Syntactic Features

Morphology, heads, gaps, etc.

3 views of a context-free rule

- generation (production): S → NP VP
- parsing (comprehension): S ← NP VP
- verification (checking): S = NP VP
- Today you should keep the third, declarative perspective in mind.

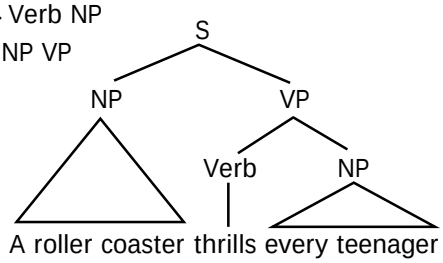
- Each phrase has
  - an interface (S) saying where it can go
  - an implementation (NP VP) saying what's in it
- To let the parts of the tree coordinate more closely with one another, enrich the interfaces:
  S[features...] = NP[features...] VP[features...]

Examples

Verb → thrills

VP → Verb NP

S → NP VP



3 common ways to use features

morphology of a single word:

Verb[head=thrill, tense=present, num=sing, person=3,...] → thrills

projection of features up to a bigger phrase

VP[head=α, tense=β, num=γ...] → V[head=α, tense=β, num=γ...] NP
provided α is in the set TRANSITIVE-VERBS

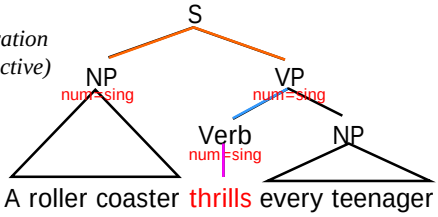
agreement between sister phrases:

S[head=α, tense=β] → NP[num=γ,...] VP[head=α, tense=β, num=γ...]

3 Common Ways to Use Features

Verb[head=thrill, tense=present, num=sing, person=3,...] → thrills
VP[head=α, tense=β, num=γ..] → V[head=α, tense=β, num=γ..] NP
S[head=α, tense=β] → NP[num=γ,...] VP[head=α, tense=β, num=γ..]

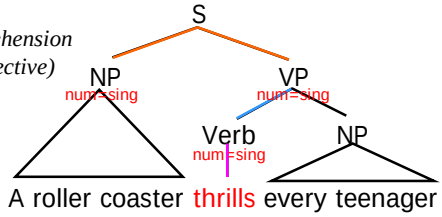
(generation perspective)

