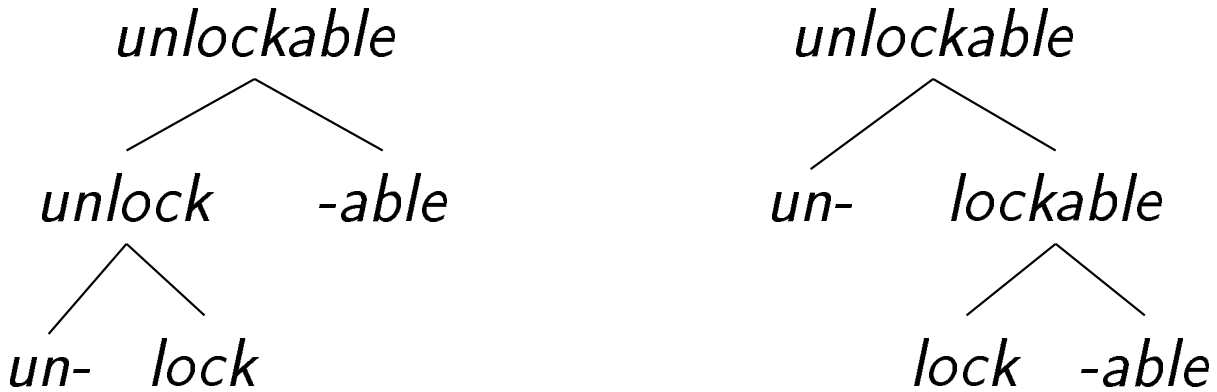
  - Inflectional affixes
    - *sleep* + Pres.Prog → *sleeping*
    - *cat* + Pl. → *cats*

# Morphological Derivation

- **Derivation**: A productive way to form new words in a language (here, English)
  - Add an affix to a stem ⇒ New meaning (and sometimes new part of speech)
- Morphological derivation is **hierarchically organized**



# Morphological Ambiguities



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    ...

# Inflectional Morphology

- Inflection:
  - Add inflectional affix to stem $\Rightarrow$ express a grammatical category (tense, number, case, gender, etc.)
  - Inflectional morphology doesn't form a new word or change the part of speech

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- *tweet* $\rightarrow$ *tweets*
- *wug* $\rightarrow$ *wugs* (**wugen*)

# Compounds

- Compounding: a productive way to form new words:
  - *green* (adj.) + *house* (n.) → *greenhouse* (n.)
    (vs. *green house*)
  - *house* (n.) + *cat* (n.) → *house cat* (n.)
- New compounds are formed every day!
  - *crowdsourcing*, *Brangelina*

# Morphology Takeaways

- Morphology studies the smallest meaningful units of language (roots/stems and affixes)
- Compounds are made up of more than one root
- Morphemes are combined using generative rules and produce hierarchical structures
- Overall, morphology is **productive**

# Syntax: Phrases & Sentences

- **Syntax**: knowledge of how to combine words into sentences
- Observation 1: Basic Word Order
  - Word order affects meaning:
    - *Dog bites man.* vs. *Man bites dog.*
    - English is an SVO language (subject-verb-object)
  - There are grammatical and ungrammatical word orders:
    - *Buffy staked the vampire after midnight.*
    - **Staked midnight Buffy the after vampire.*

# Syntax, continued

- Observation 2: Constituents/phrases (groups of words that act as a unit)
  - *Sally read about {mud/the Earth/crispy waffles/the language of her parents/*crispy/*of/*quickly/*laugh}.*
  - *{Mud/The Earth/A crispy waffle/The language of her parents/*Crispy/*Of/*Quickly/*Laugh} has a few defining features.*

