

Langage et structure

Emmanuel Chemla
(grâce au cours de Philippe Schlenker)

Pré-rentrée
Cogmaster 2007-2008

Plan

A. Quelle structure (grammaire) pour le langage?

A.1. Hypothèse 1: Structure plate

A.2. Hypothèse 2: Grammaire d'automates à états finis

Insuffisant => **arbres** et **grammaires récursives**

B. Quelques phénomènes

B.1. Ambiguïtés de structure

B.2. Les pronoms: ``Condition C''

B.3 .Interaction entre 1 et 2

A. QUELLE STRUCTURE?

A. STRUCTURE

Quel type de structure pour le langage?

- **Question méthodologique:**
Quelles sont les données pertinentes?
- **Question technique:**
Quelle est la complexité nécessaire?
- **Question empirique:**
Phénomènes dont on peut rendre compte

Savoir Syntaxique

Le langage est infini:

- a. La première personne du premier rang dort.
- b. La personne à la gauche de la première personne du premier rang dort.
- c. La personne juste derrière la personne à la gauche de la première personne du premier rang dort.

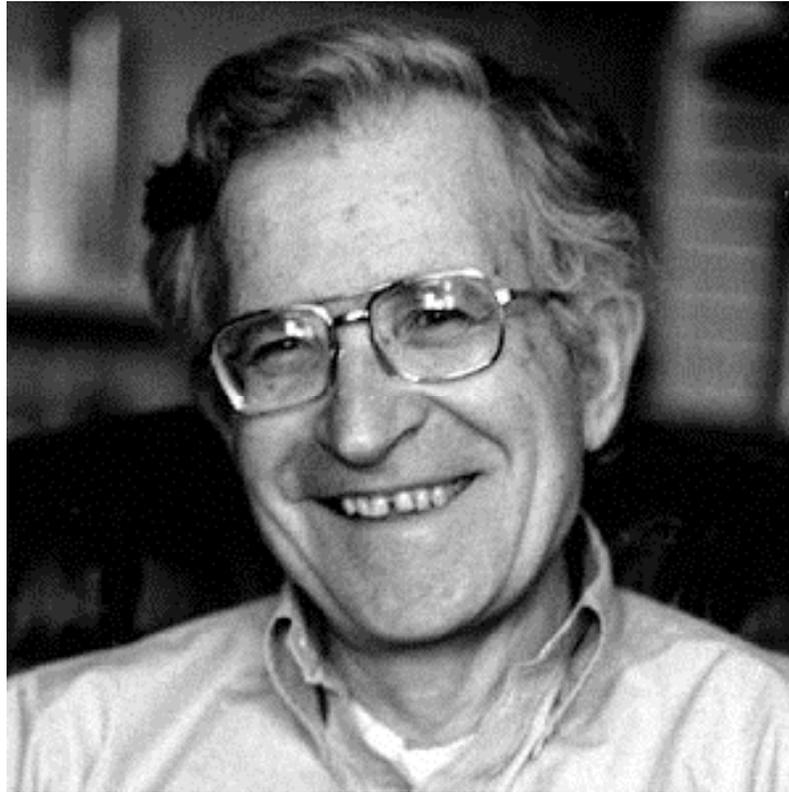
- a. Jean dort
- b. Marie sait que Jean dort
- c. Personne ne prétend que Marie sait que Jean dort
- d. Sam sait que personne ne prétend que M. sait que J. dort

Le langage est contraint:

- a. *La du rang première premier dort personne.
- b. *que dort sait Marie Jean

Syntaxiquement bien formé \neq Sensé

- a. Colorless green ideas sleep furiously (Chomsky)
- b. *Green sleep ideas colorless furiously



Noam Chomsky

A.1. Hypothèse 1: Structure plate

Marie a rencontré le Président

Hypothèse 1: Structure Plate

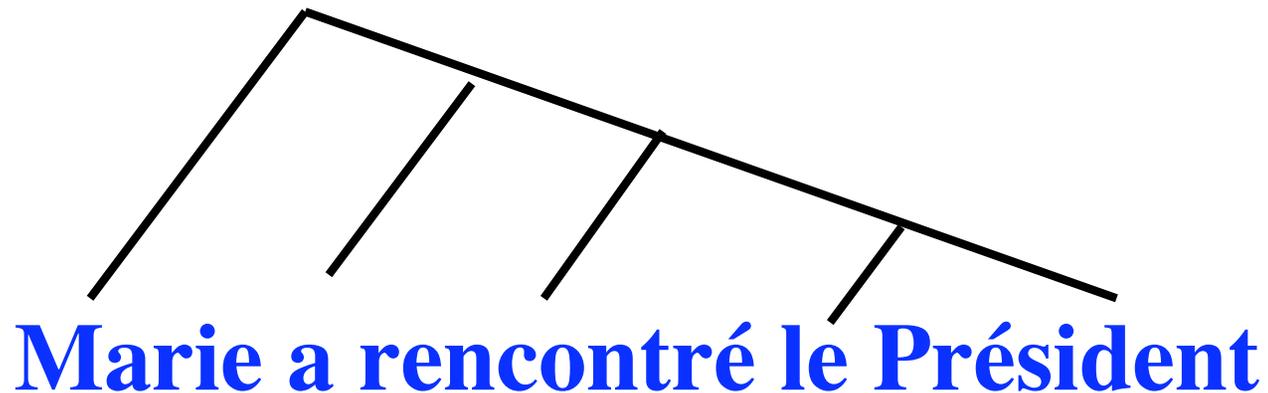
(peut rendre compte des agrammaticalités précédentes)



Hypothèse alternative: arbres

Marie a rencontré le Président

Hypothèse 2: Structure d'arbre



Argument pour la structure en arbre:

Tests de constituance

Tests de Constituance

Test 1: Réponse à une question

- a. Marie a rencontré [le Président]
b. Peux-tu me dire qui Marie a rencontré?
-Le Président

- a. Marie a [rencontré le Président]
b. Peux-tu me dire ce qu'a fait Marie?
-Rencontré le Président.

- a. [Ton ami] a rencontré le Président.
b. Peux-tu me dire qui a rencontré le Président?
-Ton ami

Test 2: Pseudo-clivées

- a. Marie a rencontré [le Président]
b. La personne que Marie a rencontré, c'est le Président.

- a. Marie a [rencontré le Président]
b. Ce qu'a fait Marie, c'est rencontrer le Président.

- a. [Ton ami] a rencontré le Président.
b. La personne qui a rencontré le Président, c'est ton ami.

Test 3: Déplacements

- a. Marie a rencontré [le Président]
b. Le Président, Marie l'a rencontré.

- a. Marie a [rencontré le Président]
b. Rencontré le Président, Marie l'a (certainement) fait.

- a. [Ton ami] a rencontré le Président.
b. Ton ami, il a rencontré le Président.

Test 4: Remplacement par un pronom

- a. Marie a rencontré [le Président]
b. Marie a rencontré LUI
Marie l'a rencontré.

- a. Marie a [rencontré le Président]
b. Marie a fait cela.
Marie l'a fait.

