ELL101: Intro to Linguistics
Week 6-7 Syntax

Tomonori Nagano <tnagano@lagcc.cuny.edu>

Education and Language Acquisition Dept.
LaGuardia Community College

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Fields of linguistics I

- Week 1-2: Phonetics (physical sound properties)
- Week 2-3: Phonology (speech sound rules)
- Week 4: Morphology (word parts)
- Week 6-7: Syntax (structure)
- Week 8-9: Semantics (meaning)
- Week 8-9: Pragmatics (conversation & convention)
- Week 10: First & Second language acquisition
- Week 11-12: Historical linguistics (history of language)
- Week 11-12: Socio-linguistics (language in society)
- Week 11-12: Neuro-linguistics (the brain and language)
- Week 11-12: Computational linguistics

Introduction: Syntax I

- What kind of problems are syntacticians interested in?

- Structural ambiguity
    1. I saw a man with the binocular.
    2. I saw a man with the briefcase.

- Different interpretations of the same surface representations.
    1. I call my friend an idiot.
    2. I call my friend a taxi.

- Different surface representations with the same interpretation.
    1. The dog chased the boy.
    2. The boy was chased by the dog.

- 1. I found John a good psychotherapist.
     → I found John to be a good psychotherapist.
  2. I found John a good psychotherapist.
     → I found a good psychotherapist for John.

- 1. John made Mary a good wife. → Mary is a good wife.
  2. John made Mary a good husband. → John is a good husband.

- 1. Fred painted the model nude. → The model is nude.
  2. Fred painted the model nude. → John is nude?

Introduction: Syntax III

- Recursive property of human language
  - The cat chased the rat.
  - The cat chased the rat that ate the cheese.
  - The cat chased the rat that ate the cheese that was rotten.
  - The cat chased the rat that ate the cheese that was rotten when that Jack ate..........

- But not quite...
  - The cat the rat the cheese was rotten ate chased.

Introduction: Syntax IV

- Argument structure
  - **Transitive sentence**
    - I ate the dinner.
    - I devoured the dinner.
    - *I dined the dinner (with my friends)
  - **Intransitive sentence**
    - I ate.
    - *I devoured.
    - I dined (with my friends)

- Alternation of the argument structure
  - <u>Noun1 Verb Noun2 → Noun2 Verb</u>
    - Janet broke the cup.
    - The cup broke.

    - Margaret cut the bread.
    - *The bread cut.

  - <u>Noun1 Verb → Noun2 Verb Noun1</u>
    - The glass melted.
    - The fire melted the glass.

    - The baby cried.
    - *Joyce cried her baby.

Syntax

Syntax is "the structure and ordering of components" (p.86) of language (Yule, 2010)

- We will approach syntax, the most extensively studied area of linguistics, in the following order.
  - part-of-speech vs. lexical category
  - linear order vs. hierarchical order
  - phrasal category (syntactic trees)
  - subcategorization (the lexicon)
  - phrase structure (PS) rules
  - transformation

Traditional grammar I

- Let's review the distinction between prescriptive and descriptive grammar

Prescriptive grammar

A prescribed (previously described) set of grammar rules that tells which rule is "good" and which one is "bad"

Descriptive grammar

The native speaker's knowledge about the language. How the native speakers use the language.

Universal Grammar (UG)

A common (universal) set of grammar that all human beings share (regardless of what language one speaks)

Traditional grammar I

- The traditional grammar is derived from the study of Latin and Greek grammar

- The prescriptive grammar based on Latin/Greek may not capture the fact about English
    - **Split-infinitive**
      To go boldly,... / To boldly go, ...

    - **Preposition stranding**
      Who did you go with? / With whom did you go?

    - **Nominative/accusative case**
      Me and my family had a party yesterday.
      My family and I had a party yesterday.

- Syntax is "the structure and ordering of components" of language according to native speakers' intuition

Traditional grammar I

- We are interested in the actual use of language (which might be different from what a grammar teacher is interested)

- However, the traditional grammar still has strong influence on the linguistic research. In addition, some topics discussed in the traditional grammar are still considered interesting in the modern linguistics.
  - part-of-speech (cf. the lexical category)
  - agreement

Part-of-speech

A large number of words often exhibit the same properties, which suggests that a language's enormous inventory of words can be grouped into a relatively small number of word classes.