# Phrase Structure Rules

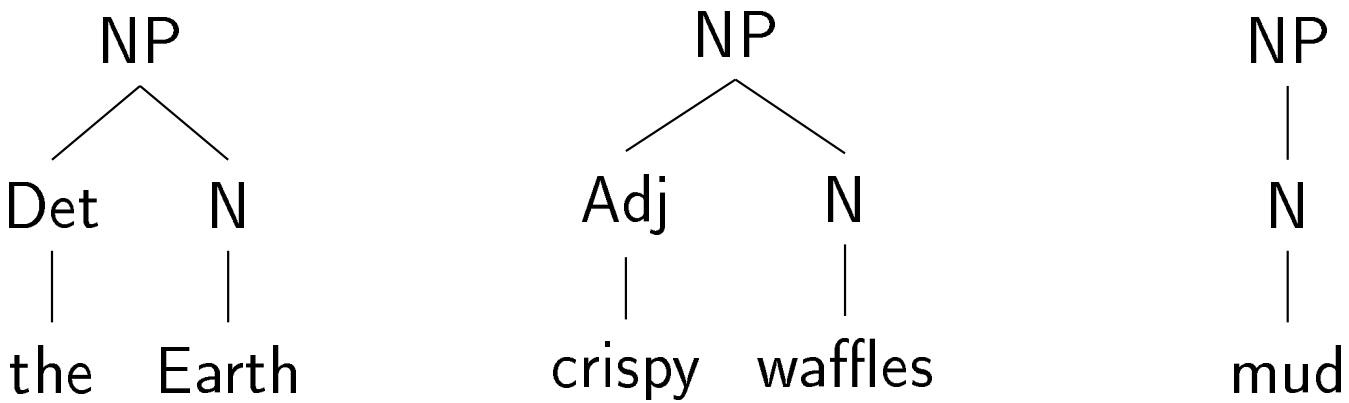
- Like morphemes in morphology, phrases are the building blocks of syntax
- Phrases are constructed and combined using phrase structure rules
- Like morphology, syntax is hierarchically organized and productive

# Nominal (Noun) Phrases

- Noun Phrases: chunks with the same distribution as, say, a proper name
- What can an NP consist of?
- Phrase Structure Rules:
  - NP $\rightarrow$ N (*mud*, *gold*, *salt*)
  - NP $\rightarrow$ Determiner N (*the Earth*, *some people*, *a cat*)
  - NP $\rightarrow$ Adj N (*crispy waffles*, *loud noises*)
  - ...
- Where can NPs occur?
  - After a preposition (*... about* ***mud***)
  - Before a verb (***The Earth*** *has ...*)
  - ...

# Noun Phrase Structure

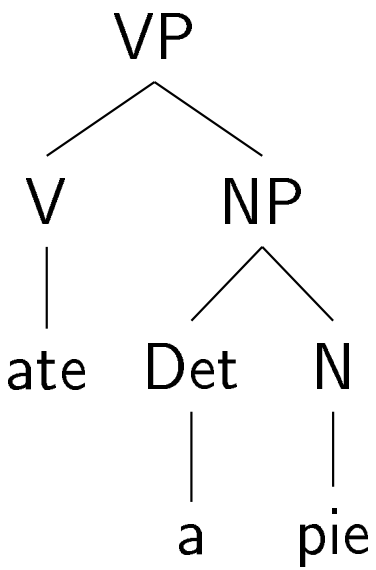
- Phrases are also organized hierarchically:

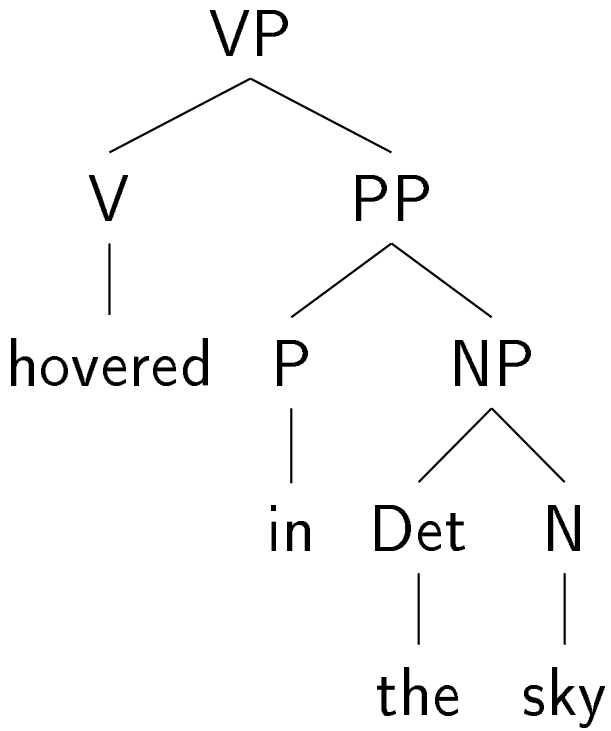


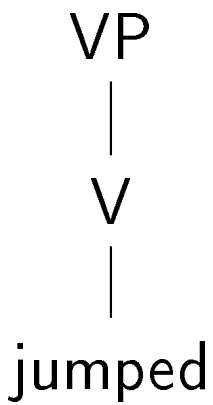
# Verb Phrases

- Verb phrases: chunks with the same distribution as say, an intransitive verb
  - *Sally {jumped/ate a pie/put a pie in the oven/*nice/*quickly/*towel}.*
- What can a VP consist of? (Phrase structure rules:)
  - VP $\rightarrow$ V (*jumped*, *runs*, *sleeps*)
  - VP $\rightarrow$ V NP (*ate a pie*)
  - VP $\rightarrow$ V PP (*hovered in the sky*)
  - VP $\rightarrow$ V NP PP (*put a pie in the oven*)
  - ...

# Verb Phrase Structure

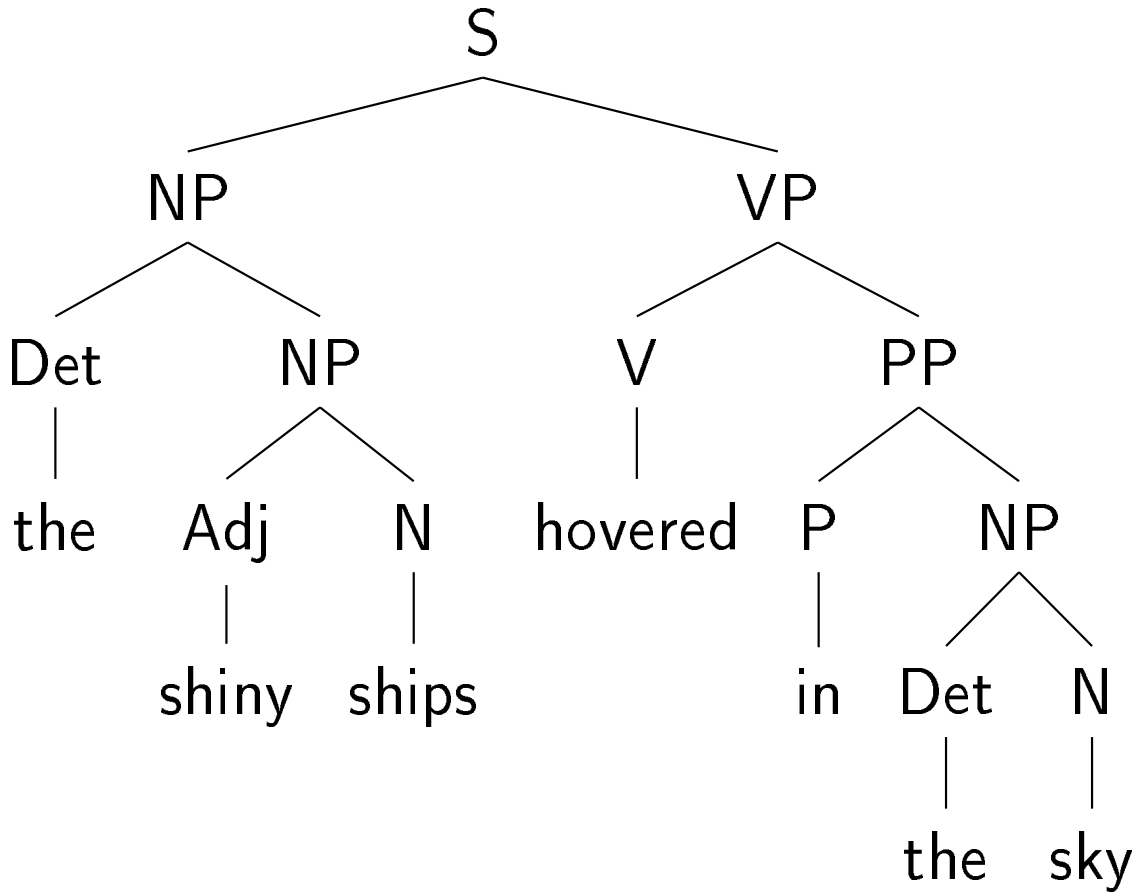


# Sentences

- How do we make a sentence?
  - S $\rightarrow$ NP VP



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  - Our sentence constructing phrase structure rule must allow sentences as part of the input

# Transformational Grammar

- Chomsky: transformations are a way to relate the surface structures of sentences to their underlying meaning (and the relationships between structures)
  - It seems that there is a unicorn on my patio.
  - A unicorn seems to be on my patio.
  - The girl threw the ball.
  - The ball was thrown by the girl.
  - You can't take the sky from me.
  - Who can't you take the sky from?
  - What can't you take from me?