- a. [Ton ami] a rencontré le Président.
b. Il a rencontré le Président

Anglais

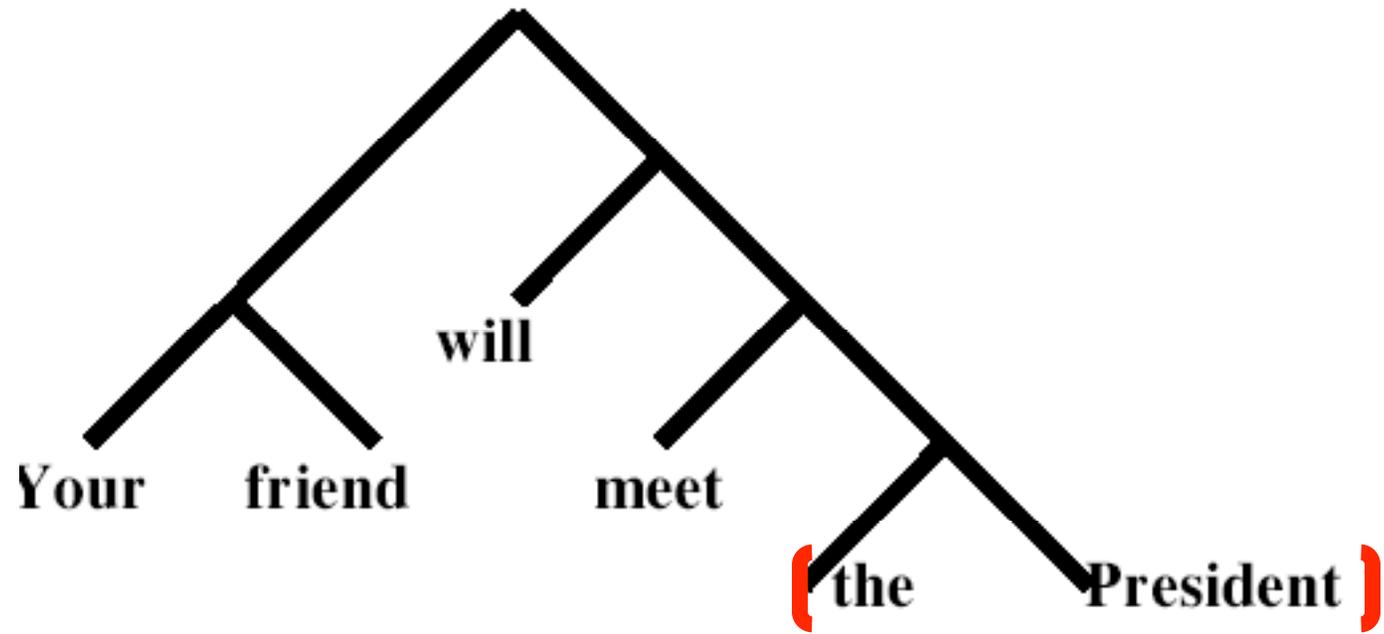
Test 1: Réponse à une question

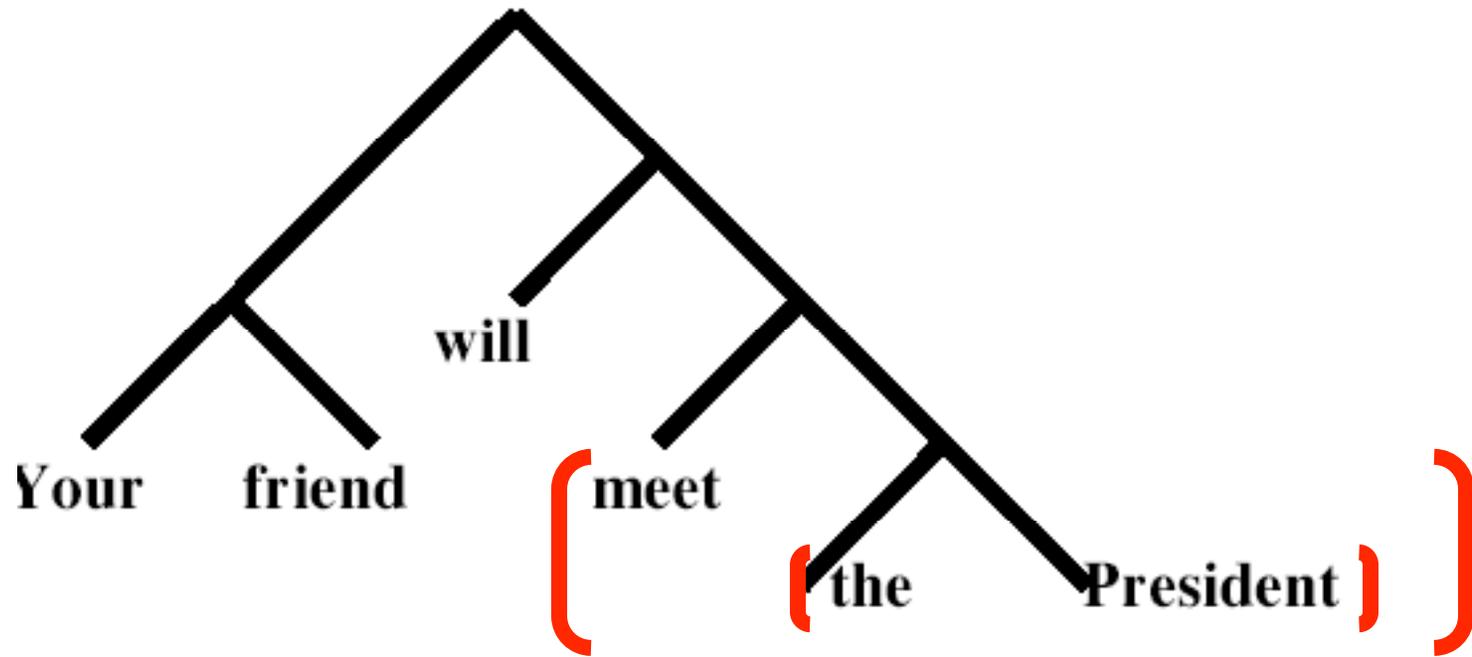
- a. Mary will meet [the President]
b. Who will Mary meet?
-The President

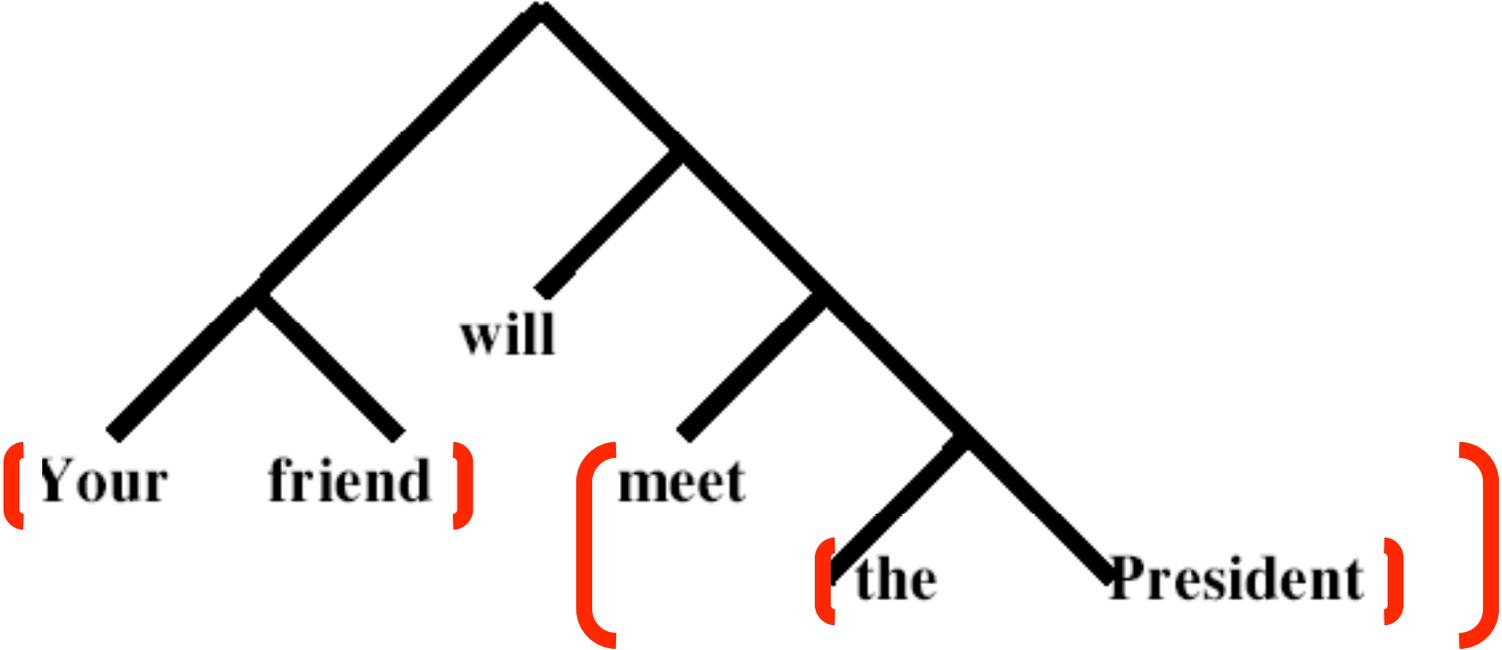
- a. Mary will [meet the President]
b. What will Mary do?
-Meet the President

- a. [Your friend] will meet the President
b. Who will meet the President?
-Your friend

- a. *will meet
- b. *meet the
- c. *friend will







Test 2: Mouvement

- a. Mary will meet [the President]
b. [The President], Mary will meet

- a. Mary will [meet [the President]]
b. [Meet the President], Mary will
e.g. in the following context:
John told you that Mary will meet the President, and
[meet the President], Mary (certainly) will.