- What are the part-of-speech of each word in the following sentences?
  - The lucky boys found a backpack in the park and they opened it carefully.
  - An English-speaking kid knows about 10,000 words by the time he or she graduates from an elementary school.

Traditional grammar III

- The/D lucky/A boys/N found/V a/D backpack/N in/P the/D park/N and/Conj they/N opened/V it/N carefully/Adv

- An/D English-speaking/A kid/N knows/V about/P 10,000/A words/N by/P the/D time/N he/N(pronoun) or/Conj she/N graduates/V from/P an/D elementary/A school/N.

Part-of-speech (POS)

- Traditional definition of Noun
  - names of things, people, abstract ideas

- Instead, we will define part-of-speech (or lexical/functional class) by the morphological behavior and the syntactic frame (environment) of language elements

Noun

Names of person, thing, and idea

- Noun's morphological behavior
  - _____ + plural morpheme (-s)
    boy-s, pizza-s, kiss-es, sheep- , criteria

- Noun's syntactic frames
  - DET _____
    the book, the celebrity, concept, an order?

  - DET ADJ _____
    a boring book, the respectful individual

Verb

Describing an event, action, or state

- Verb's morphological behavior
    - ____ + past-tense morpheme (-ed)
      studi-ed, work-ed, wrote
    - ____ + 3rd person singular morpheme (-s)
      studi-es, grasp-s, greet-s, miss-es
    - ____ + present progressive morpheme (-ing)
      study-ing, cheat-ing, counsel-ing

- Verb's syntactic frames
    - AUX ____
      can meet, will overlook, might disguise
    - (please) ____ ... !
      Please leave!, Please listen to me!, Please take a seat.

Adjective

Modifying/describing a noun

- Adjective's morphological behavior
  - ____ + comparative morpheme (-er/more)
    happi-er, tall-er, more convenient
  - ____ + superlative morpheme (-est/most)
    tall-est, sadd-est, busi-est, most affectionate

- Adjective's syntactic frames
  - DET ____ N
    a true story, the unexpected guests
  - LINKING VERB ____
    is sunny, seems angry, look ready
  - ADV ____
    very rude, highly qualified, amazingly perceptive

Adverb

Modifying/describing a verb, adjective, or another adverb

- Adverb's morphological behavior
  - [Adjective + ly]
    happi-ly, unexpected-ly, skillful-ly, eager-ly
    (but, lovely, friendly, likely etc. are adjectives)?

- Adverb's syntactic frames
  - _____ ADJ
    very nice

  - _____ Verb/Verb Phrase
    quietly run, carefully moved

  - _____ ADV
    highly carefully, very quietly

Open class and closed class

Open class

- Nouns, verbs, adjectives, and adverbs
- A new member can be easily added (productive)

Closed class

- Also known as "function words" The members of closed classes have little meaning outside of their grammatical purpose.
- Prepositions, determiners, conjunctions, auxiliary verbs etc.
- Not productive (limited in the number)

Part-of-speech::Determiner

Determiner

Determine what it follows (i.e., Noun). Usually, determiners include articles (e.g., *a*, *the*), demonstrative (e.g., *this*, *that*), and possessive pronouns (e.g., *my*, *his*)

- *a, an, the, this, that, these, those, my, his, her, their, its, which, all, few, many, several, some, every, each, any, no, all, both, some, any, either, neither, another, a few, a little, several, enough, sufficient, many, much, few, little* etc.

- Determiner's syntactic frames
  - _____ (ADJ) NP
    a funny geek, the ground-breaking discovery my best friend, his backpack

Part-of-speech::Auxiliary I

Auxiliary

Auxiliary (a.k.a., auxiliary verb) is a verb that needs another verb (or complement). Auxiliary indicates tense, aspect, voice, mood of another verb. A subset of auxiliary verbs expressing necessity and possibility is called *modal verbs*

- *am, aren't, ain't, 'm, are, aren't, ain't, 're, be, been, can, cannot (does not invert), can't, could, couldn't, did, didn't, do, don't, does, doesn't, had, hadn't, 'd, has, hasn't, 's, have, haven't, 've, is, isn't, 's, may, might, mightn't, must, mustn't, ought, shall, shan't, should, shouldn't, was, wasn't, were, weren't, will, won't, 'll, would, wouldn't, 'd*

