

Sentence Processing III

LIGN 170, Lecture 8

Syntactic ambiguity

- Bob weighed three hundred and fifty pounds of grapes.
- The cotton shirts are made from comes from Arizona.
- The horse raced past the barn fell.

Syntactic ambiguity

- Bob weighed [three hundred and fifty pounds of grapes].
- The cotton [shirts are made from ____] comes from Arizona.
- The horse [____ raced past the barn] fell.
 - The horse was raced past a barn.
 - The horse fell.

Rampant ambiguity

- Much of language is actually ambiguous (we just don't notice it)
- John bought the flower for Susan.

Rampant ambiguity

- John bought the flower for Susan.
- (referential ambiguity)



Rampant ambiguity

- John bought the flower for Susan.
- the flower is to give to Susan

Rampant ambiguity

- John **bought** the flower **for Susan**.
- the flower is to give to Susan



Rampant ambiguity

- John bought the flower for Susan.
- the flower is for Susan to give to someone else

Rampant ambiguity

- John bought the flower for Susan.
- the flower is for Susan to give to someone else



Question

- Do we pick one interpretation and stick with it unless proved otherwise
- (serial processing)

OR

- Do we keep all reasonable interpretations somewhat active until we can decide which is best?
- (parallel processing)

Garden-path model

- Serial model: We do not entertain multiple possibilities
- Instead we have two strategies:
 - **Late closure**: Attach new items to the current constituent whenever possible
 - **Minimal attachment**: Attach new items to the current phrase structure using as few nodes as possible
- We have to stop and reanalyze when contrary information is encountered

Attachment Ambiguities (standing)

Tom said Bill got the mail this morning.

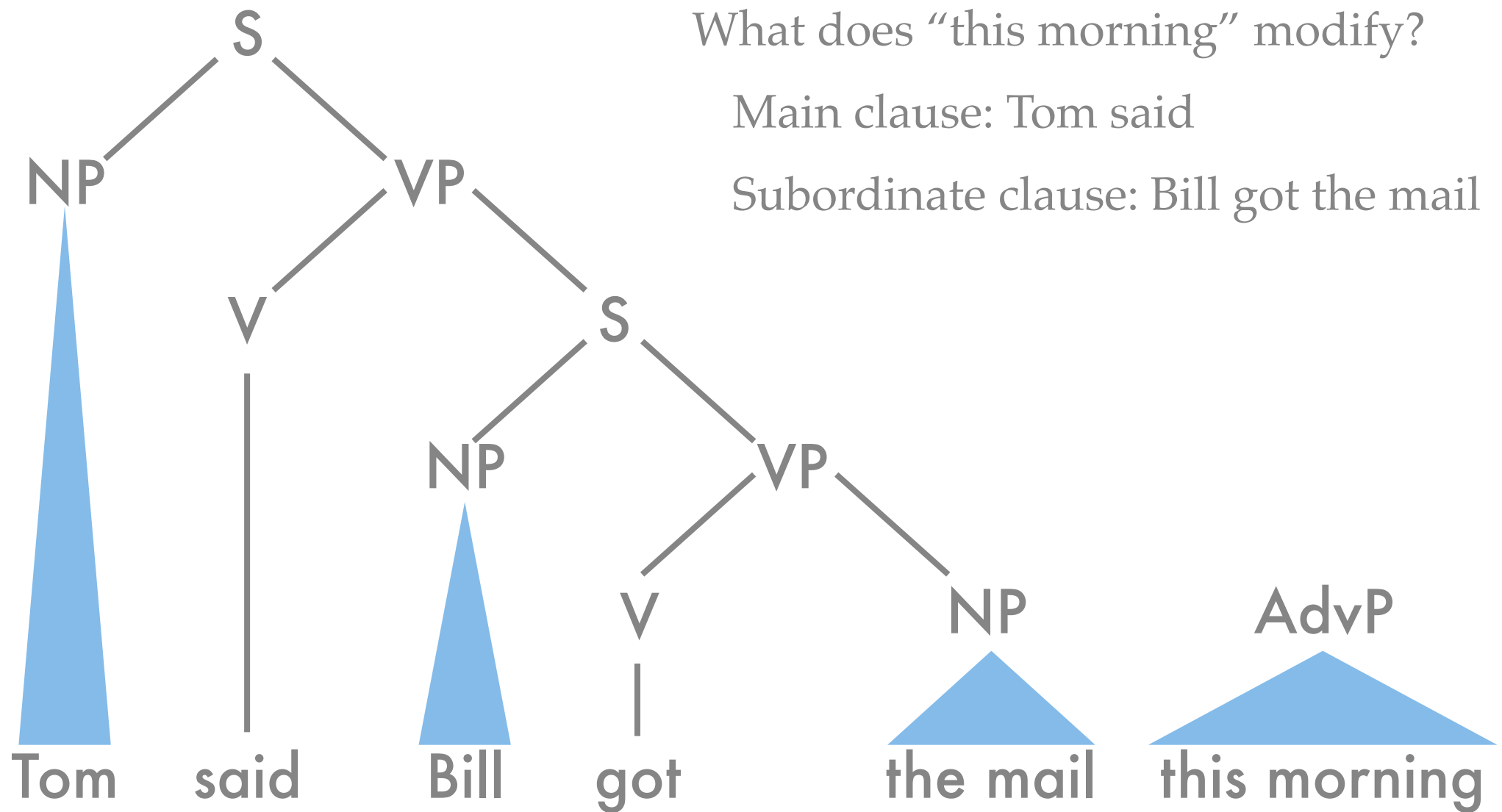
What does “this morning” modify?