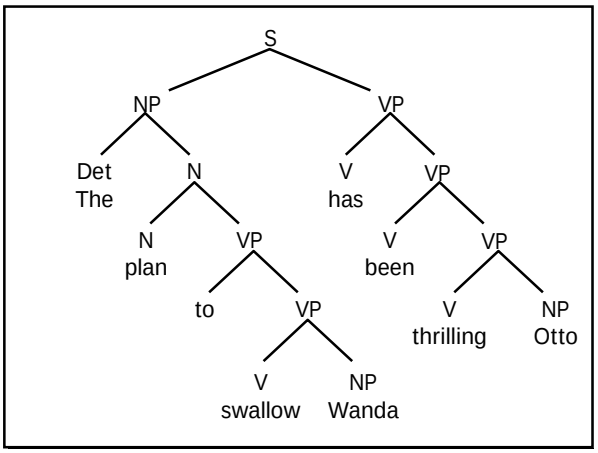


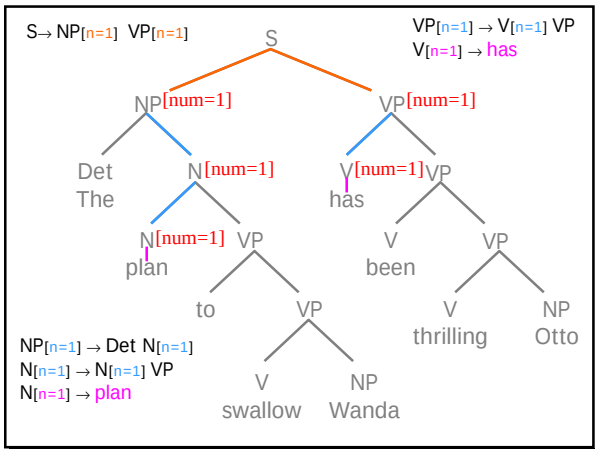
3 Common Ways to Use Features

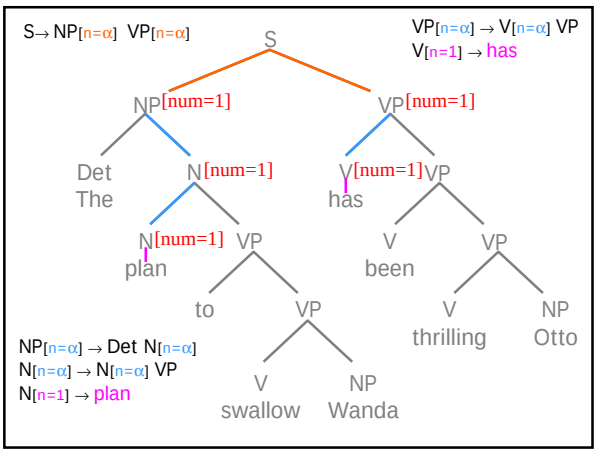
Verb[head=thrill, tense=present, num=sing, person=3,...] → thrills
VP[head=α, tense=β, num=γ..] → V[head=α, tense=β, num=γ..] NP
S[head=α, tense=β] → NP[num=γ,...] VP[head=α, tense=β, num=γ..]

(comprehension perspective)




S
NP
VP
Det
The
N
V
has
VP
N
plan
VP
V
been
VP
to
VP
V
thrilling
NP
Otto
V
swallow
NP
Wanda


S→ NP[n=1] VP[n=1]
VP[n=1] → V[n=1] VP
V[n=1] → has
NP[num=1]
VP[num=1]
Det
The
N[num=1]
V[num=1]
VP
has
N[num=1]
VP
V
been
VP
plan
to
VP
V
thrilling
NP
Otto
V
swallow
NP
Wanda
NP[n=1] → Det N[n=1]
N[n=1] → N[n=1] VP
N[n=1] → plan


S→ NP[n=α] VP[n=α]
VP[n=α] → V[n=α] VP
V[n=1] → has
NP[num=1]
VP[num=1]
Det
The
N[num=1]
V[num=1]
VP
has
N[num=1]
VP
V
been
VP
plan
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NP
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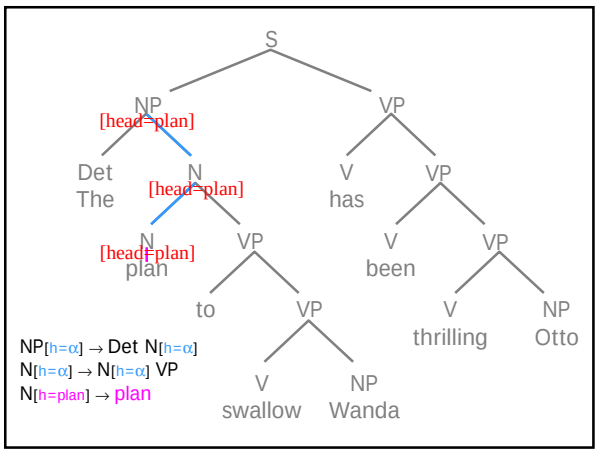
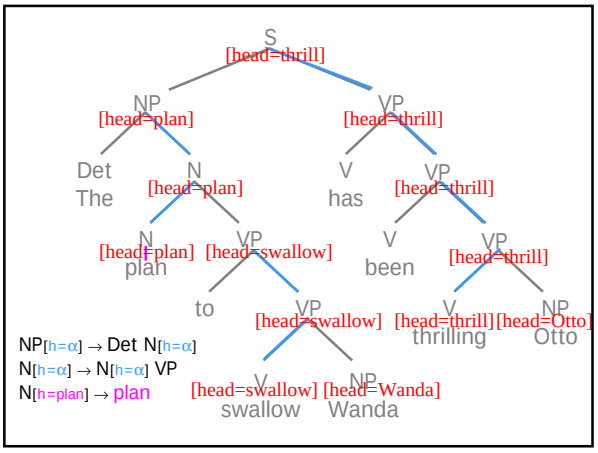
V
swallow
NP
Wanda
NP[n=α] → Det N[n=α]
N[n=α] → N[n=α] VP
N[n=1] → plan