- Auxiliary verb's syntactic frames
  - NP _____ VP: I am going, I should go, He must leave
  - _____ NP VP?: Am I going?, Should I go?, Must he leave?
  - _____ not: will not, shall not, must not, am not

Part-of-speech::Preposition I

Preposition

Preposition usually precedes a noun or pronoun and expresses a relation between two entities (e.g., locational and temporal relationship). Strictly speaking, *particle* is not preposition, but we don't make this distinction in this class

- *about, above, across, after, against, along, among, around, aslant, at, behind, below, beside, besides, between, beyond, by, down, for, from, in, inside, into, of, off, on, onto, out, over, through, throughout, till, to, toward, towards, under, up, upon, with, within, without etc.*

- Preposition's syntactic frames
    - (right) _____ NP
    - (right) into the store, (right) over the bleachers
    - (right) at the corner

Part-of-speech::Conjunction

Conjunction

Conjunction connects two of the same entities (e.g., Noun and Noun, Adjective and Adjective etc.) together and create the same entity

- and, but, or, (because, as, cause, since) etc.

- Conjunction's syntactic frames
  - N _____ N
  - ADJ _____ ADJ
  - NP _____ NP
  - ADJP _____ ADJP
  - Sentence _____ Sentence

Part-of-speech::Pronoun

Pronoun

A word that can function by itself as a noun phrase and that refers something/someone else in the discourse

- he, she, we, they, I, you, him, her, us, them, me, it ...

- The syntactic frames of pronoun is the same as those of the noun

Phrasal category (Phrase)

A "phrasal category" is a set of constituents that shows the same function and shares the same distribution as a lexical head (part-of-speech)

- The joggers ran through the park

- The/D joggers/N ran/V through/P the/D park/N
  - the + joggers → NP

  - the + park → NP

  - through + the + park → PP

  - ran + through + the + park → VP

  - the + joggers + ran + through + the + park → S

Phrasal Category::Noun Phrase

- What's the phrasal category of the following phrases (what kind of the syntactic frame do they appear)?
    - Susan
    - a student
    - you and I
    - most dogs
    - some children
    - a huge bear
    - my friend from Brazil
    - the people that we interviewed

- They behave as if they were nouns. Thus, we call them "noun phrases" (abbreviated as NP)

Phrasal Category::Verb Phrase

- What's the phrasal category of the following phrases?
    - snored
    - love music
    - walked the dog through the park
    - believe that dogs are smart
    - wanted to leave
    - will sleep soundly
    - can lift 100 pounds
    - are wearing sunglasses
    - go home and have a beauty rest

- They behave as if they were verbs. Thus, we call them "verb phrases" (abbreviated as VP)

- What's the phrasal category of the following phrases?
  - smart
  - very expensive
  - as tall as his father
  - smarter than the average bear
  - certain to win

- They behave as if they were adjectives. Thus, we call them "adjective phrases" (abbreviated as AP)

Phrasal Category::Adverbial Phrase

- What's the phrasal category of the following phrases?
  - soundly
  - fiercely
  - as fluently as a native
  - almost certainly

- They behave as if they were adverbs. Thus, we call them "adverb phrases" (abbreviated as AdvP)

Phrasal Category::Prep Phrase

- What's the phrasal category of the following phrases?
  - from Uganda
  - with Howard and his dog
  - for nothing
  - to the head honcho

- The prepositional phrases are headed by a preposition. Thus, we call them "prepositional phrases" (abbreviated as PP)

- So, each word can be defined by lexical/functional category. But, it can also belongs to more than one phrasal categories. ("park" is a noun. It's also part of NP and VP)

    - The/D joggers/N ran/V through/P the/D park/N

    - The joggers/(D+N→NP) ran/V through/P the park/(D+N→NP)

    - The joggers/NP ran/V through the park/(P+NP→PP)

    - The joggers/NP ran through the park/(V+PP→VP)

    - The joggers ran through the park/(NP+VP→S)

Phrasal category II

- Or even better, the phrasal category is represented as a *hierarchical* diagram.