Main clause: Tom said

Subordinate clause: Bill got the mail

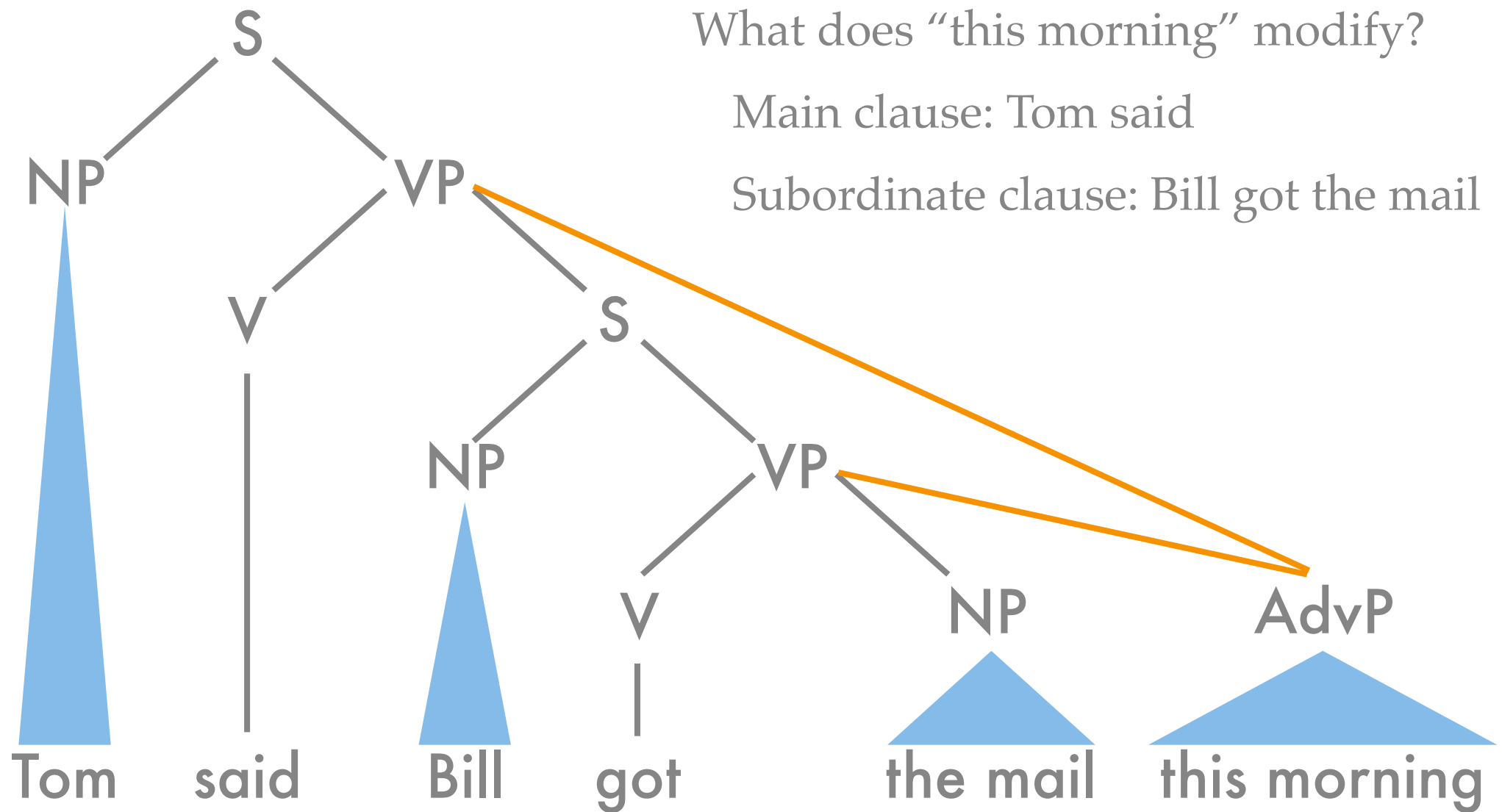
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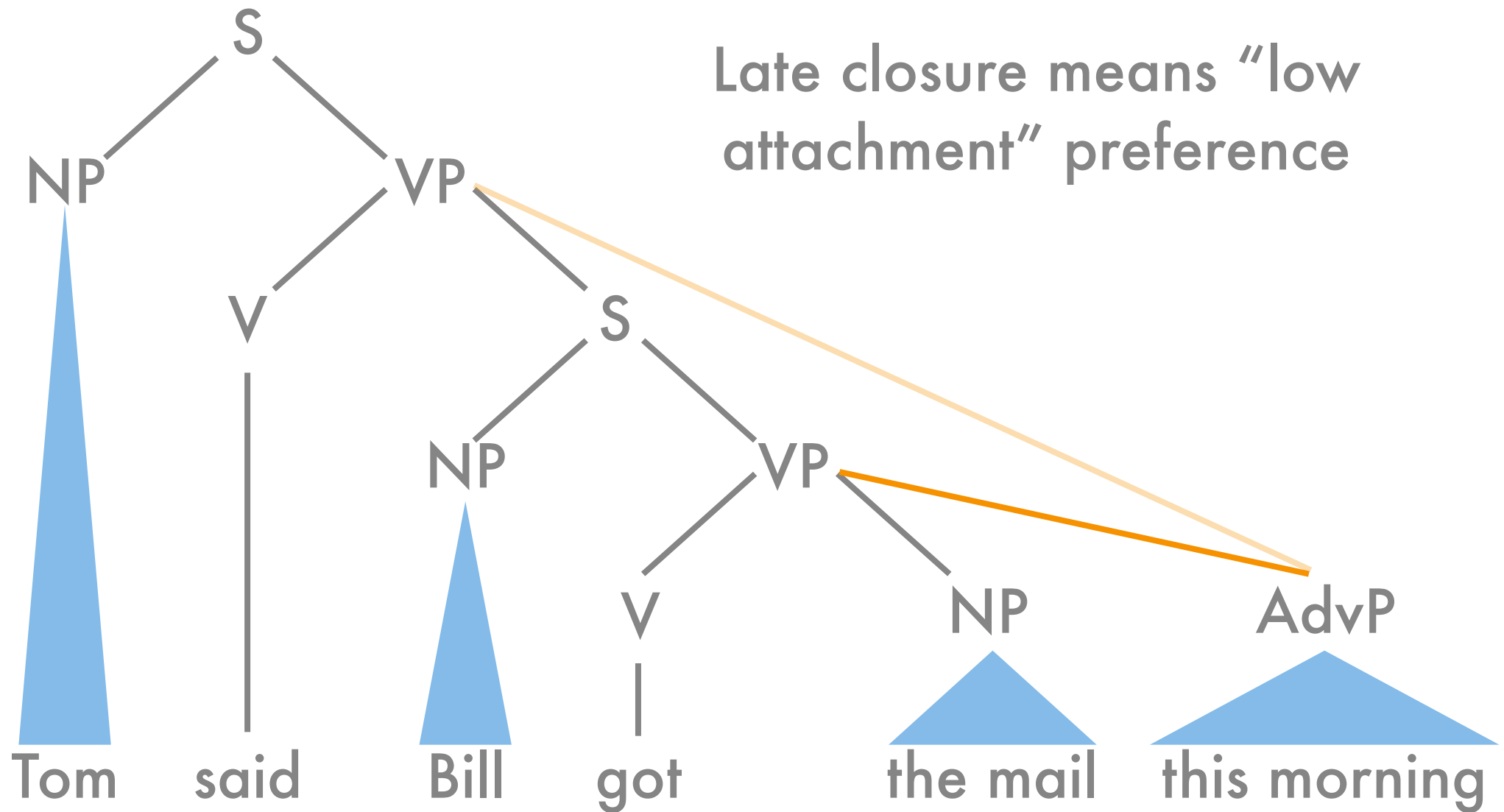
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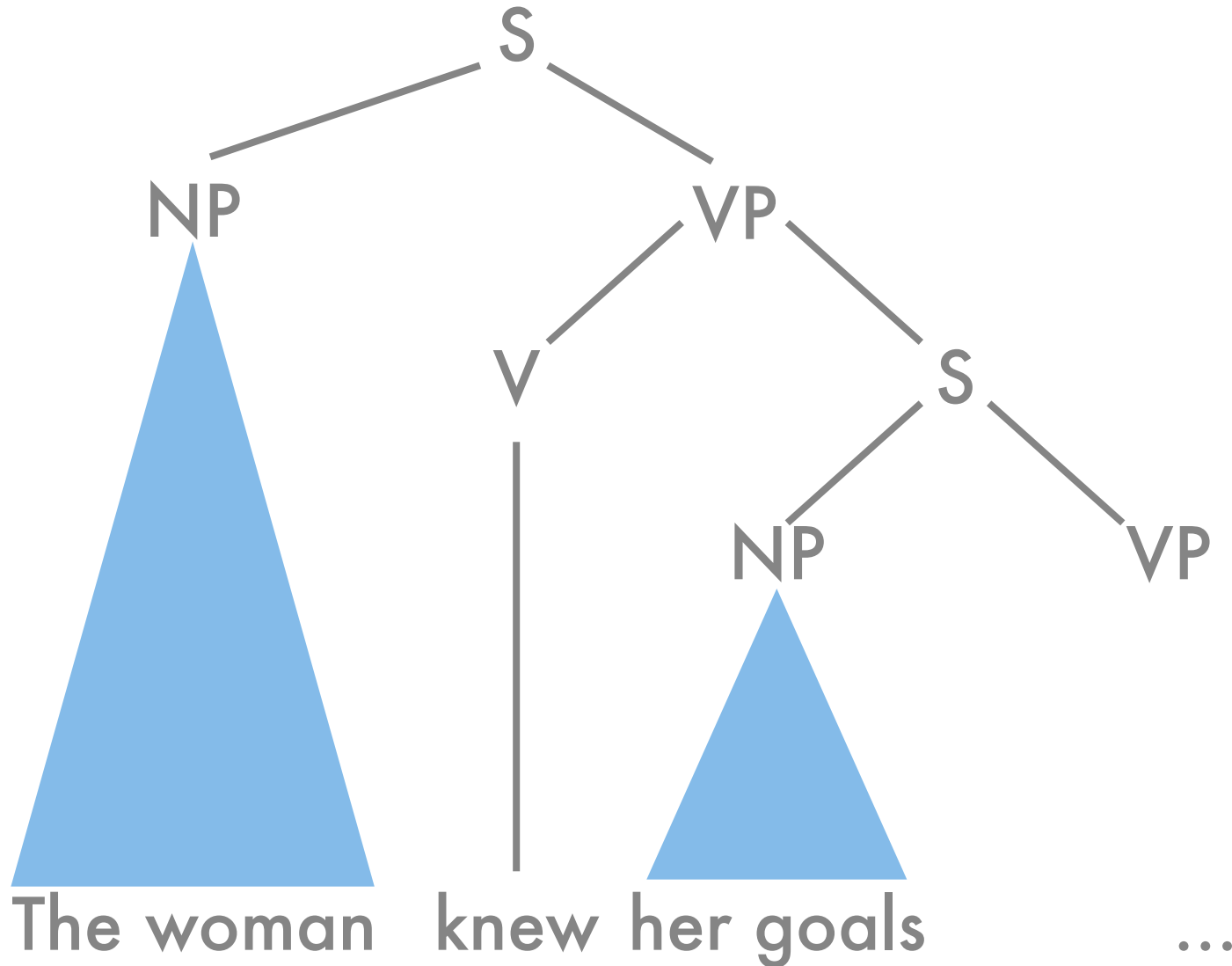


- Evidence in favor:
- Comprehenders often appear to prefer subordinate attachment
- Longer reading times on disambiguating words when they do not support minimal attachment

NP/S Complement Ambiguities (temporary)

The woman knew her goals **for the next five years**.

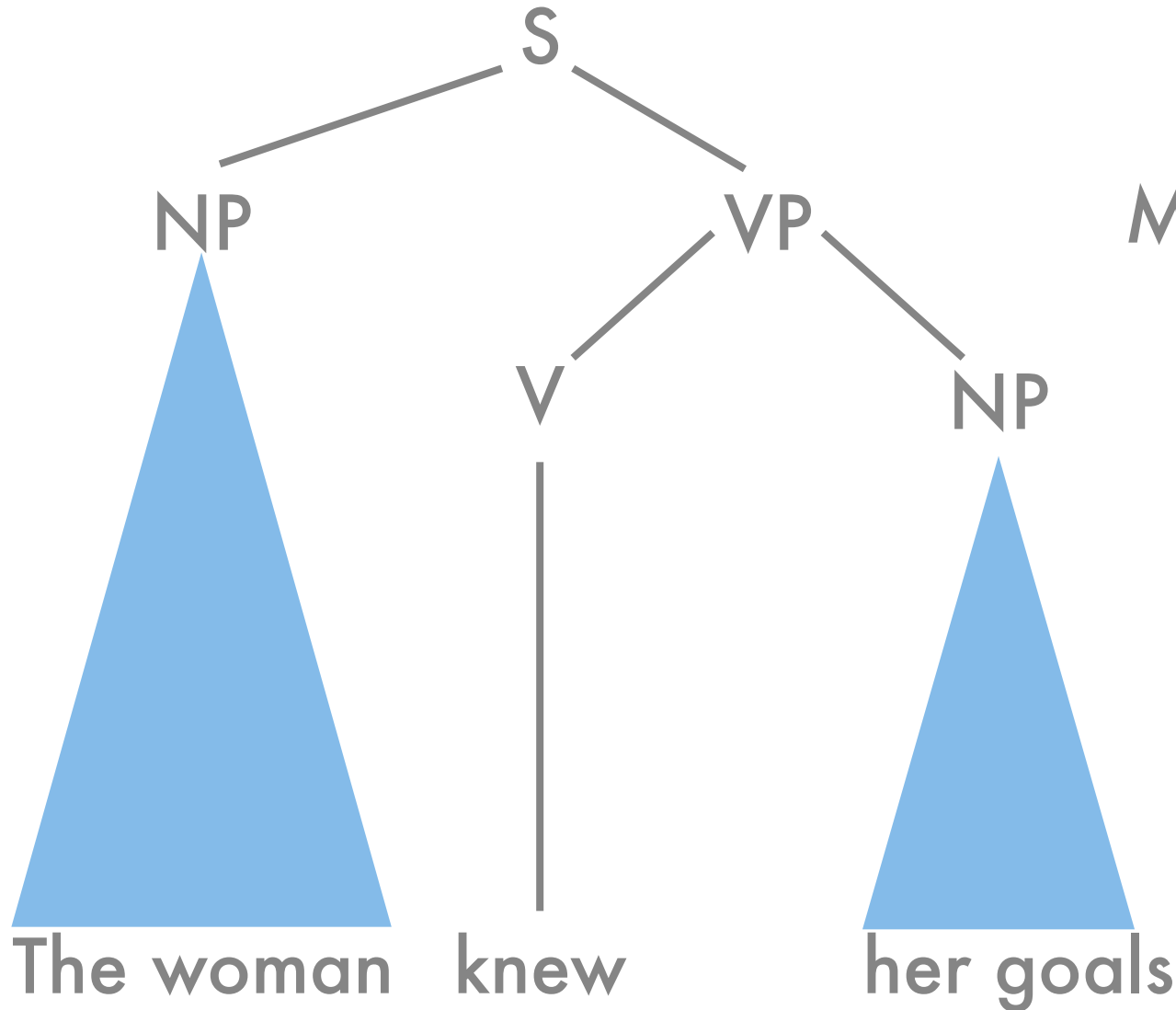
The woman knew her goals **were difficult to achieve**.