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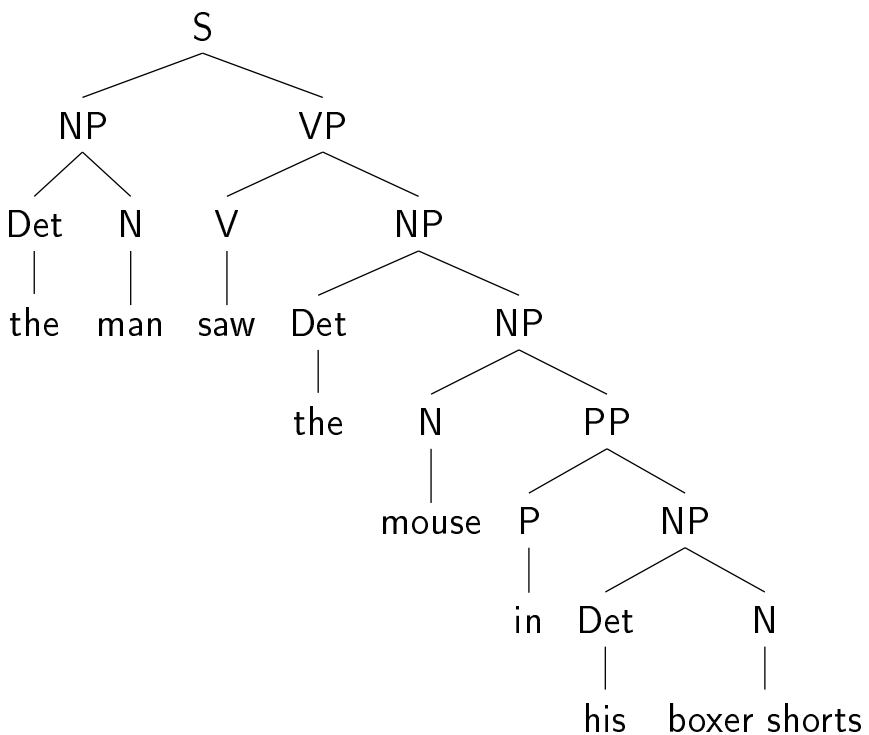

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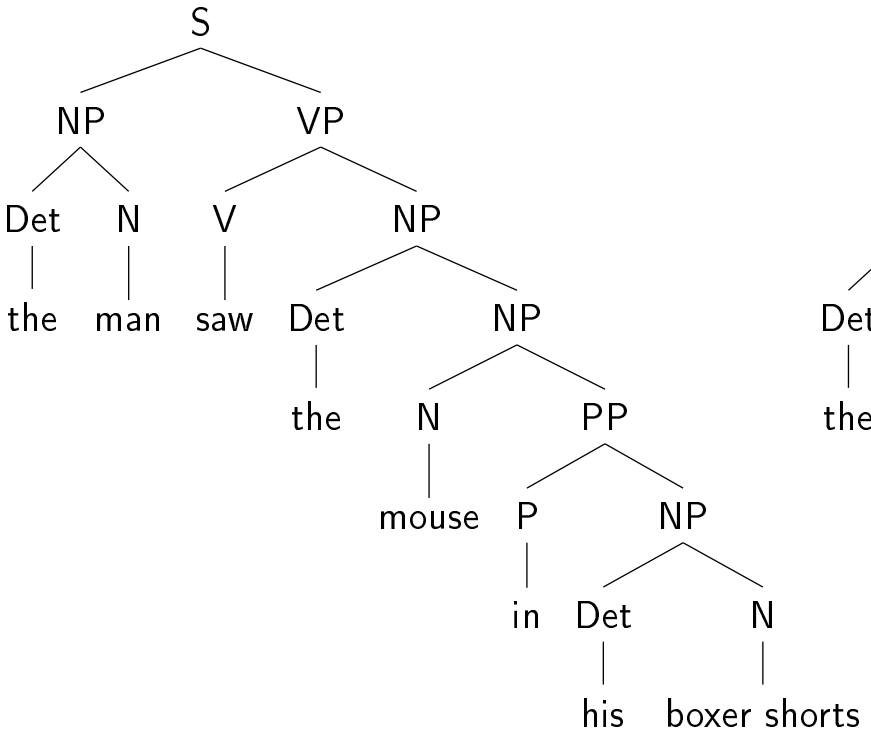