- a. [Your friend] will meet the President
b. [Your friend], she will meet the President.]

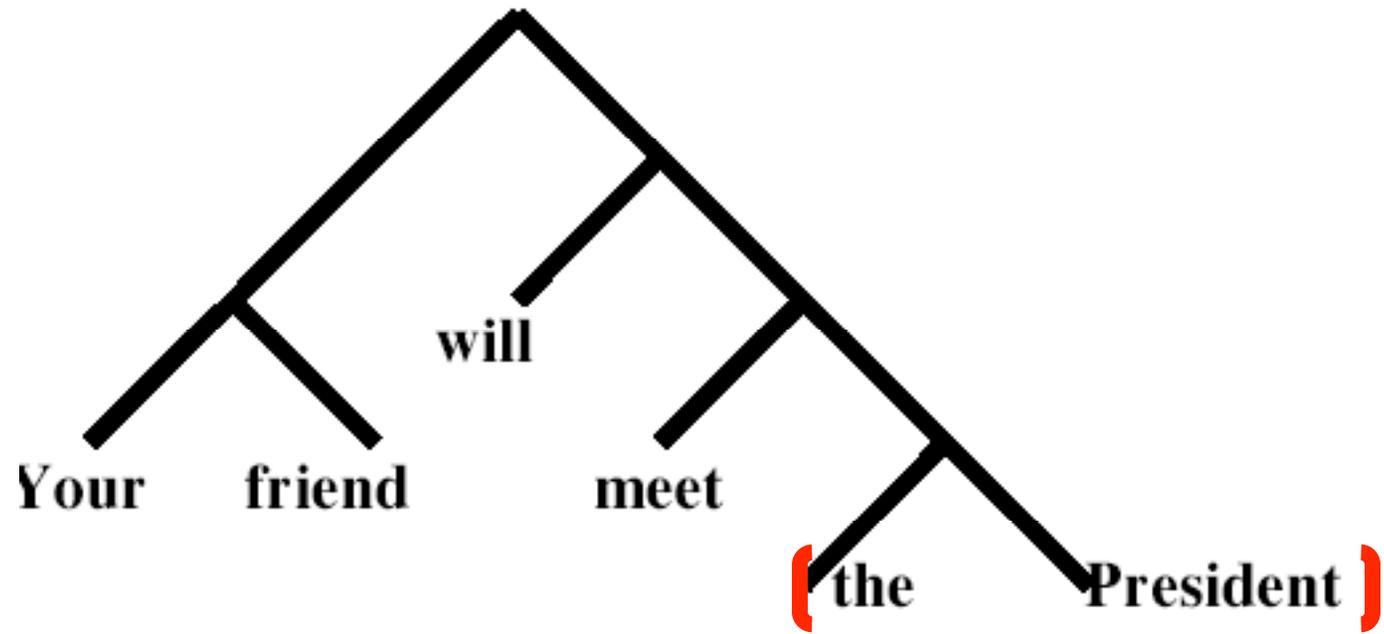
- a. *Will meet, Mary the President
- b. *Meet the, Mary President
- b. *Friend will, your the President