S
NP
[head=plan]
VP
Det
The
N
[head=plan]
V
has
VP
N
[head=plan]
VP
V
been
VP
to
VP
V
thrilling
NP
Otto
V
swallow
NP
Wanda
NP[h=α] → Det N[h=α]
N[h=α] → N[h=α] VP
N[h=plan] → plan


S
[head=thrill]
NP
[head=plan]
VP
[head=thrill]
Det
The
N
[head=plan]
V
has
VP
[head=thrill]
N
[head=plan]
VP
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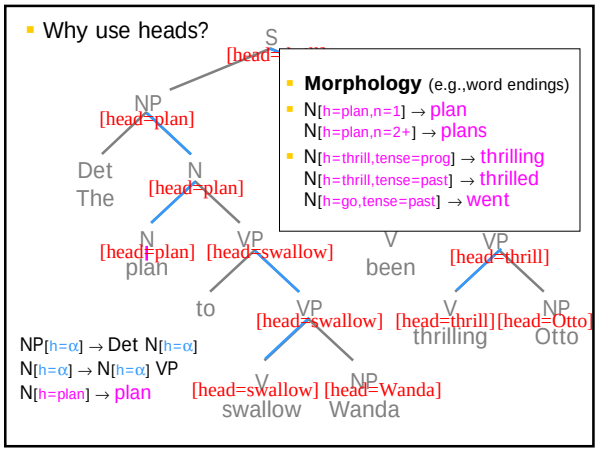
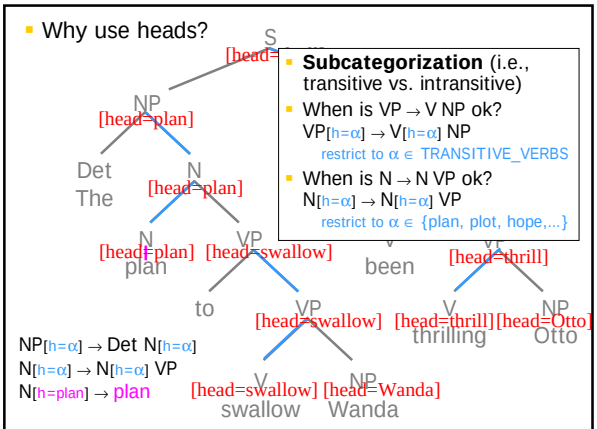
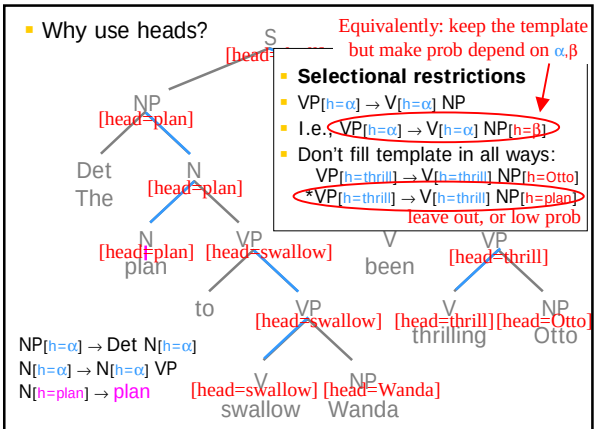
V
thrilling
NP
[head=thrill]
[head=Otto]
V
swallow
NP
[head=Wanda]
NP[h=α] → Det N[h=α]
N[h=α] → N[h=α] VP
N[h=plan] → plan


Why use heads?
Morphology (e.g.,word endings)
N[h=plan,n=1] → plan
N[h=plan,n=2+] → plans
N[h=thrill,tense=prog] → thrilling
N[h=thrill,tense=past] → thrilled
N[h=go,tense=past] → went
S
NP
[head=plan]
Det
The
N
[head=plan]
N
[head=plan]
VP
[head=swallow]
V
been
VP
[head=thrill]
to
VP
[head=swallow]
V
thrilling
NP
[head=thrill]
[head=Otto]
V
swallow
NP
[head=Wanda]
NP[h=α] → Det N[h=α]
N[h=α] → N[h=α] VP
N[h=plan] → plan

- Why use heads?