NP/S Complement Ambiguities (temporary)

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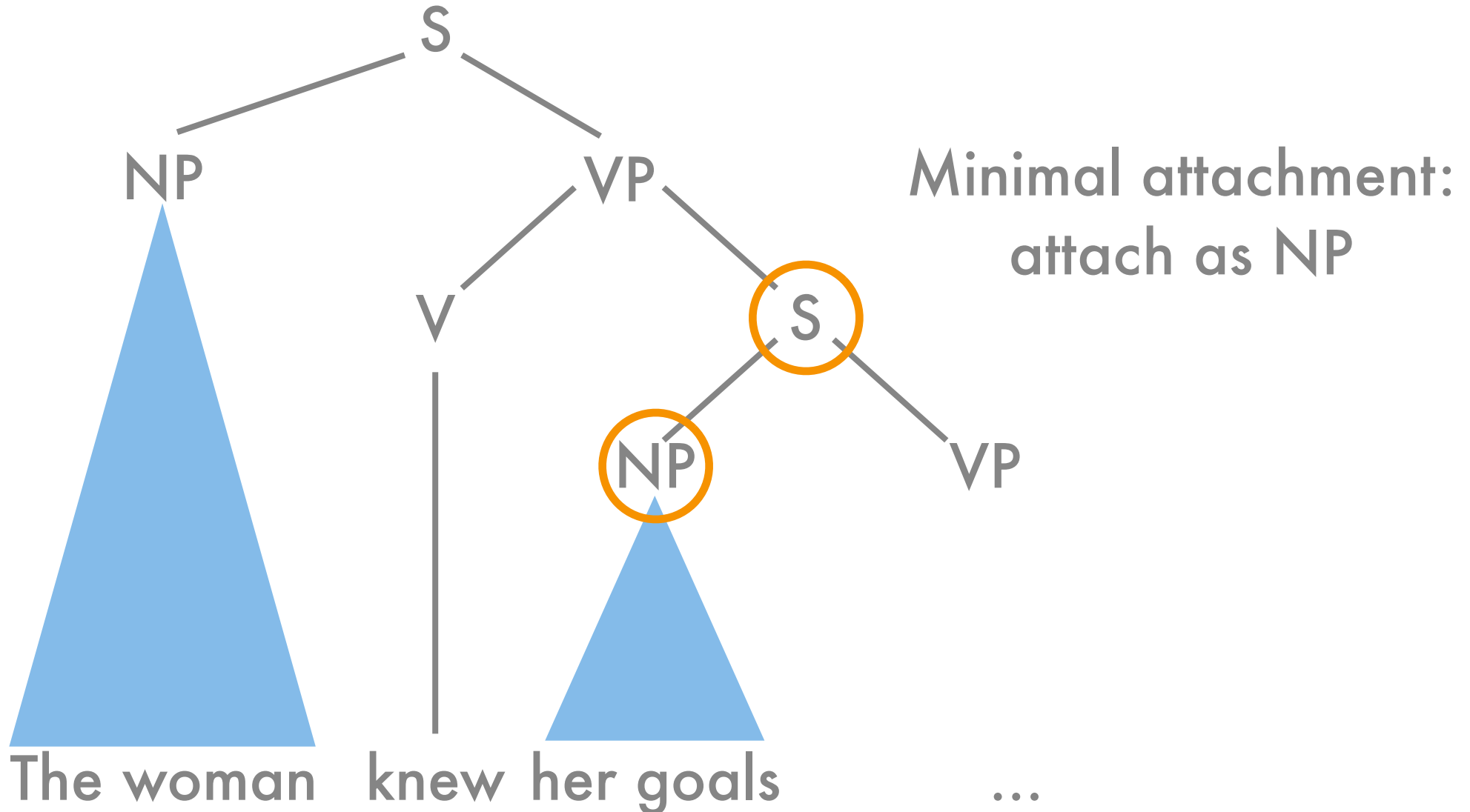


Minimal attachment:
attach as NP

NP/S Complement Ambiguities (temporary)

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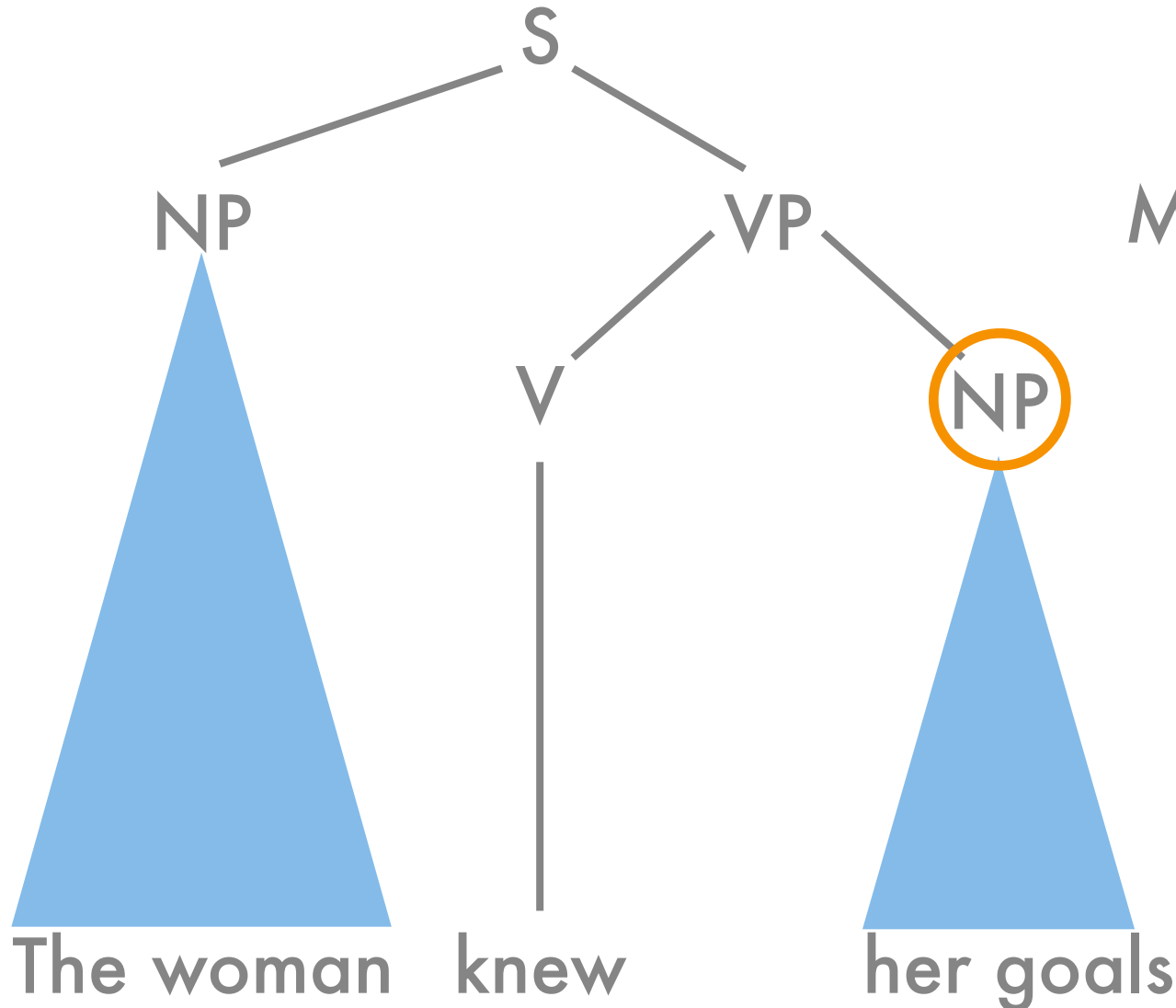
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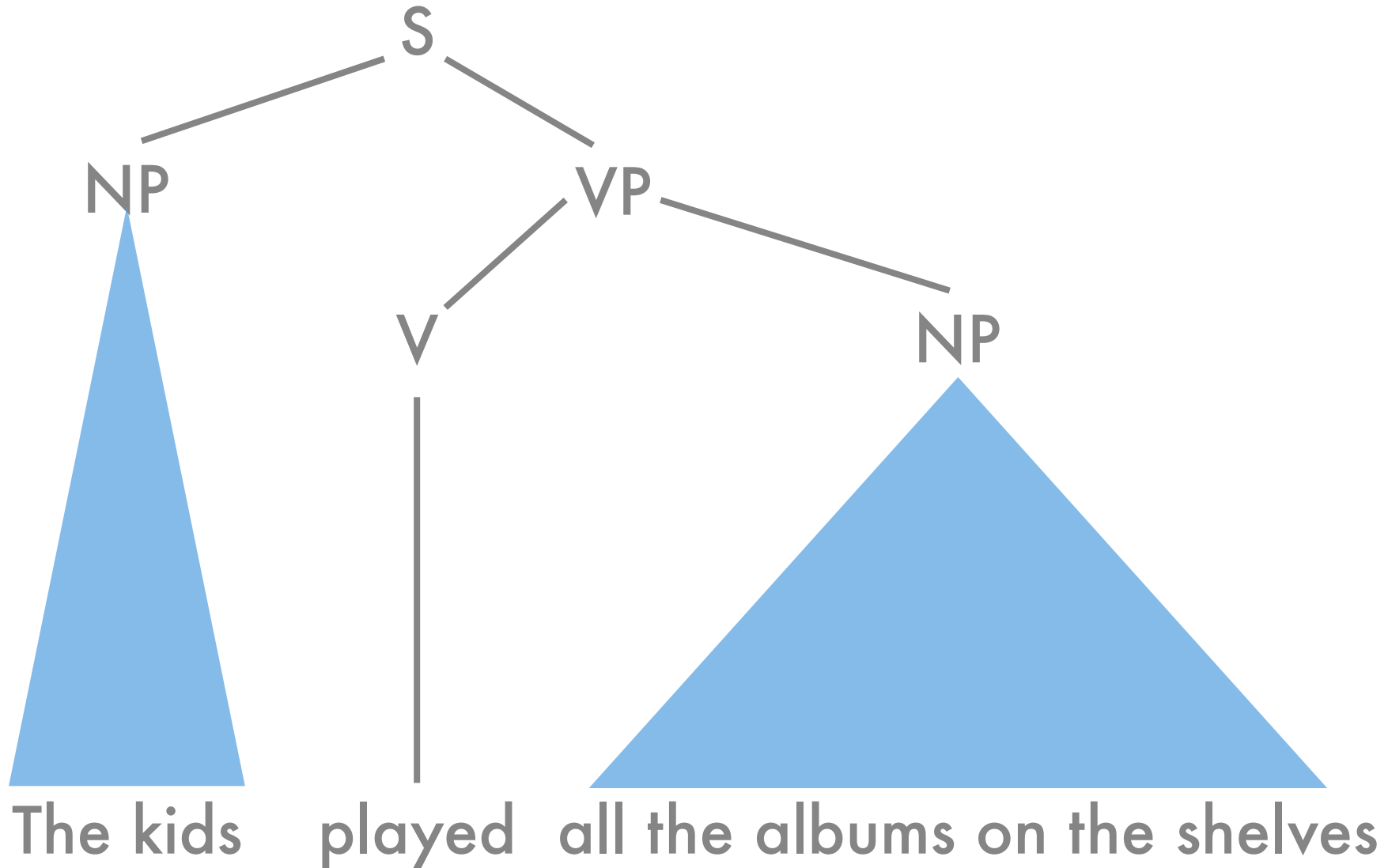