The joggers ran through the park.

D	N	V	P	D	N
NP		V	P	NP	
NP		V	PP		
NP		VP			
S					

Constituency Tests I

- The legitimate phrase should pass one or more constituency tests.

Substitution test

- It's possible to substitute a constituent for a pronoun (e.g., *it, him, he, there, them, do so* etc.)
  - Robin was planning to see the entire "Lord of the Rings Trilogy" this coming Saturday.
  - Robin was planning to see <u>it</u> this coming Saturday.

Deletion

- It's possible to delete the constituent when it's highly predictable from the context (e.g., repetition)
  - Jack <u>bought a jacket</u> and <u>so did</u> Mike.

Constituency Tests II

Movement

- It's possible to move the constituent.
  - I sent an invitation to your friend.
  - To your friend, I sent an invitation.

Wh-question

- It's possible to make a *wh*-question to which the answer is the constituent.
  - I watched the Lord of the Rings with my girlfriend last year.
  - What did I watch with my girlfriend last year?
  - With whom did I watch the Lord of the Rings?

Bracket notation (see handout) I

- We use square brackets to indicate the syntactic classes that each element belongs to.

- My mother likes her car.

- The lexical/functional category
  [D my] [N mother] [V likes] [D her] [N car]

- Noun phrase and verb phrase
  [NP [D my] [NP [N mother]]] [VP [V likes] [NP [D her] [NP [N car]]]]

- Sentence
  [S [NP [D my] [NP [N mother]]] [VP [V likes] [NP [D her] [NP [N car]]]]]

Bracket notation (see handout) II

How to use the bracket notation

Pick any opening bracket. Add 1 when you see an opening bracket (i.e., [) and reduce 1 when you see the closing bracket (i.e.,]). Keep counting until you hit 0.

- Let's try
  [s [NP [D my] [NP [N mother]]] [VP [V likes] [NP [D her] [NP [N car]]]]]

Bracket notation (see handout)

- Alternatively, we also use the "syntactic tree" to indicate the hierarchical syntactic structures
- My mother likes her cars

```
                      S
            ┌─────────┴─────────┐
           NP                   VP
        ┌───┴───┐           ┌────┴────┐
        D      NP           V        NP
        │       │           │      ┌──┴──┐
       my       N        likes     D    NP
                │                   │     │
             mother                her    N
                                          │
                                         car
```
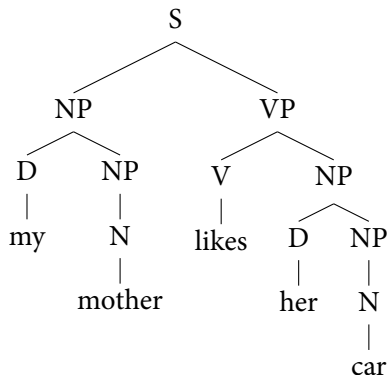
- We will practice tree drawing – but we need to know the rules for the tree structures (phrase structure rules)

Phrase structure rules I

- The phrase structure (PS) rules are a set of rules that capture three major characteristics of human language

- The PS grammar can
  - generate all well-formed sentences (**recursion**)
  - represent ambiguity (**structural ambiguity**)
  - show superficially different sentences may be closely related, and some superficially similar sentences are in fact different (**surface structure & deep structure**)

Phrase structure rules II

Recursion

- There are an infinite number of well-formed sentences in human language because of recursion

- The gun was <u>on the table</u>.
- The gun was on the table <u>near the window</u>.
- The gun was on the table near the window <u>in the bed room</u>.

- Girls like shopping.
- <u>All</u> girls like shopping.
- <u>Almost all</u> girls like shopping.

Phrase structure rules III

Structural ambiguity

- One sentence may have more than two valid interpretations

- Annie whacked a man with an umbrella.
  (who had the umbrella?)
- I once shot an elephant in my pajamas.
  (where was the elephant?)
- Small boys and girls
  (who are small?)

- There are a lot of structurally ambiguous sentences in the real life (e.g., newspaper)

Phrase structure rules IV

Surface structure vs. Deep structure

- The same action or event can be represented in superficially different sentences.