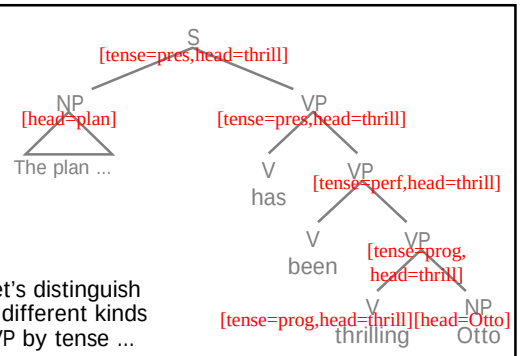


- Why use heads?

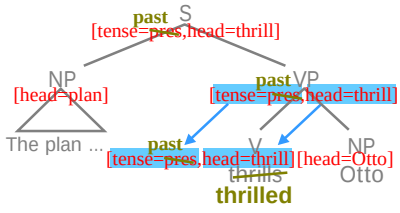


Part of the English Tense System

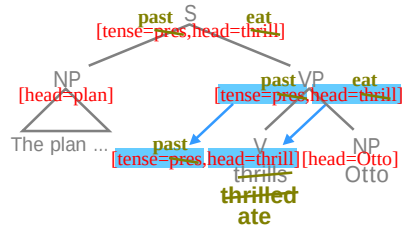
	Present	Past	Future	Infinitive
Simple	eats	ate	will eat	to eat
Perfect	has eaten	had eaten	will have eaten	to have eaten
progressive	is eating	was eating	will be eating	to be eating
Perfect+ progressive	has been eating	had been eating	will have been eating	to have been eating



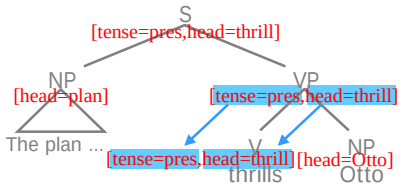
- Let's distinguish the different kinds of VP by tense ...



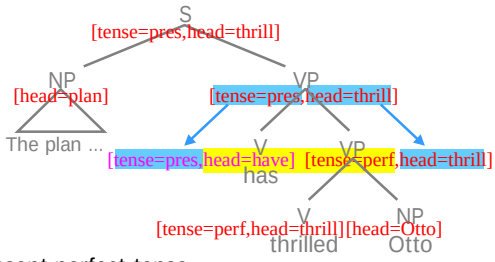
Past
- ~~Present~~ tense



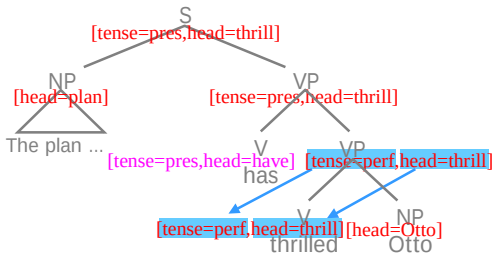
Past
- ~~Present~~ tense



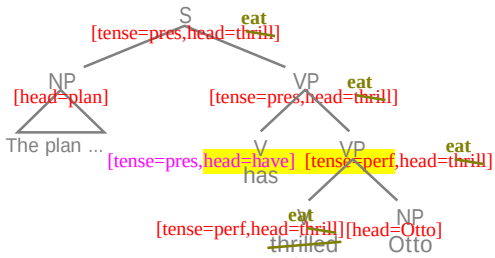
- Present tense (again)