Minimal attachment:
attach as NP

- Evidence in favor of the minimal attachment
 - Rayner et al. (1983)
 - Stimuli
 - The kids played all the albums on the stereo before they went to bed.
 - The kids played all the albums on the shelf before they went to bed.
 - Minimal attachment predicts stereo / shelf will go with albums
 - Plausibility predicts the *stereo* will go with *played*

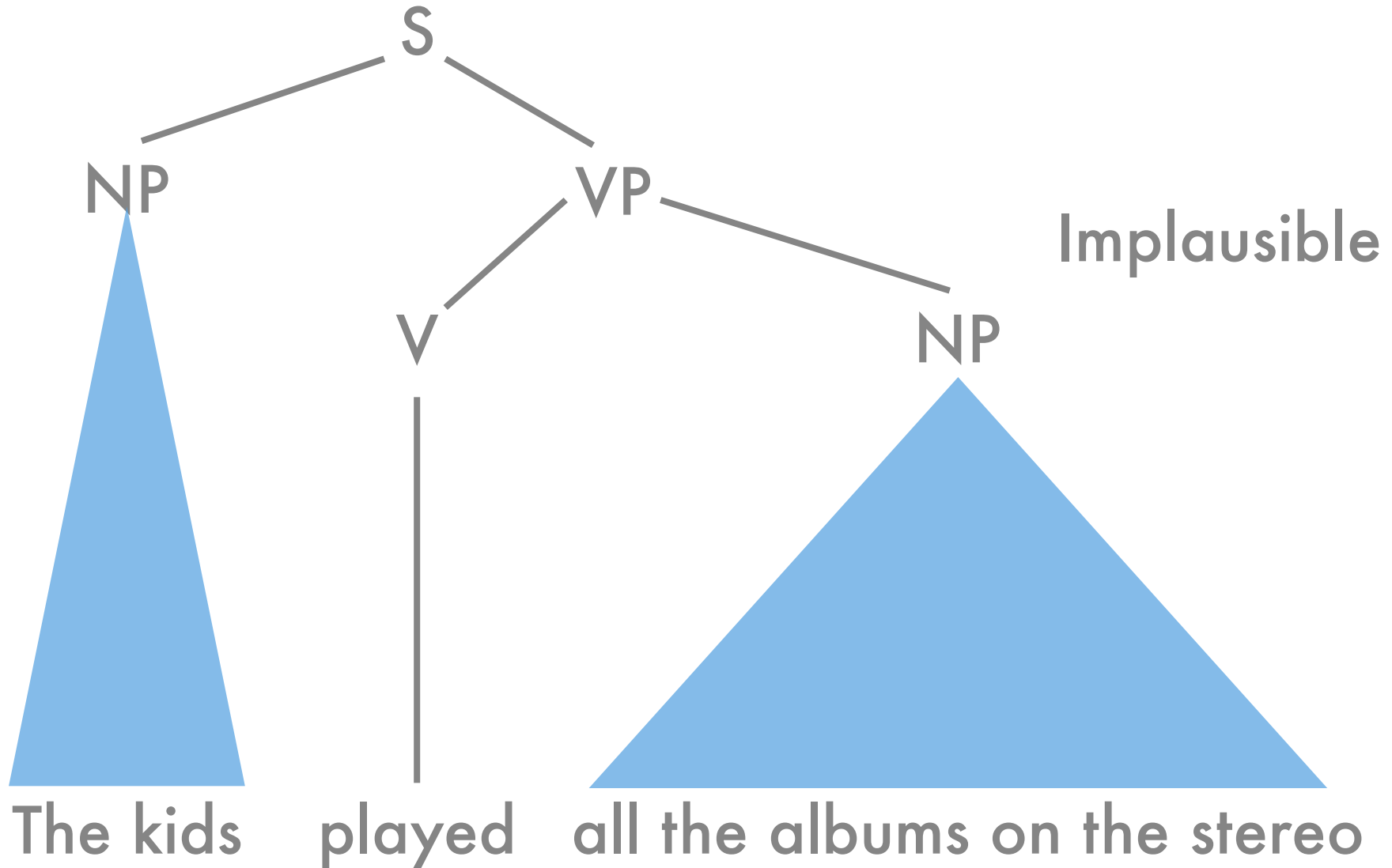
The kids played all the albums on the stereo

The kids played all the albums on the shelves



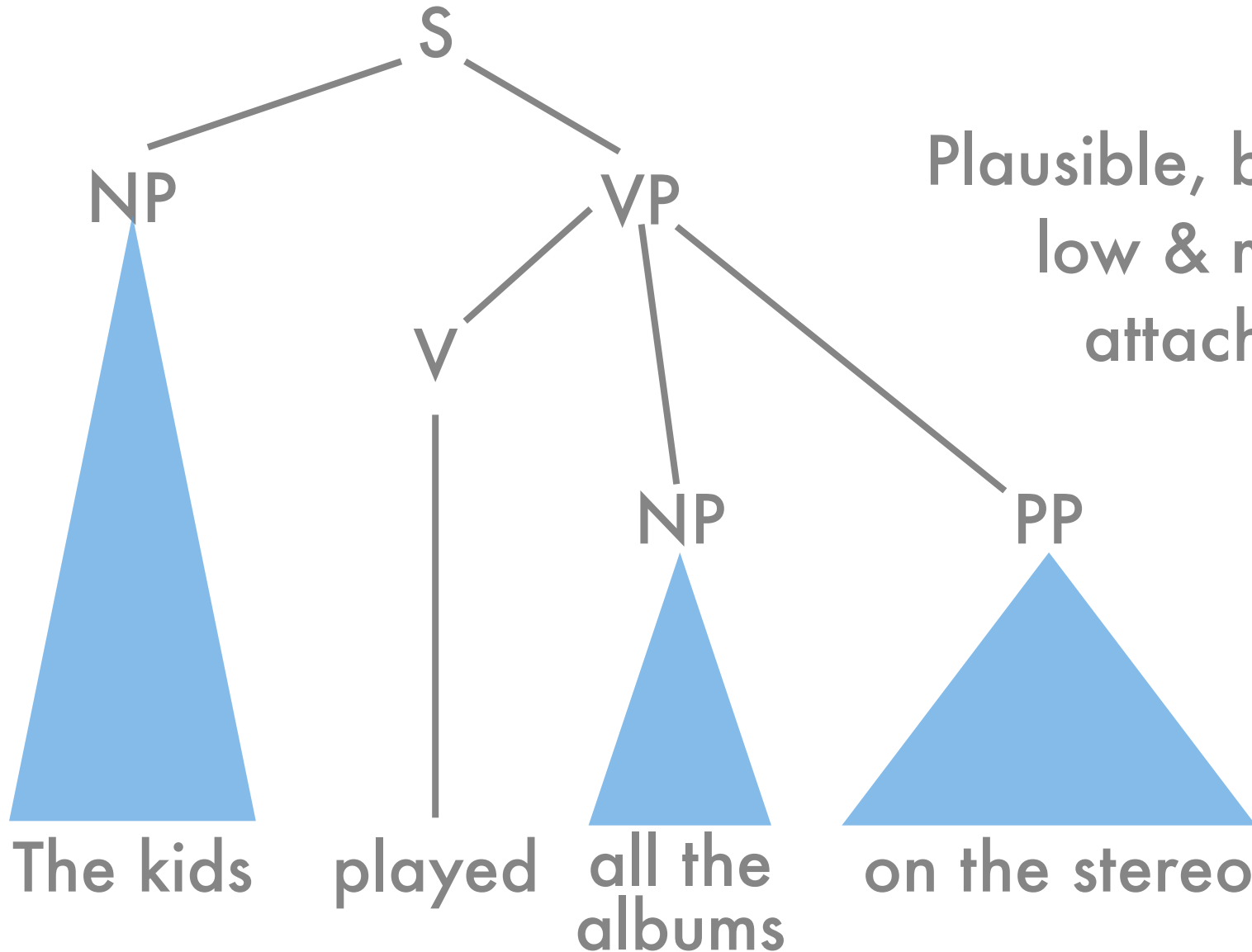
The kids played all the albums on the stereo

The kids played all the albums on the shelves



The kids played all the albums on the stereo

The kids played all the albums on the shelves



Plausible, but violates
low & minimal
attachment

- If semantic plausibility plays an early role in parsing, then *stereo* should go with *played* initially and easily
- But it doesn't
- Subjects look at it longer, indicating difficulty
- Minimal attachment plus reanalysis

- Key points of garden-path model
 - Non-syntactic information like plausibility is not considered in the initial interpretation of the ambiguity
 - Other possible interpretations are not considered unless forced by disambiguating input