- Charlie broke the window. (active voice)
- The window was broken by Charlie. (passive voice)

- **Transformation rules** are added to the PS rule to capture the surface structure-deep structure relationship.
  NP_1 VP NP_2 → NP_2 Aux $VP_{passive}$ (by NP_1)

- In this class, we will use a simplified version of the PS rules.

- Phrase Structure (PS) rules

  a. $S \rightarrow NP + VP$

  b. $NP \rightarrow (D) + NP$

  c. $NP \rightarrow AP + NP$

  d. $NP \rightarrow N (+ PP)$

  e. $NP \rightarrow NP + PP$

  f. $VP \rightarrow Aux + VP$ or AP

  g. $VP \rightarrow V (+ PP)$

  h. $VP \rightarrow V + NP$

  i. $VP \rightarrow V + NP + NP$

  j. $VP \rightarrow VP + PP$ or $AdvP$

  k. $AP \rightarrow (AdvP +) A$

  l. $AdvP \rightarrow Adv$

  m. $PP \rightarrow P + NP$

  n. $NP \rightarrow NP+ Conj + NP$

  o. $S \rightarrow S + Conj + S$

S = Sentence, NP = Noun Phrase, N = Noun, D = Determiner, VP = Verb Phrase, V = Verb, PP = Propositional Phrase, P = Proposition,

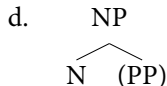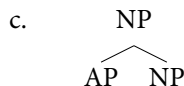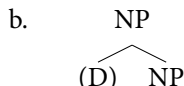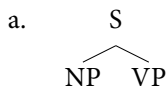Aux = Auxiliary, AP = Adjective Phrase, A = Adjective, AdvP = Adverb Phrase, Adv = Adverb, Conj = Conjunction

Syntax Tree II

- Phrase Structure (PS) rules in tree representations

a.
```
        S
      /   \
    NP     VP
```

b.
```
        NP
      /    \
    (D)     NP
```

c.
```
        NP
      /    \
    AP      NP
```

d.
```
      NP
    /    \
   N     (PP)
```

e.
```
       NP
     /    \
   NP      PP
```

f.
```
       VP
     /    \
   Aux    VP/AP
```

g.
```
        VP
      /    \
   V_intra  (PP)
```

h.
```
        VP
      /    \
   V_trans  NP
```

i.
```
          VP
        /  |  \
   V_ditra NP  NP
```

j.
```
         VP
       /    \
     VP    PP/AdvP
```

k.
```
         AP
       /    \
    (AdvP)    A
```

l.
```
      AdvP
        |
       Adv
```

m.
```
       PP
     /    \
    P      NP
```

n.
```
          NP
        /  |  \
      NP  Conj  NP
```

o.
```
          S
        /  |  \
       S  Conj  S
```
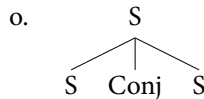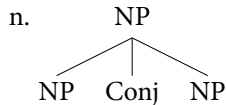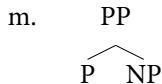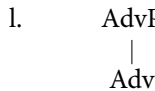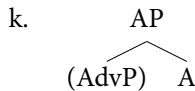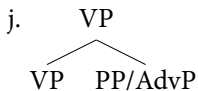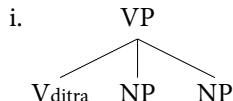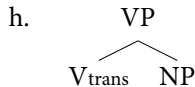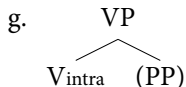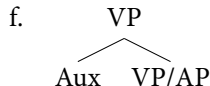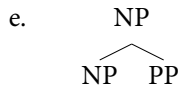
Syntax Tree III

- Let's see an example.
  "A dog bit a girl"

- Apply the rule S → NP + VP (NP and VP can build S)

```
              S
            /   \
          NP     VP
          |      |
        a dog  bit a girl
```
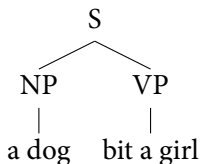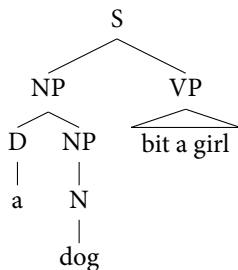
- Strictly speaking, trees should be built bottom-up (from the terminal nodes to higher nodes), but for now we just ignore it.