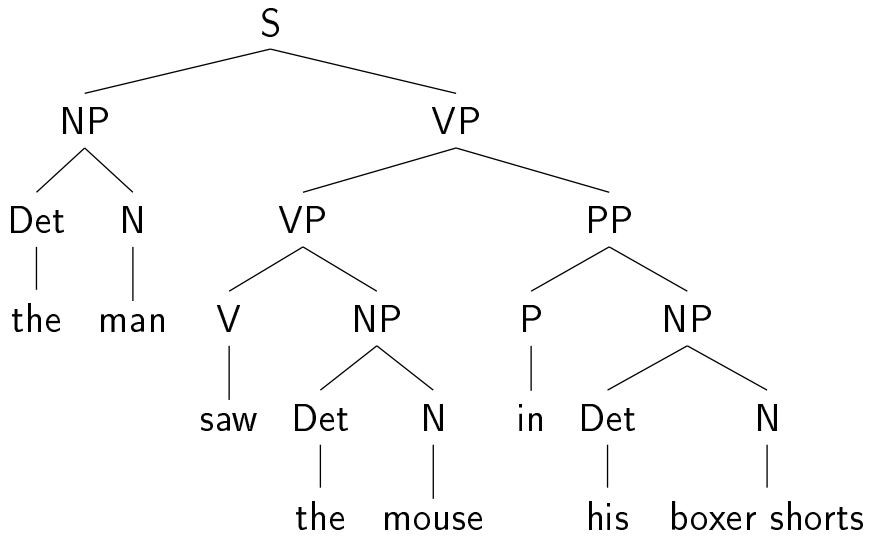

# Clicker Poll

- Which of the following is an acceptable continuation of this sentence?
  While Mary was mending a sock . . .
  a) Bill called
  b) fell down
  c) Both (a) and (b)
  d) None of the above

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- *The horse raced past the barn fell.* X
- This is evidence of incremental parsing
  - We get to *barn*, and think we have one structure, but that structure is incompatible with the following word
  - So we go back and reanalyze the structure of the sentence:
    *[The horse (that was) raced past the barn]$_{NP}$ fell.*

# Syntax Takeaways

- Phrases in syntax are like morphemes in morphology: they are the building blocks that allow you to make larger phrases, and eventually sentences
- Syntax is productive too! (recursion)
- You build sentences using nondeclarative memory

# Semantics & Pragmatics: Compositional Meaning

- **Semantics**: The meanings attached to words and the rules of composition that derive the meanings of phrases and sentences from those word meanings
  - *All dogs sleep.* $\Rightarrow \forall x[\mathrm{dog}(x) \rightarrow \mathrm{sleep}(x)]$
  - *Angel doesn't like Spike* $\Rightarrow \neg\mathrm{like}(\mathrm{Spike})(\mathrm{Angel})$
- **Pragmatics**: How context interacts with the semantic meaning to produce discourse and social meaning
  - *Can you pass the salt?* $\Rightarrow$ request to pass the salt
  - *Buffy is under the impression that Dawn is safe.* $\Rightarrow$ The speaker believes that Dawn is not safe
  - Q: How's your day been?
    A: #Yes!

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    OR
    → I saw a tool for hitting baseballs

# How the Levels Interact

- We've already seen that :
  - Phonology feeds into morphology (words are made of sounds)
  - Morphology feeds into syntax (sentences and phrases are made of words)
  - Syntax feeds into semantics (meaning is derived from structure)

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# Wrap Up

- Language is inevitable and human
- Linguists are interested in descriptive grammar to characterize the language knowledge that speakers have
  - Phonological knowledge
  - Morphological knowledge
  - Syntactic knowledge
  - Lexical, semantic, and pragmatic knowledge
- Language is productive, hierarchical, and compositional

# Thanks!


xkcd 1443