Constraint satisfaction model

- Parallel model: We do entertain multiple possibilities
- Multiple constraints are combined to decide alternative interpretations in parallel
- Alternatives compete with one another during processing

Constraints

- Semantic fit between first NP and different possible thematic roles assigned by future structure
- Frequency that verb occurs in particular form or voice
- Frequency of particular argument structures with a given verb
- Information from post-ambiguity constraints

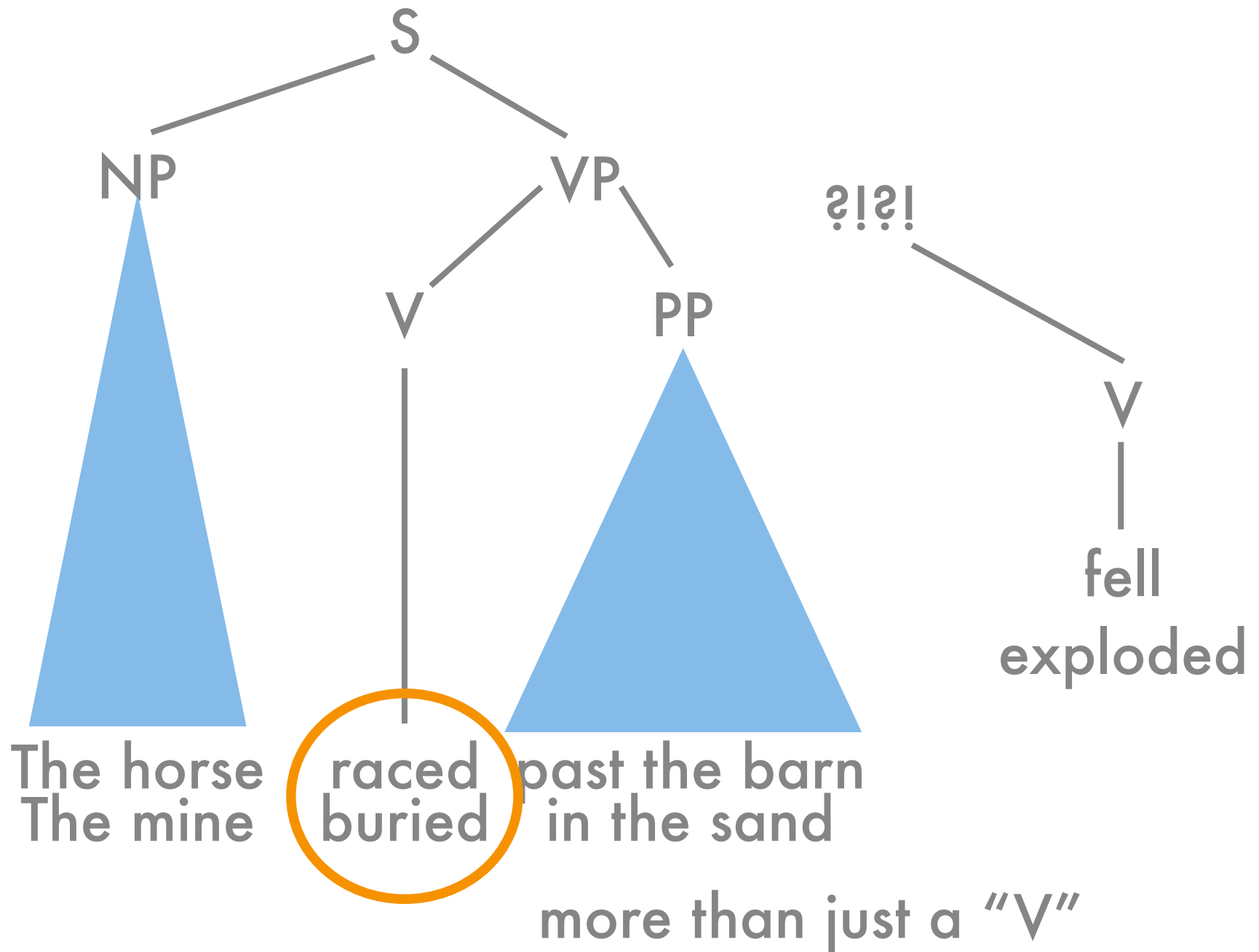
Argument structure & verb form

- The actress selected
 - ... by the end of the week. (*past intransitive*)
 - ... the lead role. (*past transitive*)
 - ... by the director was an unknown. (*rel. clause participle*)

How often do each of these uses occur?

Argument structure & verb form

- Frequency and semantic fit
 - Why is this sentence fine:
 - The land mine buried in the sand exploded
- But this sentence is a garden-path:
 - The horse raced past the barn fell



Constraint: Semantic fit between first NP
and different possible thematic roles
assigned by future structure

Horses often race



Bombs don't often bury

Constraint: Frequency that verb occurs in particular form or voice

“race” occurs in past tense usage 10 times more often than in past participle



“bury” occurs 5 times more often as a past participle than in past tense

The boy buried the toy < The boy was buried.

Constraint: Frequency of particular argument structures with a given verb

“race” typically used intransitively



“bury” typically used transitively

Constraint satisfaction

- Parallel model: We do entertain multiple possibilities
- Multiple constraints are combined to decide alternative interpretations in parallel
- Alternatives compete with one another during processing
 - The alternative that best fits the constraints has largest amount of activation
 - But other alternatives are not dismissed

Context counts

- Predicts that non-syntactic factors influence ambiguity resolution
 - Attachment preferences
 - Relative clause interpretations

Evidence

- Spivey & Tanenhaus (1998)
 - Hypothesis
 - Presence of multiple referents should bias relative clause interpretations

Materials

Preceding setup possibilities

One-Referent Setup context	An actress and the producer's niece were auditioning for a play. The director selected / chose the actress but not the niece.
Two-Referent Setup context	Two actresses were auditioning for a play. The director selected / chose one of the actresses but not the other.

Materials

Possible Target sentences

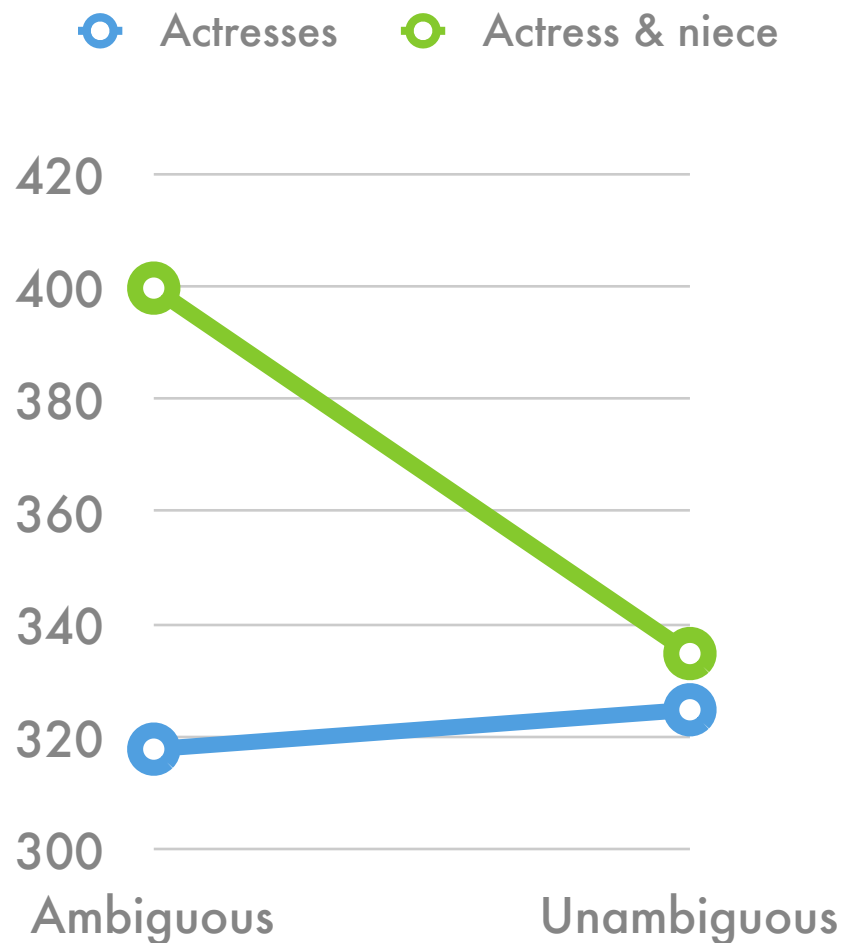
Ambiguous reduced relative	The actress selected by the director believed that her performance was perfect.
Unambiguous reduced relative	The actress chosen by the director believed that her performance was perfect.
Unreduced relative	The actress who was selected by the director believed that her performance was perfect.

Materials

Possible Target sentences

Ambiguous reduced relative	The actress selected by the director believed that her performance was perfect.
Unambiguous reduced relative or Unreduced relative	<p>The actress chosen by the director believed that her performance was perfect.</p> <p>The actress who was selected by the director believed that her performance was perfect.</p>

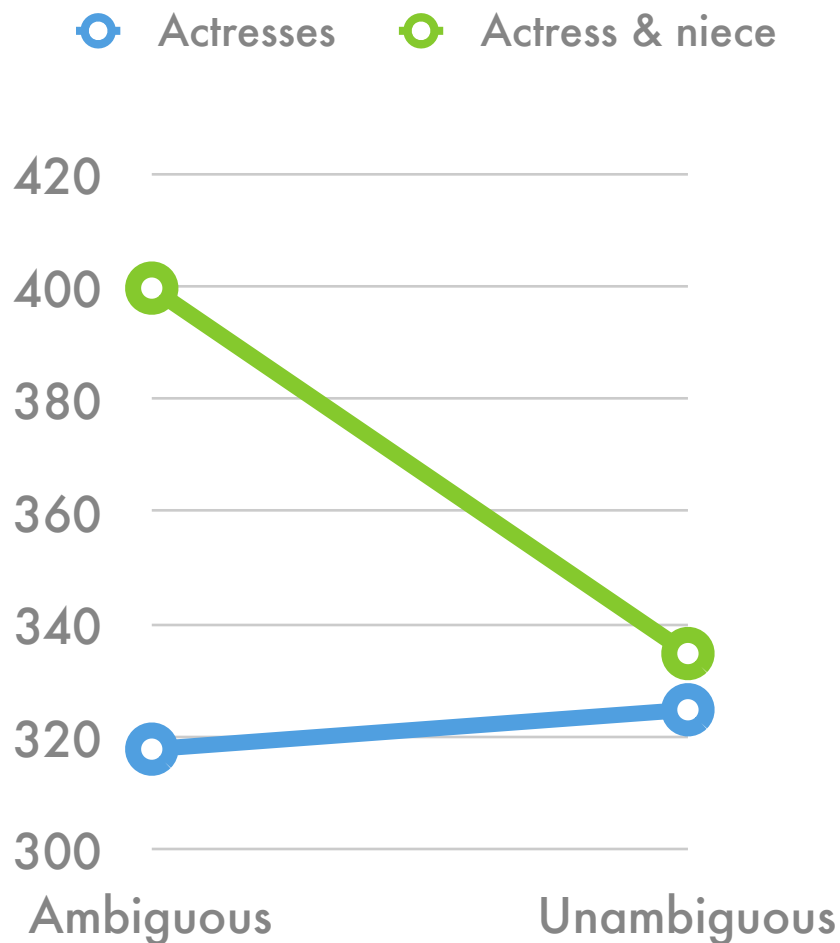
Results at disambiguating “by”



Two actresses were auditioning for a play. The director selected one of the actresses but not the other.