Syntax Tree IV

- Apply the rule NP → D + NP

```
                S
          ┌─────┴─────┐
         NP            VP
        ╱  ╲          ╱‾‾╲
       D    NP      bit a girl
       │    ╱╲
       a  dog
```

- Apply the rule NP → N

```
                S
          ┌─────┴─────┐
         NP            VP
        ╱  ╲          ╱‾‾╲
       D    NP      bit a girl
       │    │
       a    N
            │
           dog
```

Syntax Tree V

- Apply the rule VP → V + NP

```
                    S
         ┌──────────┴──────────┐
        NP                    VP
      ┌──┴──┐              ┌───┴───┐
      D    NP              V      NP
      │     │              │    ╱────╲
      a    dog            bit  a girl
```

- Apply the rule NP → D NP

```
                    S
         ┌──────────┴──────────┐
        NP                    VP
      ┌──┴──┐           ┌──────┴──────┐
      D    NP           V            NP
      │     │           │          ┌──┴──┐
      a     N          bit         D    NP
            │                      │   ╱──╲
           dog                     a   girl
```
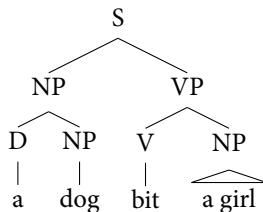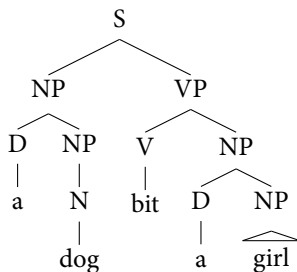
Syntax Tree VI
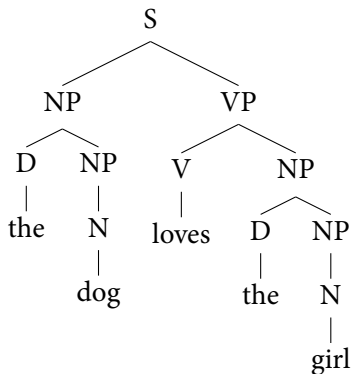
- Finally, apply the rule NP → N
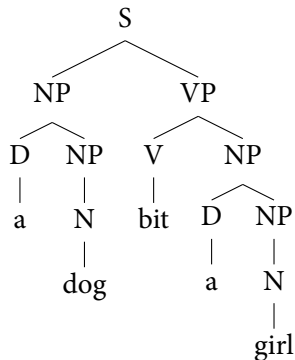
Syntax Tree VII

- The bracket notation and the syntactic tree represent the same information (namely, the hierarchical syntactic structure)

- With some practice, there should be little difficulty in translating a bracket notation to a syntactic tree representation, and vice versa.
  - The dog loves the girl.
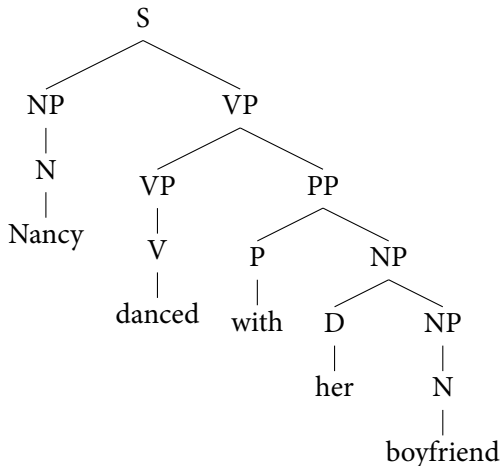 - The moviegoers applauded the new movie by a young director

- The dog loves the girl.

- [s [np [d the] [np [n dog]]] [vp [v loves] [np [d the] [np [n girl]]]]]

-
```
                          S
                 ┌────────┴────────┐
                NP                 VP
            ┌────┴────┐        ┌────┴────┐
            D        NP        V         NP
            │         │        │      ┌───┴───┐
           the        N      loves    D       NP
                       │               │       │
                      dog             the       N
                                                │
                                              girl
```

Practice with Syntax Tree III

- Nancy danced with her boyfriend.