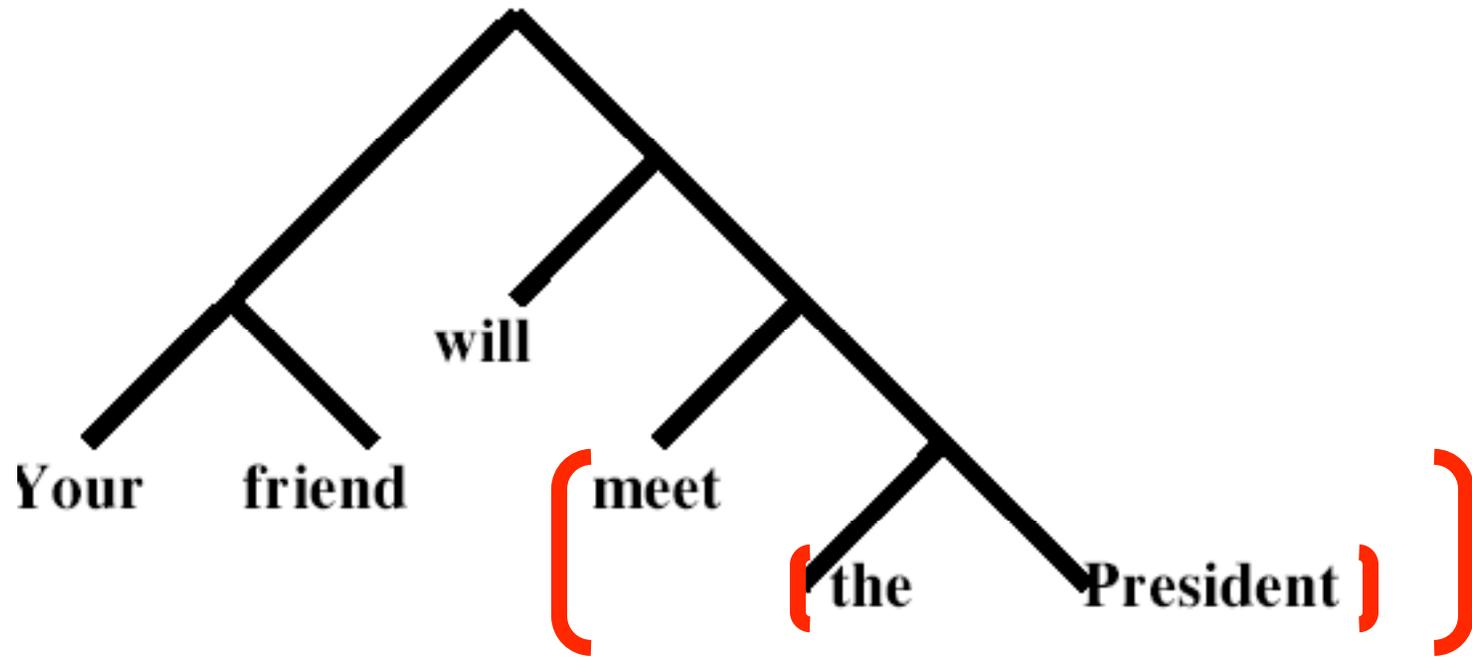
Test 3: Remplacement par un pronom

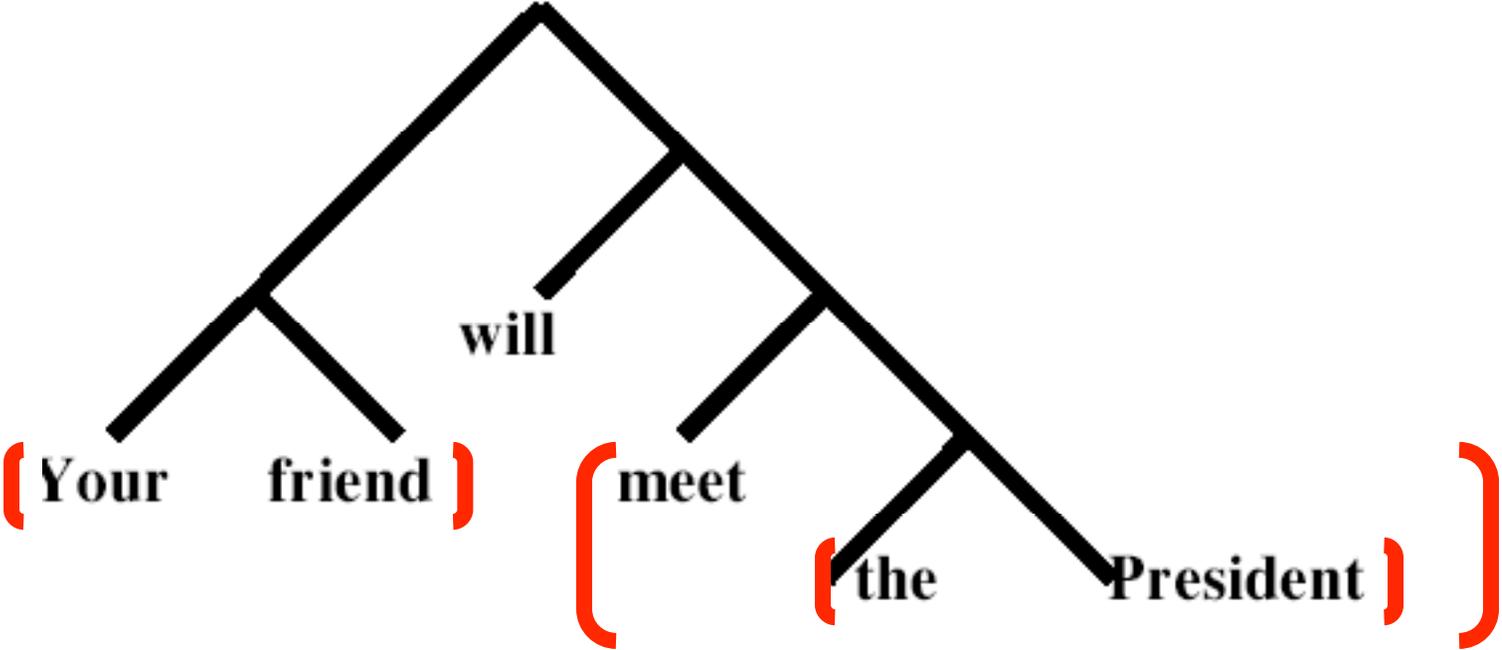
- a. Mary will meet [the President]
b. Mary will meet **him**

- a. Mary will [meet the President]
b. -No, she won't do **it**

- a. [Your friend] will meet the President
b. **She** will meet the President



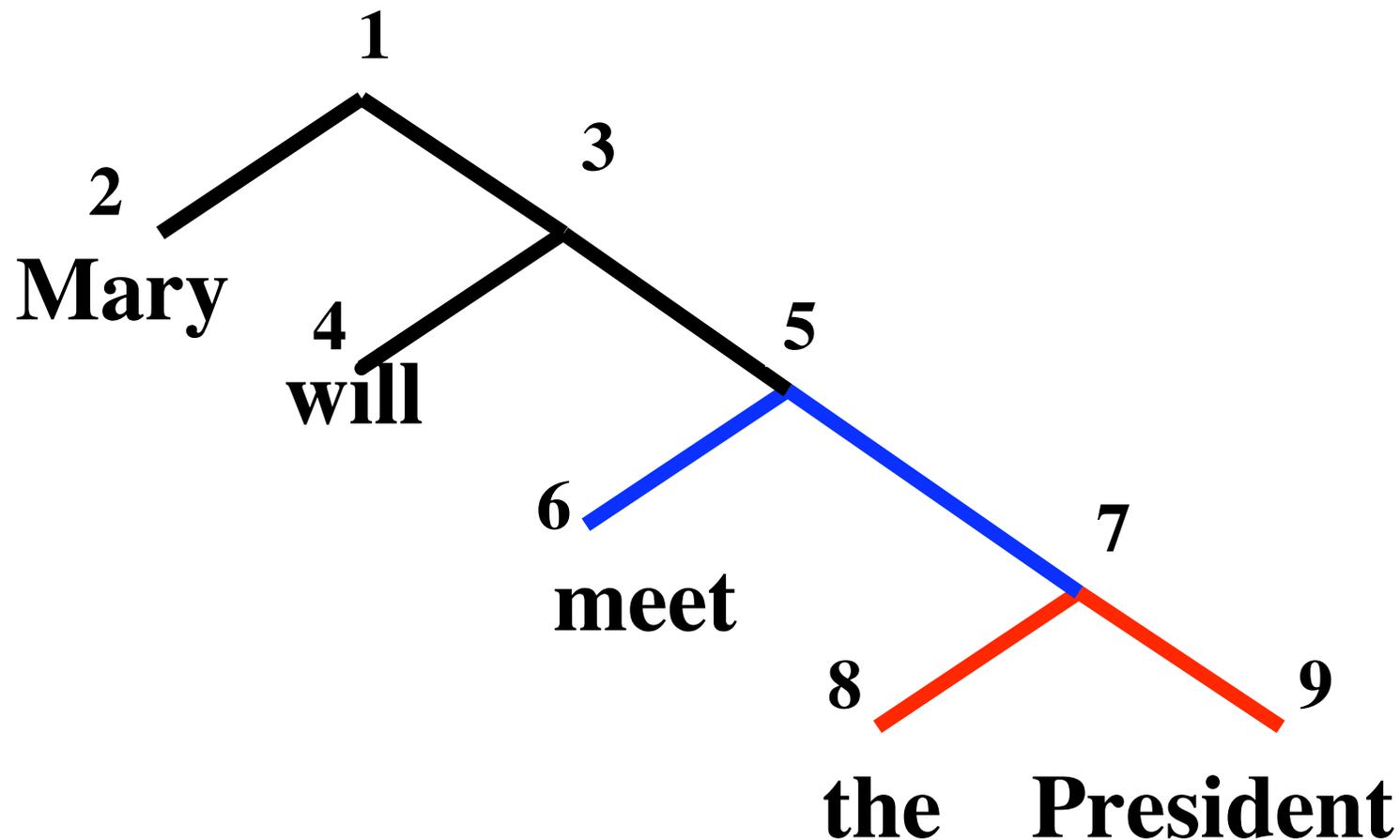




Arbres: terminologie anglaise

-Root, nodes, terminal nodes

-mother, daughter, sister + containment [=domination]



Exemple d'application:

Formation des Questions en Anglais

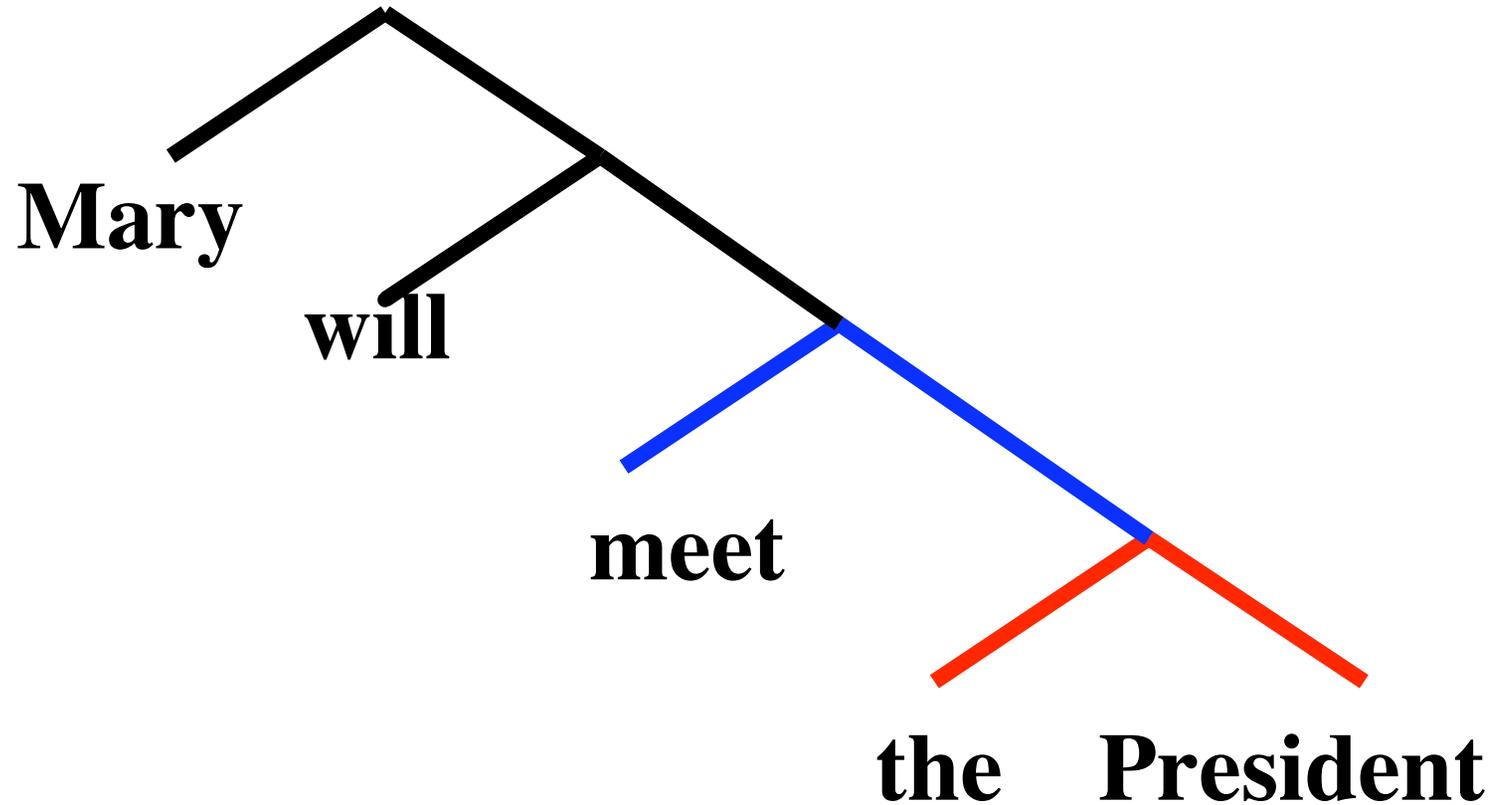
- a. A unicorn that is eating a flower is in the garden
- b. *Is a unicorn that ___ eating a flower is in the garden?
- c. Is a unicorn that is eating a flower ___ in the garden?
(Move the second *is*)

... déplacer le dernier *is*?

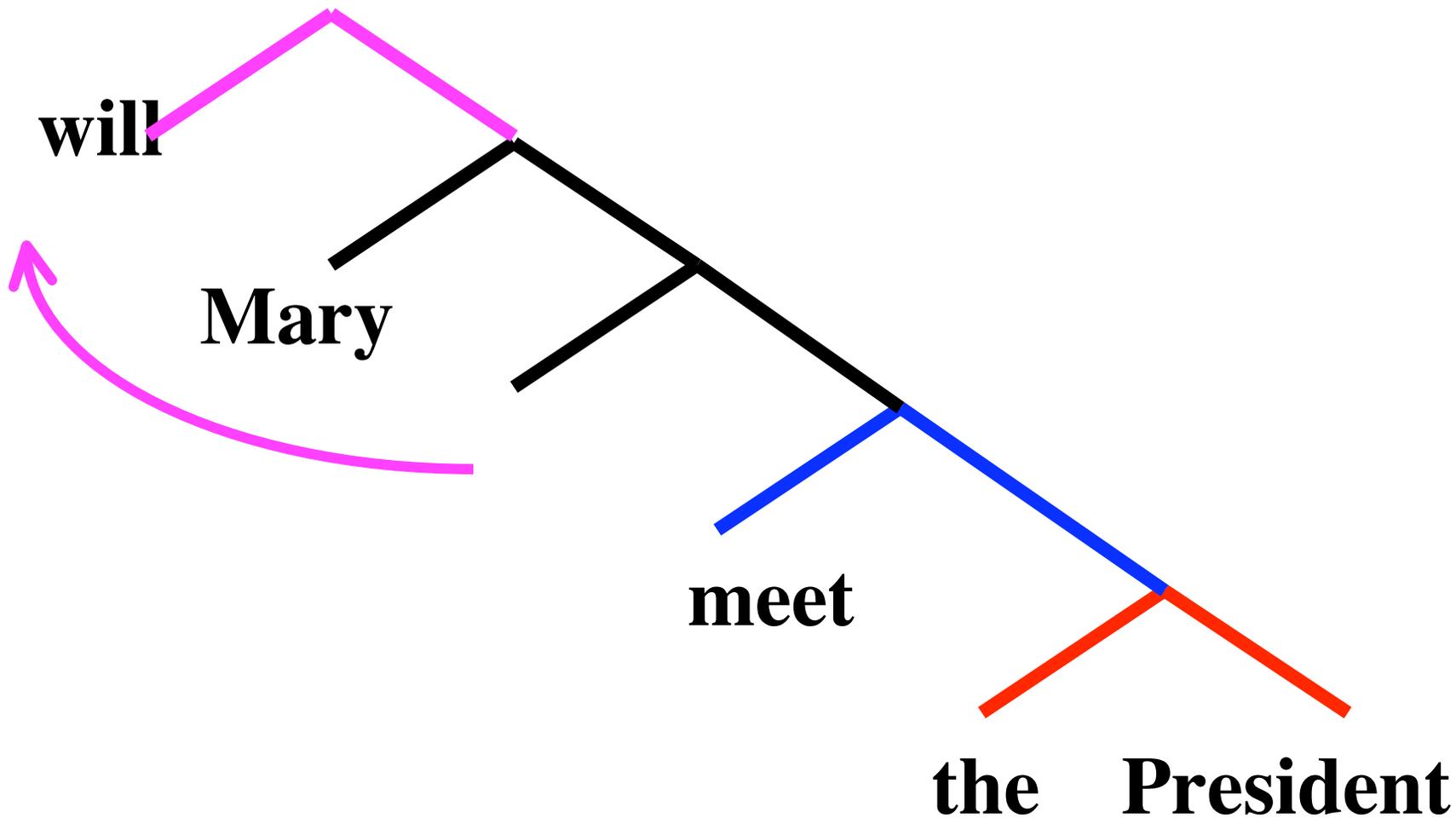
- a. John is in the garden next to someone who is asleep.
- b. Is John ___ in the garden next to someone who is asleep?
- c. *Is John is in the garden right next to someone who ___
asleep? (Move the last *is*)