The actress chosen by the director believed that her performance was perfect.

Results at disambiguating “by”



An actress and the producer's niece were auditioning for a play. The director selected the actress but not the niece.

The actress selected by the director believed that her performance was perfect.

Hypothesis revisited

- Presence of multiple referents should bias relative clause interpretations
 - True
 - Reduced relatives can be licensed by context, and thus interpreted as such even in ambiguous reduced context
 - People don't anyways follow the garden-path!

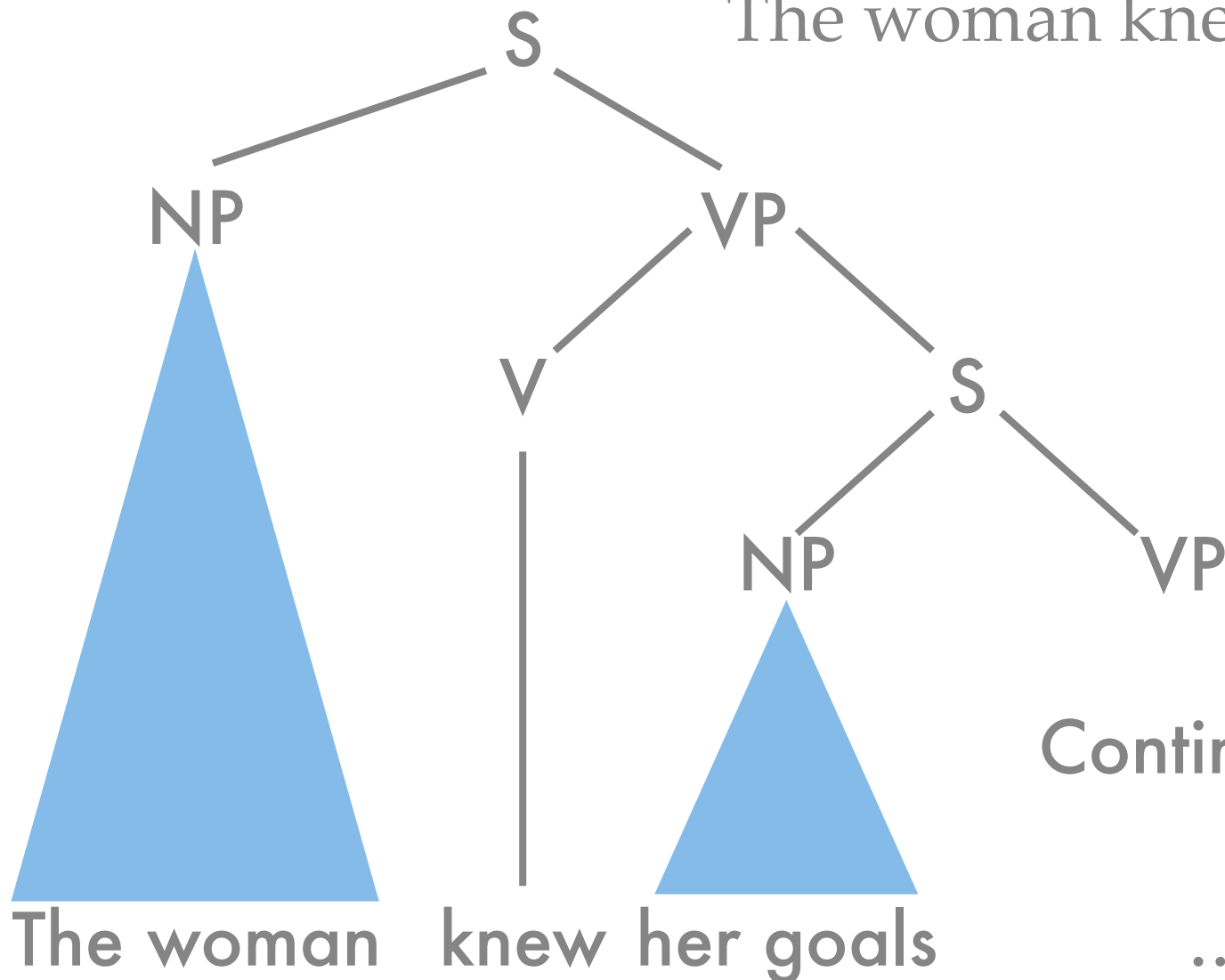
- So, what about Rayner et al. and other studies that show low / minimal attachment preferences?
- Spivey & Tanenhaus argue that the materials in these experiments probably had strong biases toward these attachment preferences
- Additional biases may not have been able to overcome them

- More evidence for constraint satisfaction
- Verb argument bias:
 - Complement-bias:
 - (1) The woman knew her goals
 - NP-bias:
 - (2) The woman realized her goals

NP/S Complement Ambiguities (temporary)

Complement-bias verb:

The woman knew her goals ...

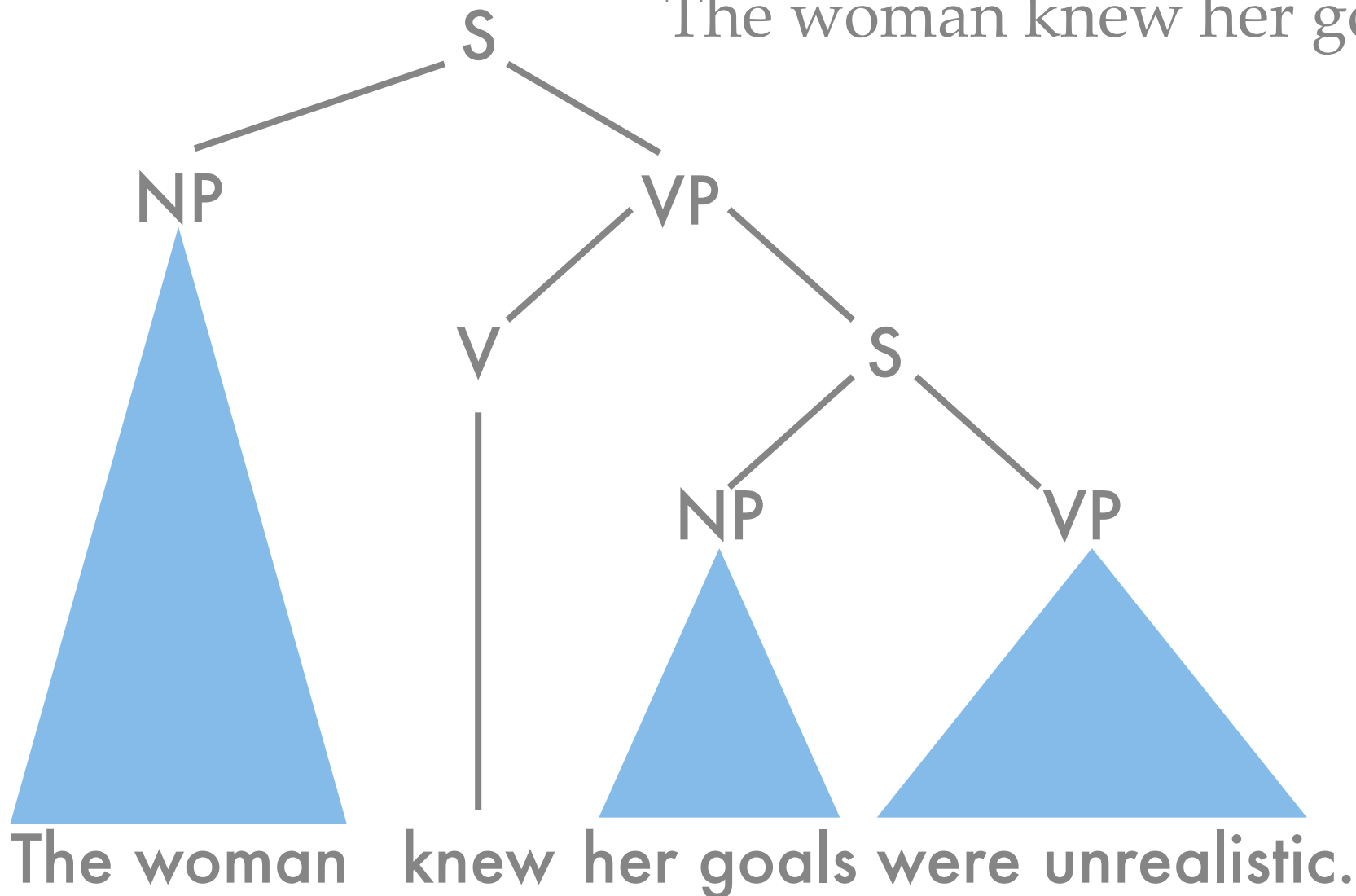


Continuation expected!