- Present perfect tense

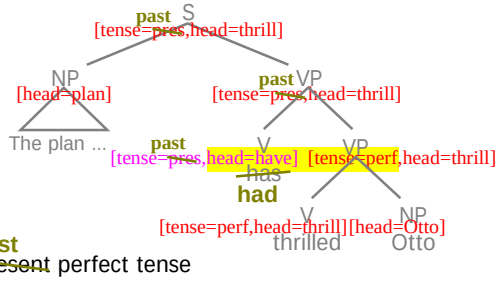


- Present perfect tense



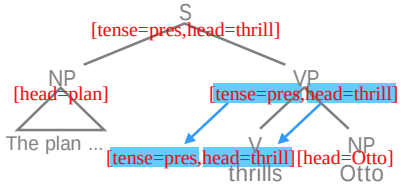
- Present perfect tense
- The yellow material makes it a perfect tense – what effects?

not **ate** – why?

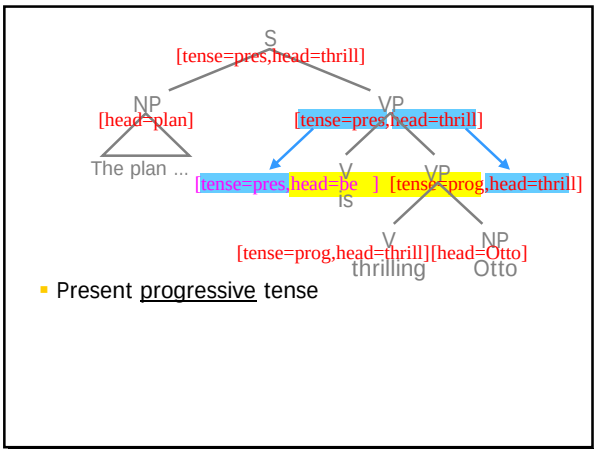


Past

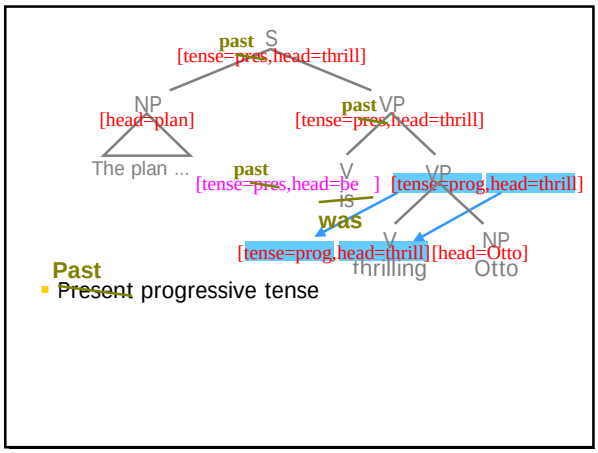
- Present perfect tense



- Present tense (again)