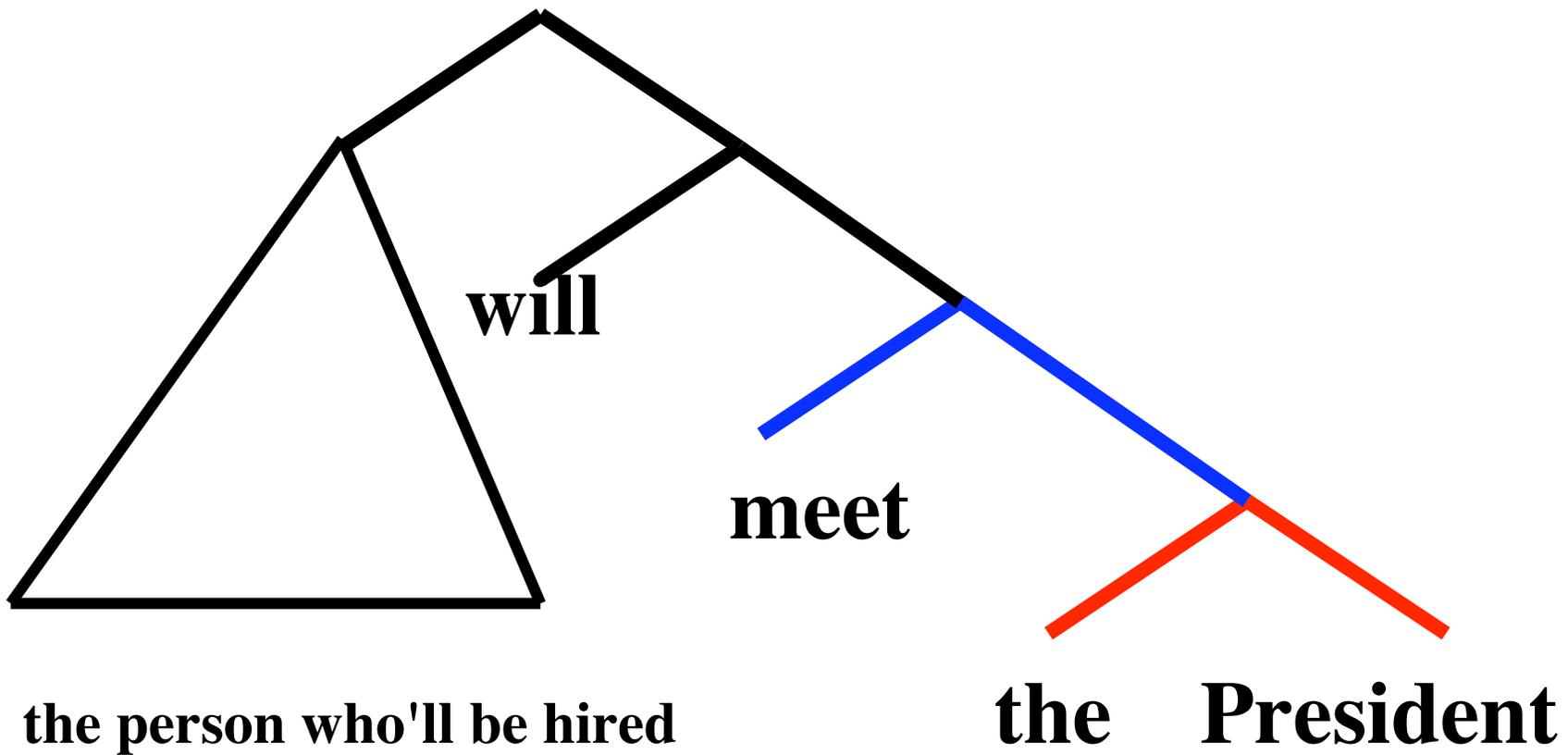
... déplacer le premier *is* (ou *will*)?