NP/S Complement Ambiguities (temporary)

Complement-bias verb:

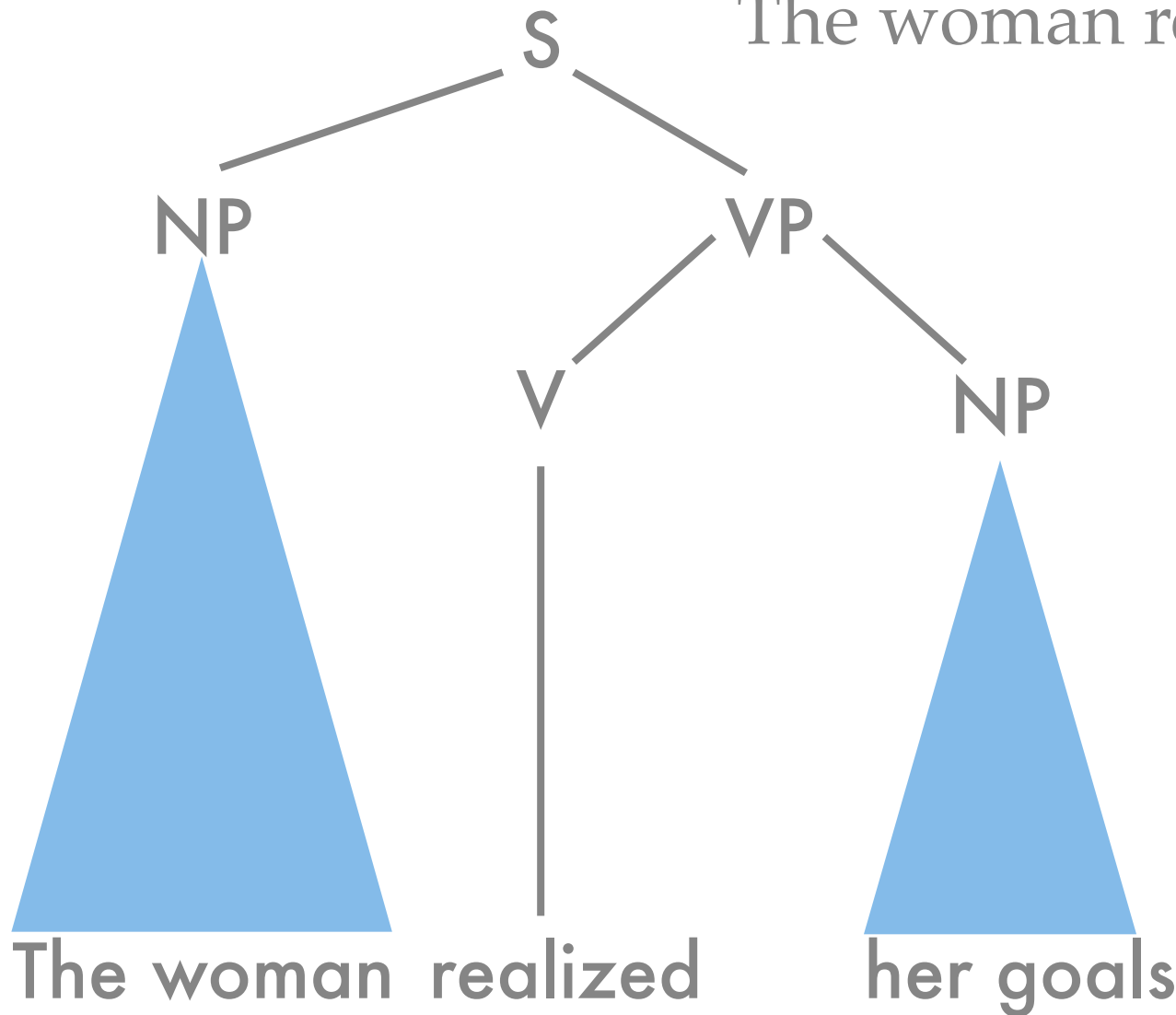
The woman knew her goals ...



NP/S Complement Ambiguities (temporary)

Complement-bias verb:

The woman realized her goals

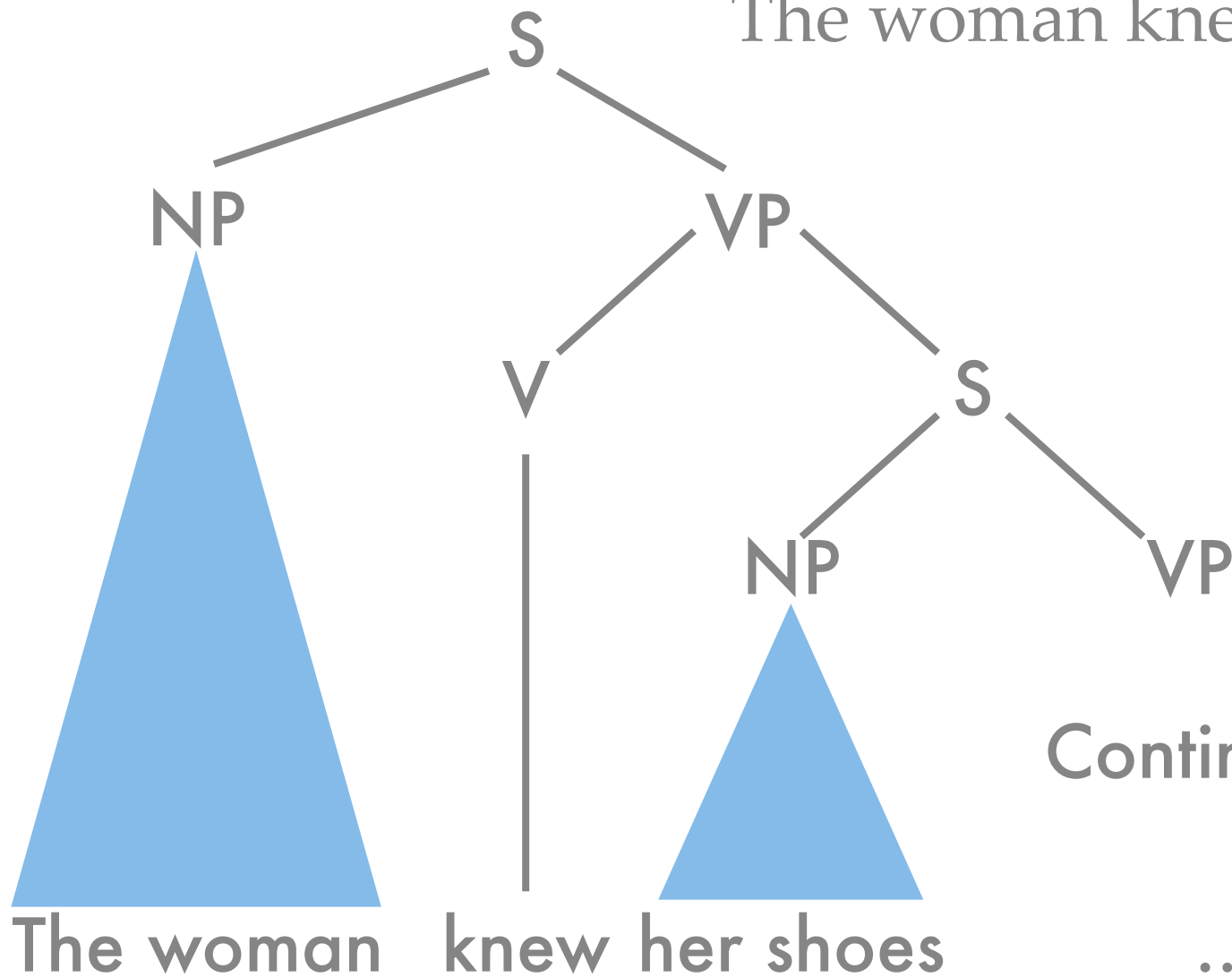


No
continuation
expected

NP/S Complement Ambiguities (temporary)

Complement-bias verb:

The woman knew her shoes ...

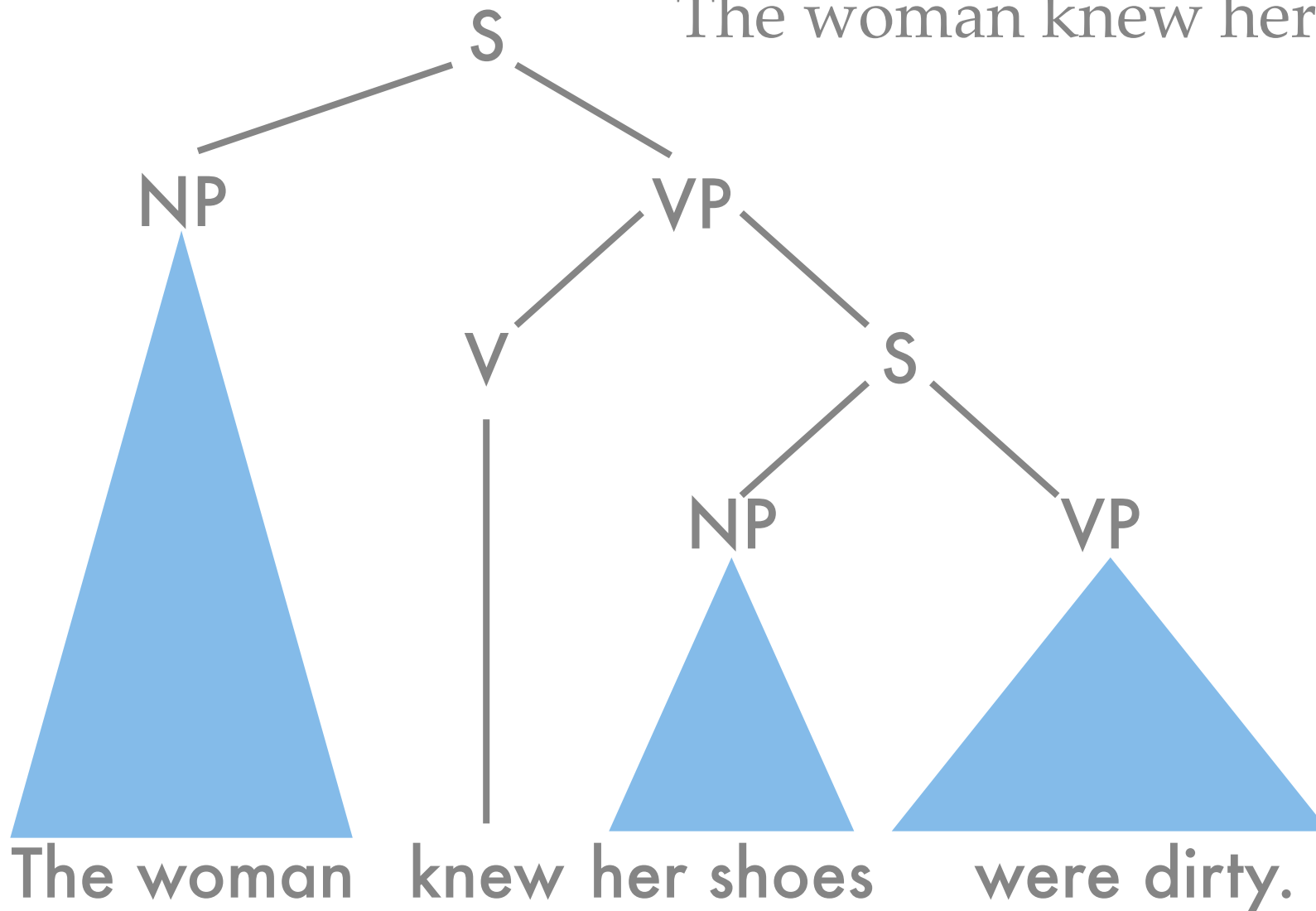


Continuation expected!