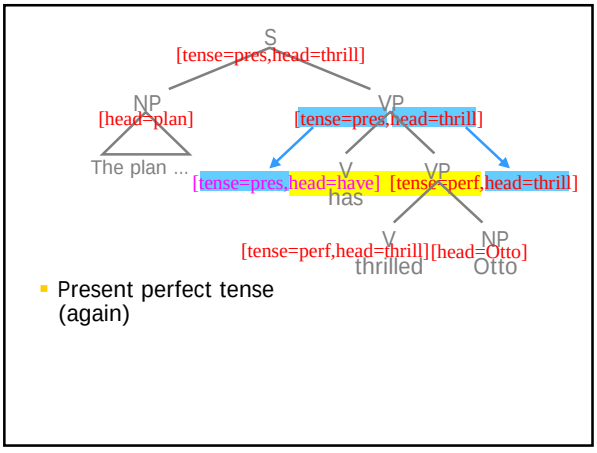


- Present progressive tense

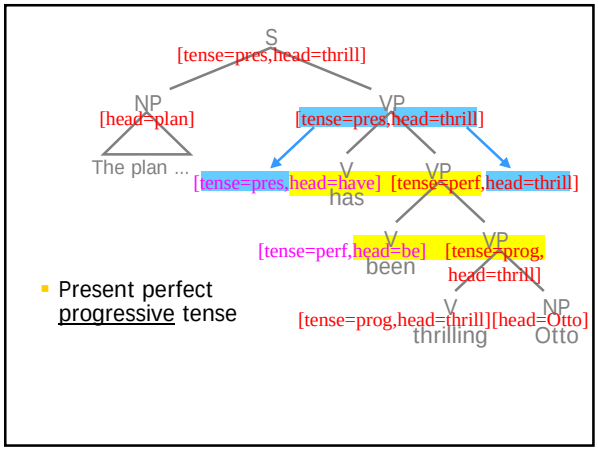


Past

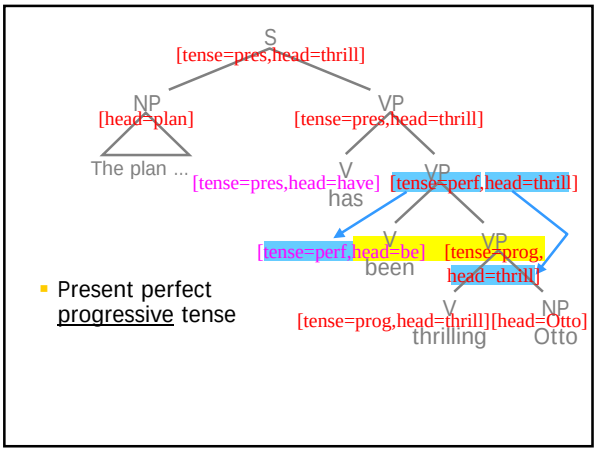
- ~~Present~~ progressive tense



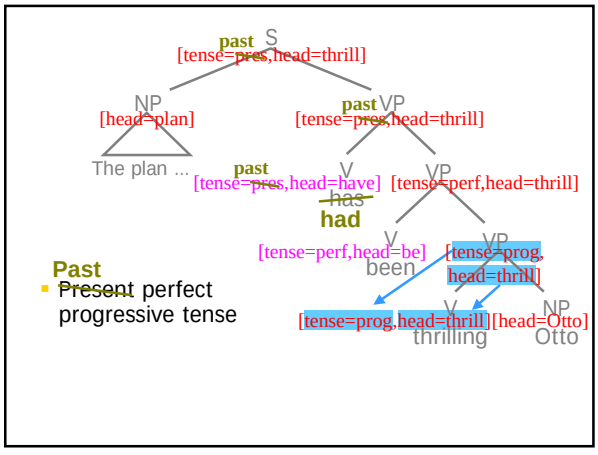
- Present perfect tense (again)