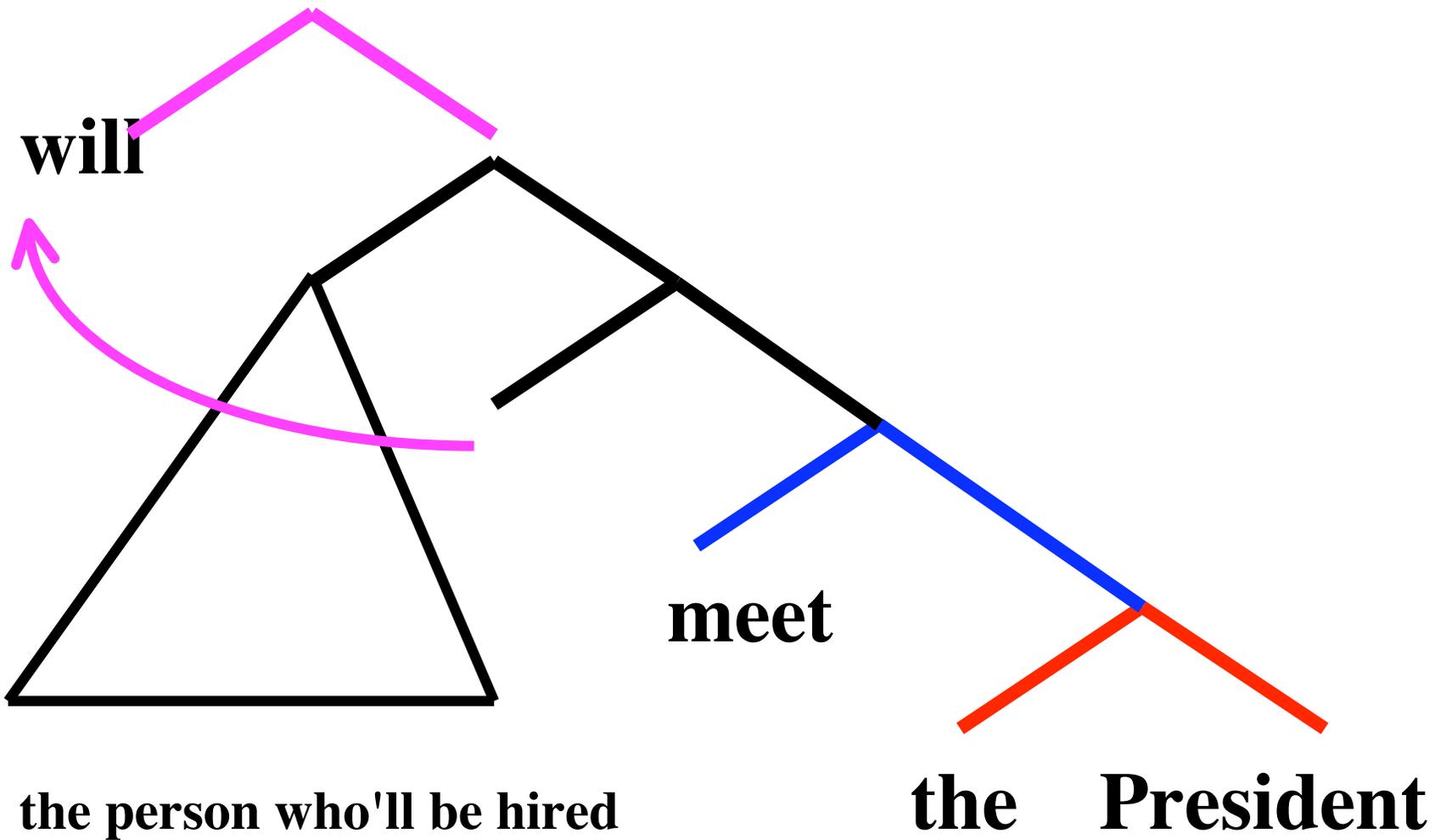
Formation des Questions en Anglais

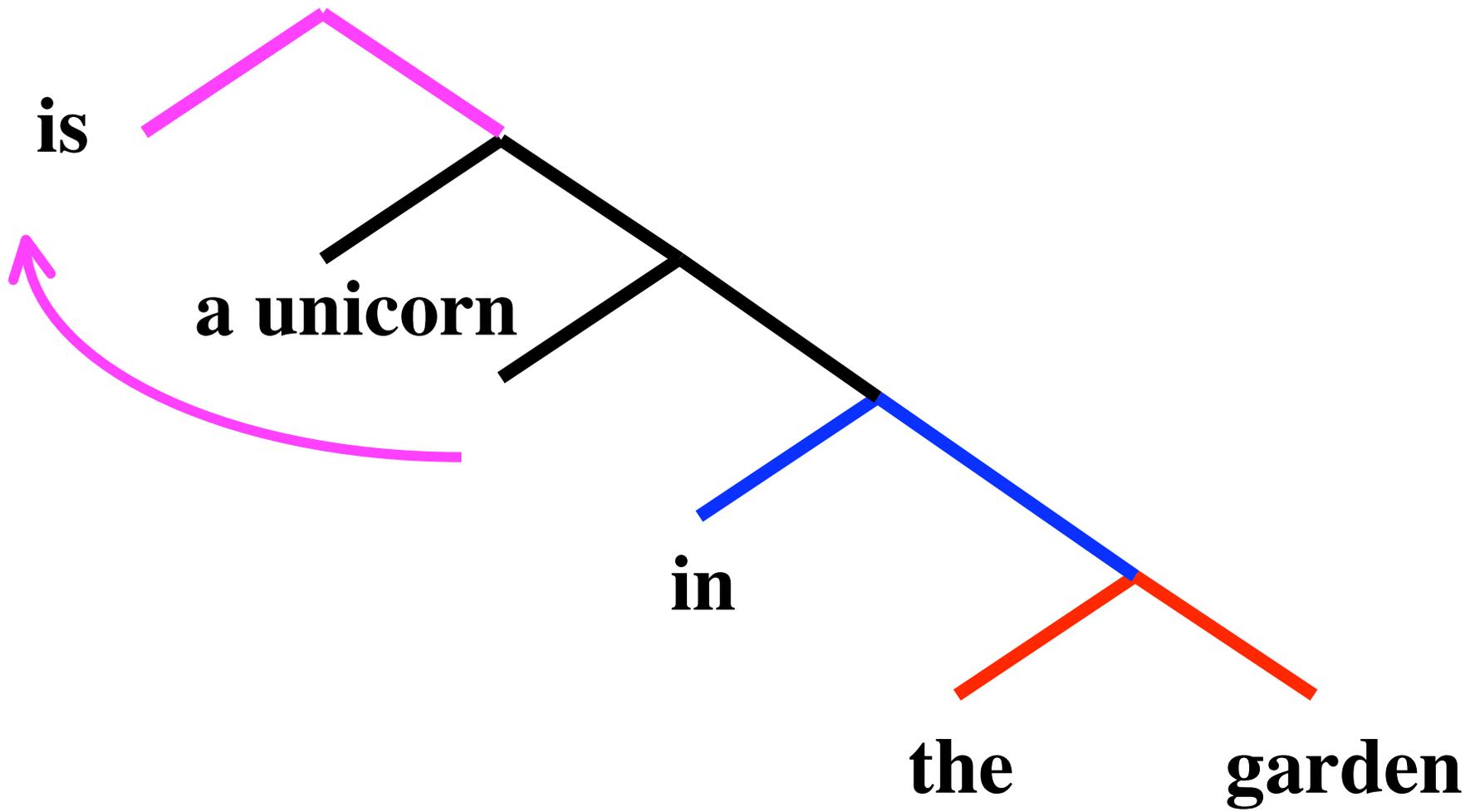


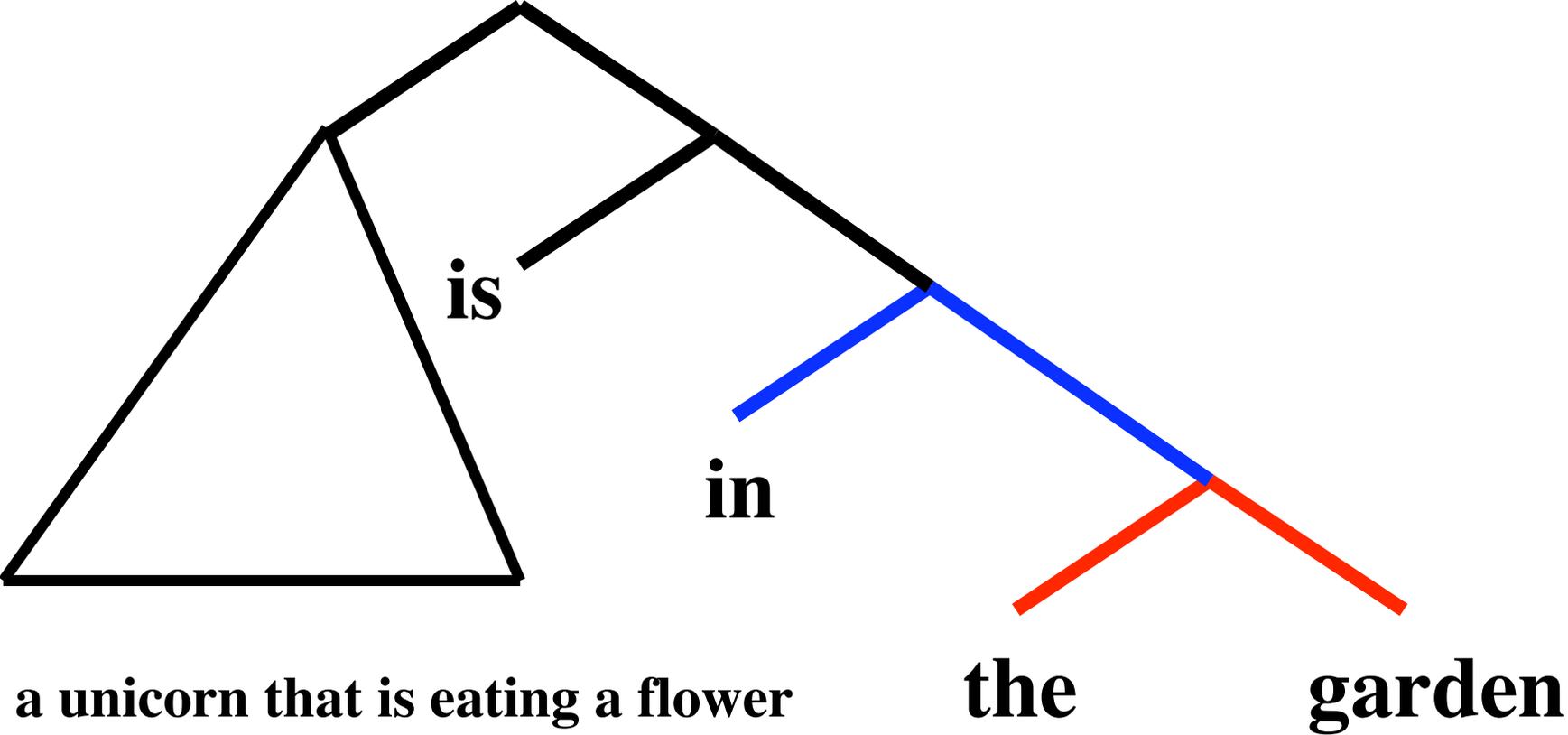
Formation des Questions en Anglais

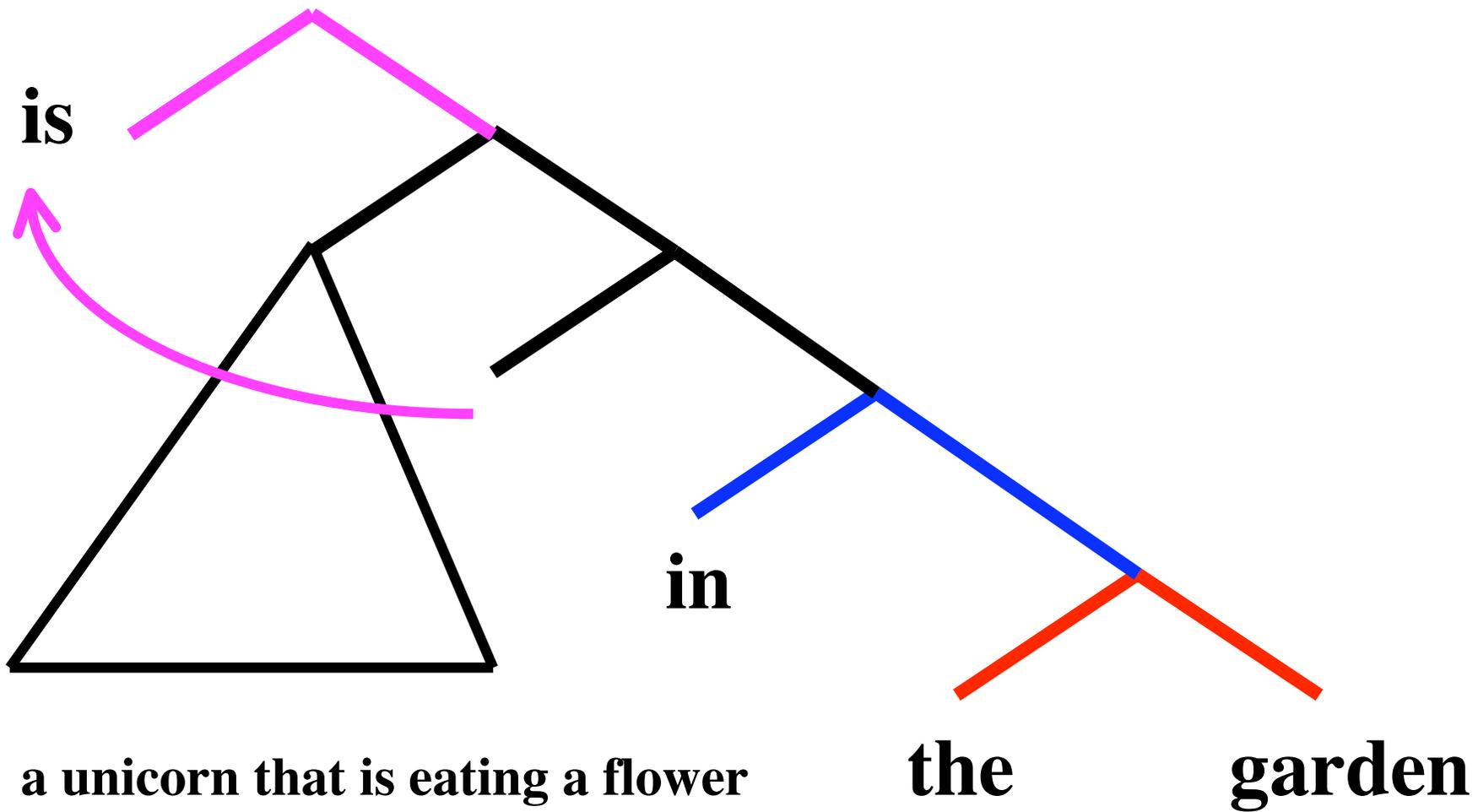










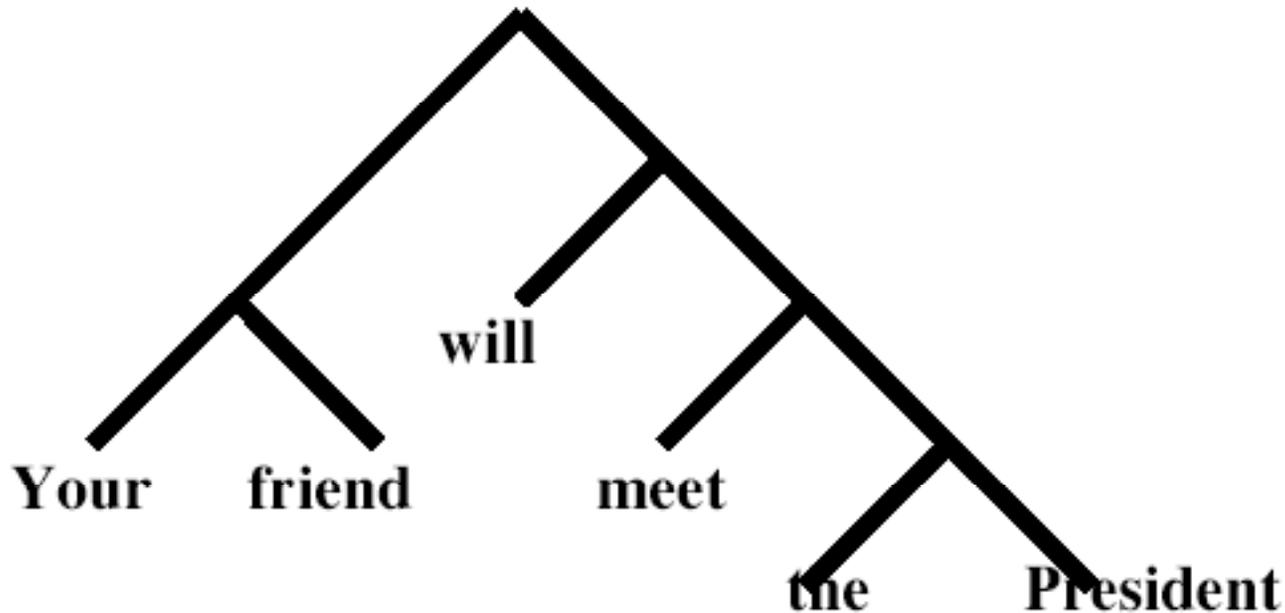