NP/S Complement Ambiguities (temporary)

Complement-bias verb:

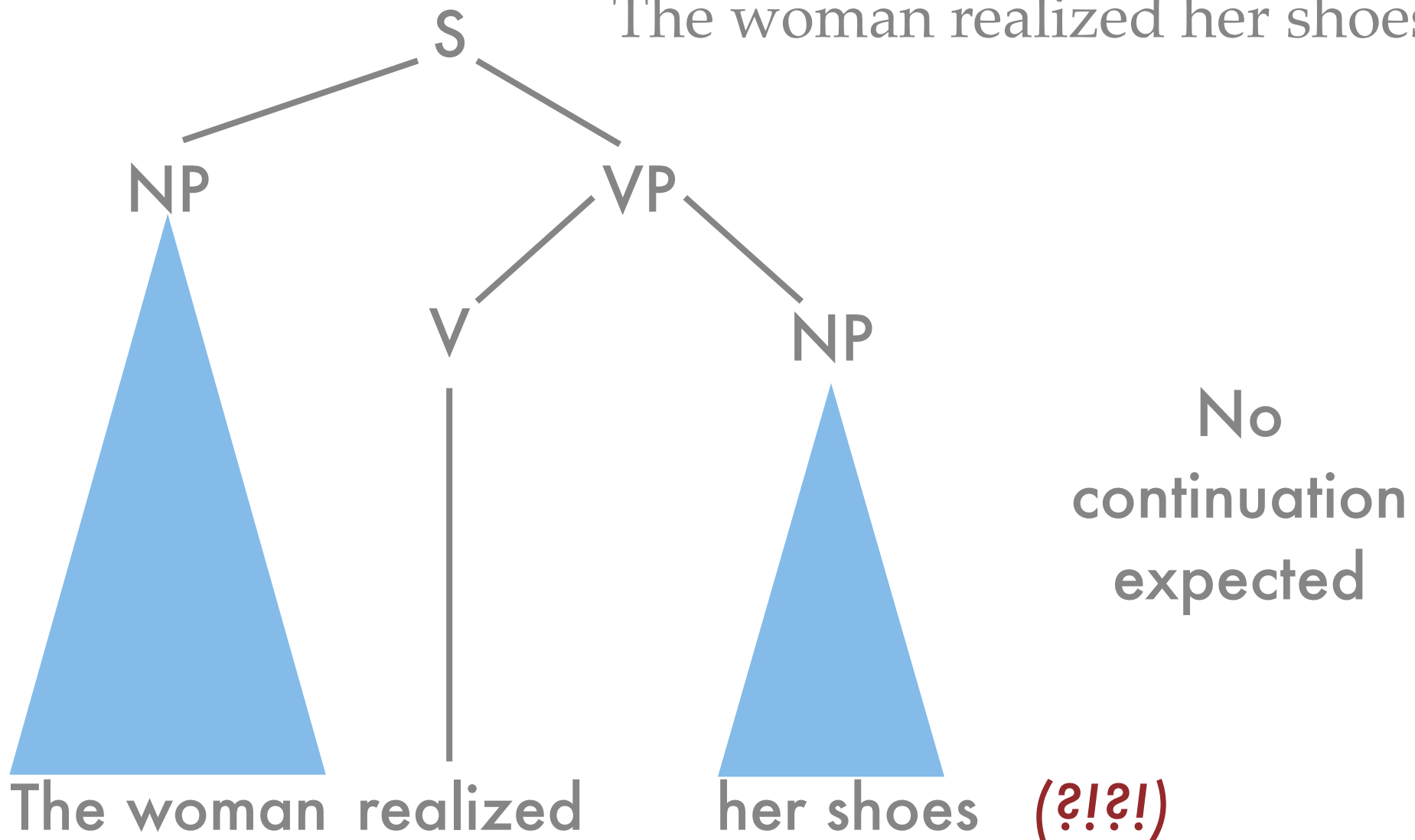
The woman knew her shoes ...



NP/S Complement Ambiguities (temporary)

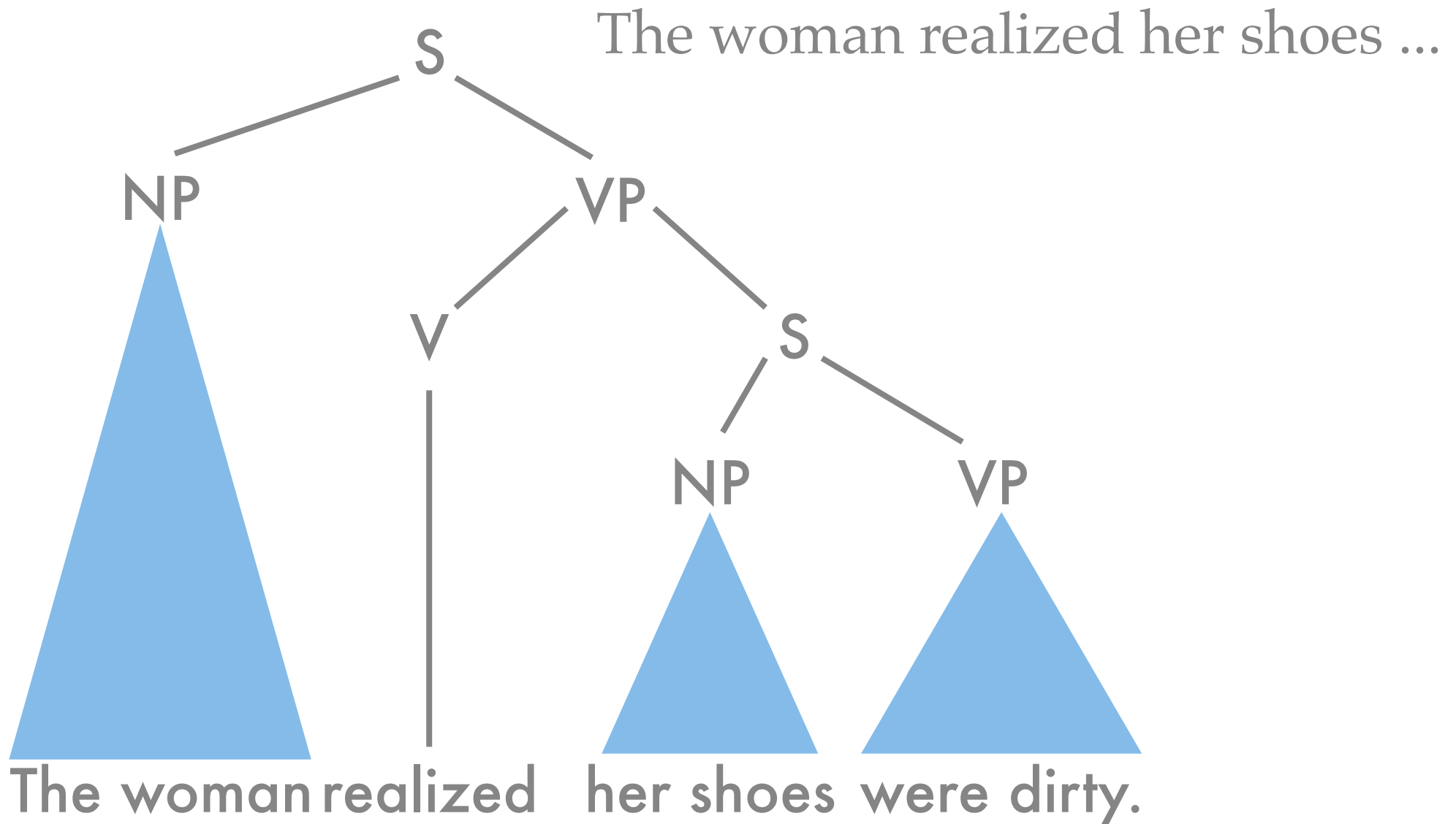
Complement-bias verb:

The woman realized her shoes



NP/S Complement Ambiguities (temporary)

NP-bias verb:



- Difficulty with sentence complement interpretation is not because of minimal attachment strategy
- Complement-bias:
 - (1) The woman knew her goals
- NP-bias:
 - (2) The woman realized her goals

Verb bias toward one kind of continuation versus another dictates (in part) which interpretation is preferred

- Evidence from attachment ambiguity
- Plausibility of the possible attachments
- The driver of the car with the moustache was pretty cool.
- Compared with
- The car of the driver with the moustache was pretty cool.



- Garden-path predicts low attachment
- The driver of the car with the moustache



- Garden-path predicts low attachment
- The driver of the car with the moustache



- No difference in reading times at prepositional modifier - *moustache* read in the same amount of time regardless of plausibility of nearest noun
- The driver of the car with the moustache
- Evidence against garden-path account
- Could be evidence in support of constraint satisfaction
 - People use plausibility to avoid incorrect low attachment

- Key points about constraint satisfaction model
- Pragmatic, semantic and syntactic constraints apply to interpretation
 - Including frequency of occurrence
- All interpretations are maintained at least a little until resolution
 - Favored interpretation most active

Question revisited

- Do we pick one interpretation and stick with it unless proved otherwise
- (serial processing)

OR

- Do we keep all reasonable interpretations somewhat active until we can decide which is best?
- (parallel processing)

About the midterm

(next Tuesday!)

- 10 long-answer questions
 - You will need to answer 8
 - Each will be worth 10 points
- See Review Sheet