- [S [NP [N Nancy]] [VP [VP [V danced]] [PP [P with] [NP [D her] [NP [N boyfriend]]]]]]

Syntax tree:

- S
  - NP
    - N
      - Nancy
  - VP
    - VP
      - V
        - danced
    - PP
      - P
        - with
      - NP
        - D
          - her
        - NP
          - N
            - boyfriend

- *The dog buried the bone.*

- [S [NP [D the] [NP [N dog]]] [VP [V buried] [NP [D the] [NP [N bone]]]]]

-

```
                        S
              ┌─────────┴─────────┐
             NP                   VP
          ┌───┴───┐          ┌─────┴─────┐
          D      NP          V          NP
          │       │          │       ┌───┴───┐
         the      N        buried     D      NP
                  │                   │       │
                 dog                 the      N
                                              │
                                            bone
```
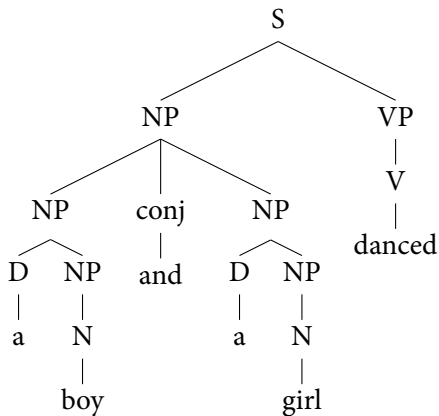
- *A boy and a girl danced.*

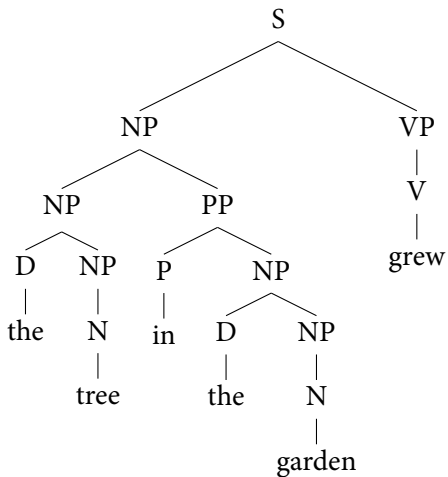- [S [NP [NP [D a] [NP [N boy]]] [conj and] [NP [D a] [NP [N girl]]]] [VP [V danced]]]

-

```
                              S
                   ┌──────────┴──────┐
                  NP                 VP
          ┌────────┼────────┐        │
         NP       conj      NP        V
      ┌───┴──┐     │     ┌───┴──┐     │
      D     NP    and    D     NP  danced
      │      │           │      │
      a      N           a      N
             │                  │
            boy               girl
```

- *The tree in the garden grew.*

- [s [NP [NP [D the] [NP [N tree]]] [PP [P in] [NP [D the] [NP [N garden]]]]] [VP [V grew]]]

-

Argument vs. Adjunct

- a student of linguistics - necessary information
- a student with long hair - extra information

- arrived at the airport - necessary information
- stopped at the store - necessary information
- came at noon - extra information

- There is a way to represent the distinction with the syntactic structures
  - argument - required by the lexical item
  - adjunct - extra information to the lexical item

- The PS rule captures the recursion by the fact that the same rule can (recursively) apply.

- Write the syntactic tree of
  - The dog sleeps.
  - The dog sleeps near the tree.
  - The dog sleeps near the tree in the garden.
  - The dog sleeps near the tree in the garden of my house.