- Present perfect progressive tense

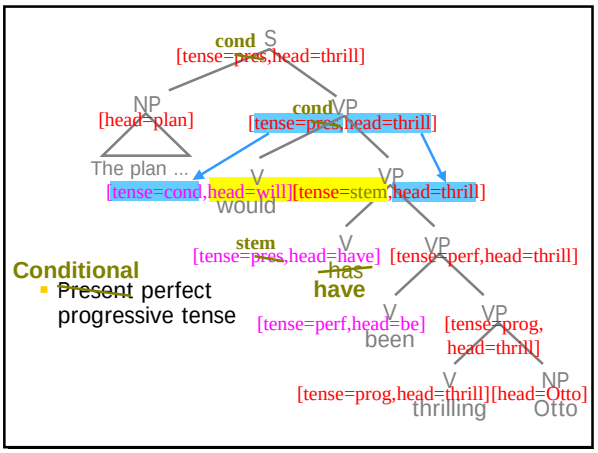


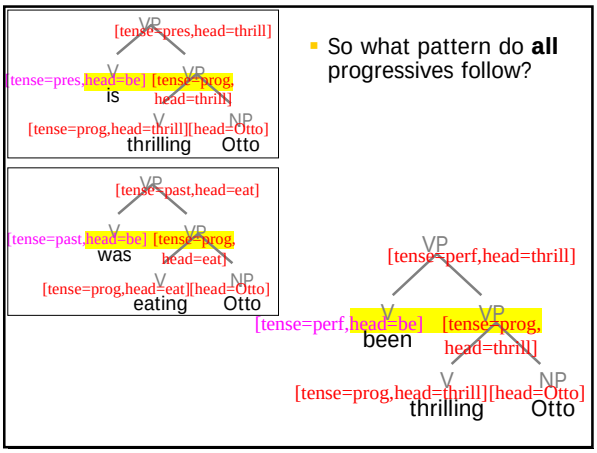
- Present perfect progressive tense

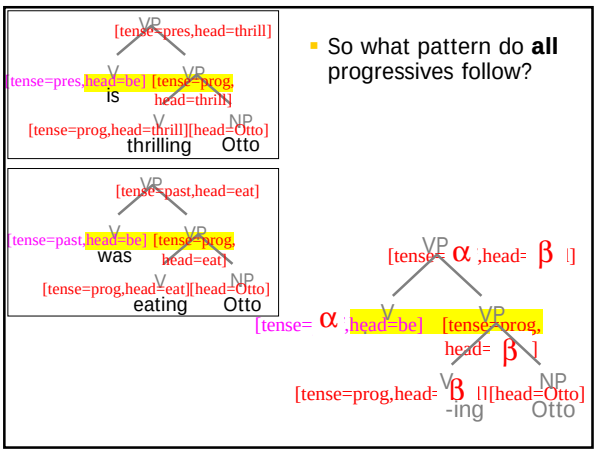


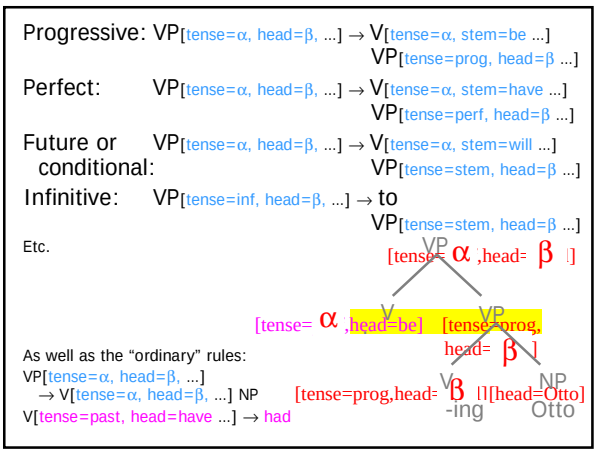
Past

- ~~Present~~ perfect progressive tense









Gaps ("deep" grammar!)

- Pretend "kiss" is a pure transitive verb.
- Is "the president kissed" grammatical?
  - If so, what type of phrase is it?

- the sandwich that
- I wonder what
- What else has

the president kissed e
Sally said the president kissed e
Sally consumed the pickle with e
Sally consumed e with the pickle

Gaps

- **Object gaps:**
- the sandwich that
- I wonder what
- What else has

the president kissed e
Sally said the president kissed e
Sally consumed the pickle with e
Sally consumed e with the pickle

[how could you tell the difference?]

- **Subject gaps:**
- the sandwich that
- I wonder what
- What else has

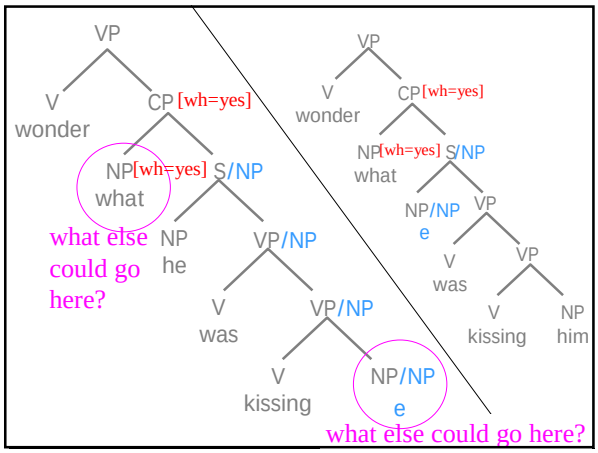
e kissed the president
Sally said e kissed the president

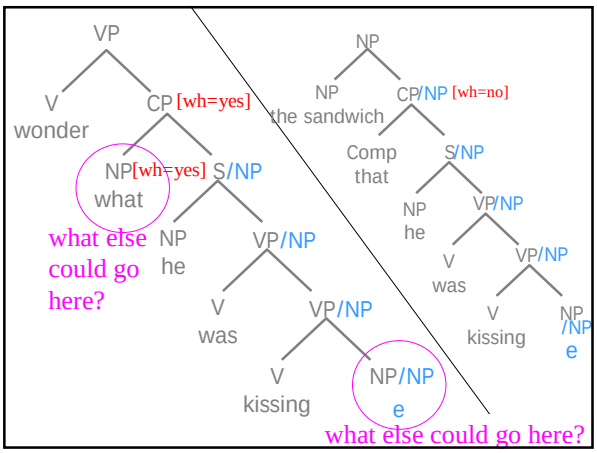
Gaps

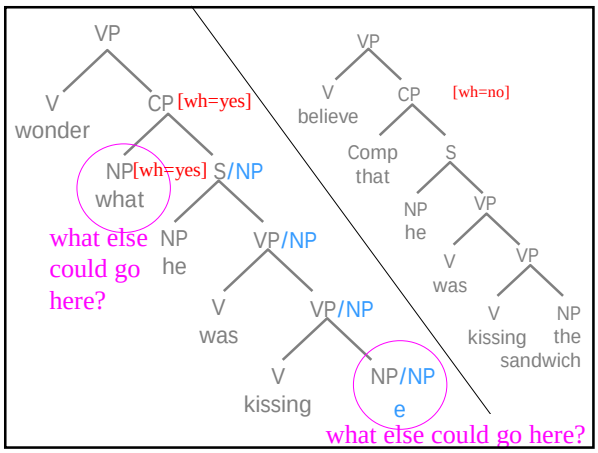
- **All gaps are really the same – a missing NP:**
- the sandwich that
- I wonder what
- What else has

the president kissed e
Sally said the president kissed e
Sally consumed the pickle with e
Sally consumed e with the pickle
e kissed the president
Sally said e kissed the president

Phrases with missing NP:
X[missing=NP]
or just X/NP for short

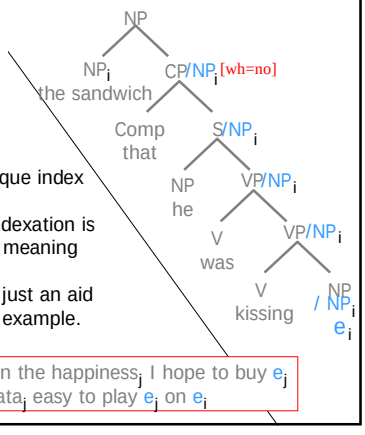




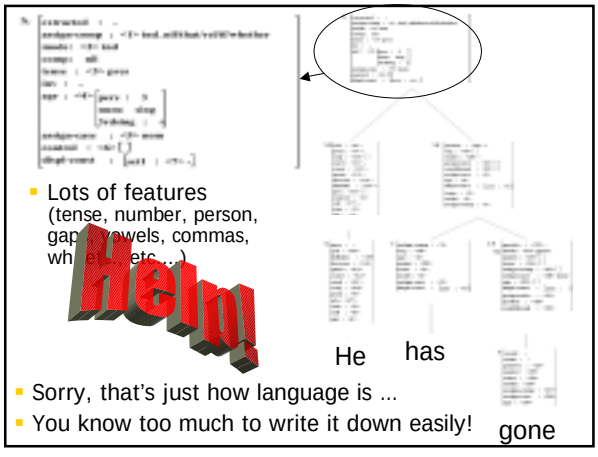


To indicate what fills a gap, people sometimes "coindex" the gap and its filler.

- Each phrase has a unique index such as "i".
- In some theories, coindexation is used to help extract a meaning from the tree.
- In other theories, it is just an aid to help you follow the example.



the money$_i$ I spend e$_i$ on the happiness$_j$ I hope to buy e$_j$
which violin$_i$ is this sonata$_j$ easy to play e$_j$ on e$_i$



- Sorry, that's just how language is ...
- You know too much to write it down easily!