- Rules (e) and (m) are applied recursively.
  - P + NP → PP
  - NP + PP → NP

Recursion revisited II
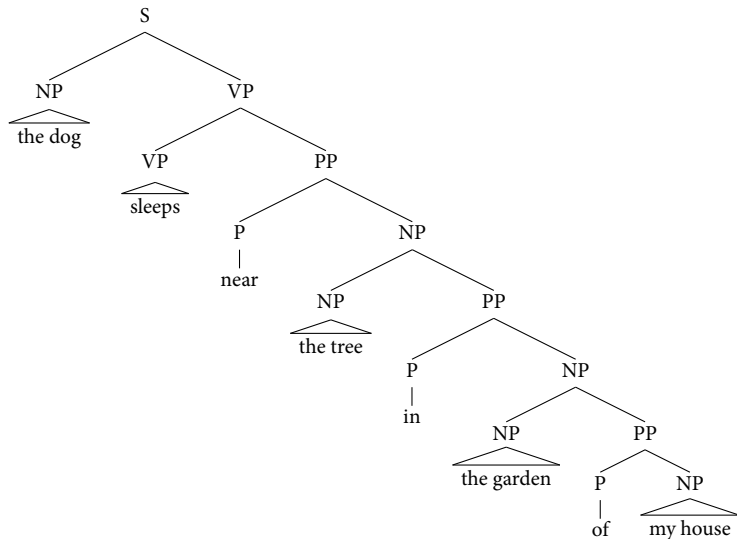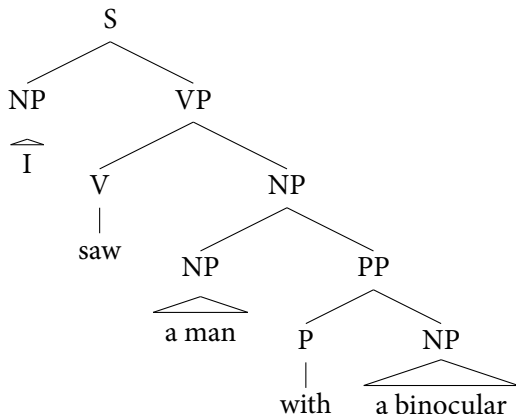
Structural ambiguity revisited I

- How can we capture the structural ambiguity with syntactic trees?
  "I saw a man with the binocular"

- If a sentence is structurally ambiguous, there should be more than two (legal) syntactic representations (that is, more than one correct syntactic trees without violating the PS rules)

Structural ambiguity revisited I

- "I saw a man with the binocular" has two interpretations.
  - I used the binocular to see a man.
  - I saw a man who carried the binocular.

- Notice that prepositional phrase "with the binocular" modifies different things depending on the interpretation.
  - I used the binocular to see a man (modifying VP or how we saw the man)
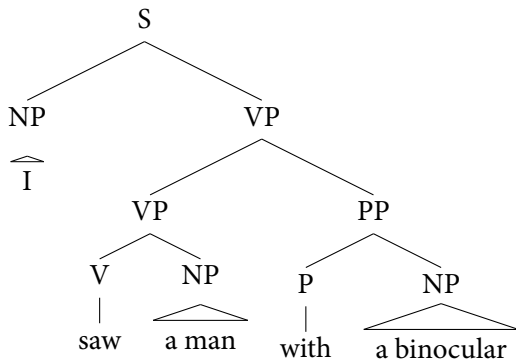 - I saw a man who carried the binocular (modifying NP (the man))

- Which one is the reading "I used the binocular to see a man" (see the next slide)?

Structural ambiguity revisited III

- Which one is the reading "I used the binocular to see a man"?

Structural ambiguity revisited IV

- The structurally ambiguous sentences in real life (from Pinker (2007)). How do you analyze those sentences?

  - Yoko Ono will talk about her husband John Lennon who was killed in an interview with Barbara Walters.

  - Two cars were reported stolen by the Groveton police yesterday.

  - The license fee for altered dogs with a certificate will be $3 and for pets owned by senior citizens who have not been altered the fee will be $1.50.

  - Tonight's program discuss stress, exercise, nutritinon, and sex with Celtic forward Scott Wedman, Dr. Ruth Westheimer, and Dick Cavett.

Transformation rules I

- **Transformation rules** are added to the PS rule to capture the surface structure-deep structure relationship.

  - NP_1 VP $NP_2 \rightarrow NP_2$ Aux $VP_{passive}$ (by NP_1)

  - [$_{NP_1}$ the dog] [$_{VP}$ loves] [$_{NP_2}$ the girl]

  - [$_{NP_2}$ the girl] [$_{Aux}$ is [$_{VP}$ loved]] (by [$_{NP_1}$ the dog])

- The state-of-the-art syntax theories, however, do not employ the transformation rules at all.

Bibliography I

Yule, G. (2010). *The Study of Language*. Cambridge University Press, New York, NY, 4th edition. ISBN: 9780521749220; Course: ELL101 (textbook); Price: $29.99.

This presentation slide was created with LaTeX and *beamer* LaTeX style.