A.2. Hypothèse 2:

Grammaire d'automates à états finis

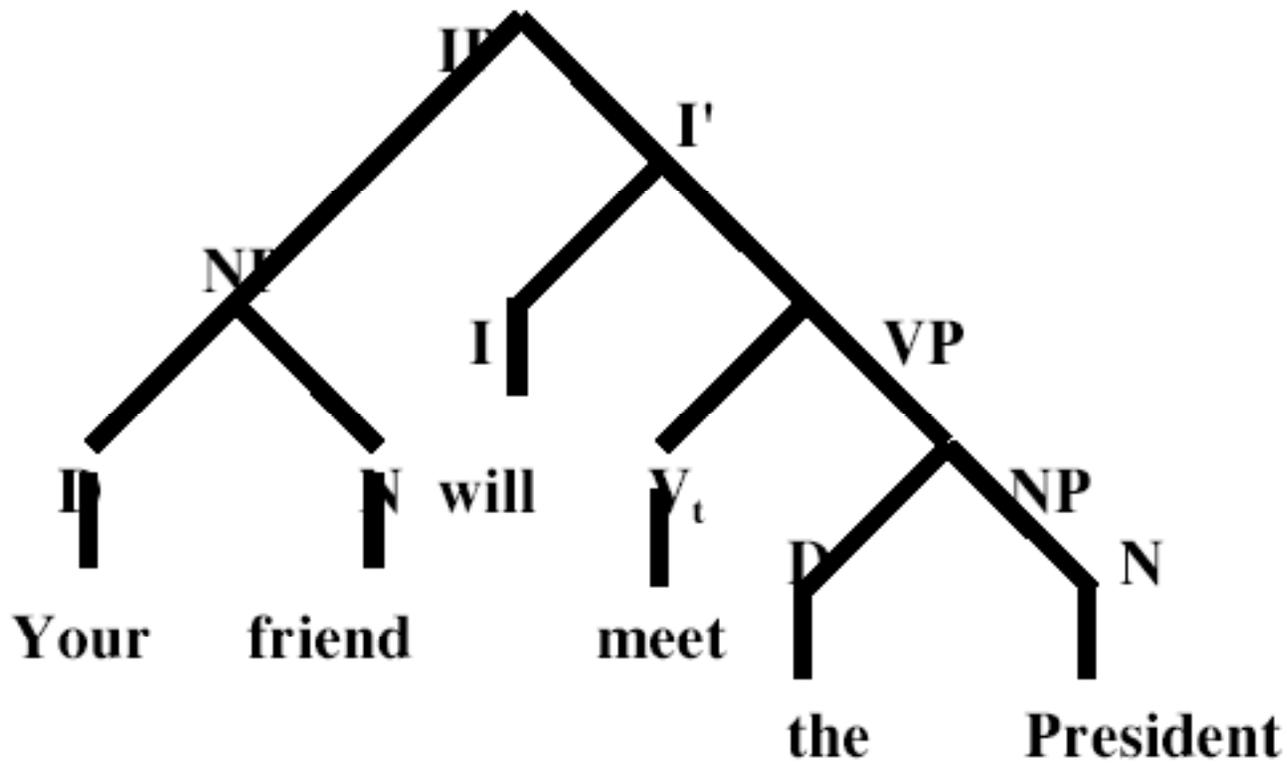
D'où viennent les arbres?

Idée: Les arbres représentent **la façon dont les phrases sont construites**. Deux éléments forment un constituant s'il sont introduits par une même règle.

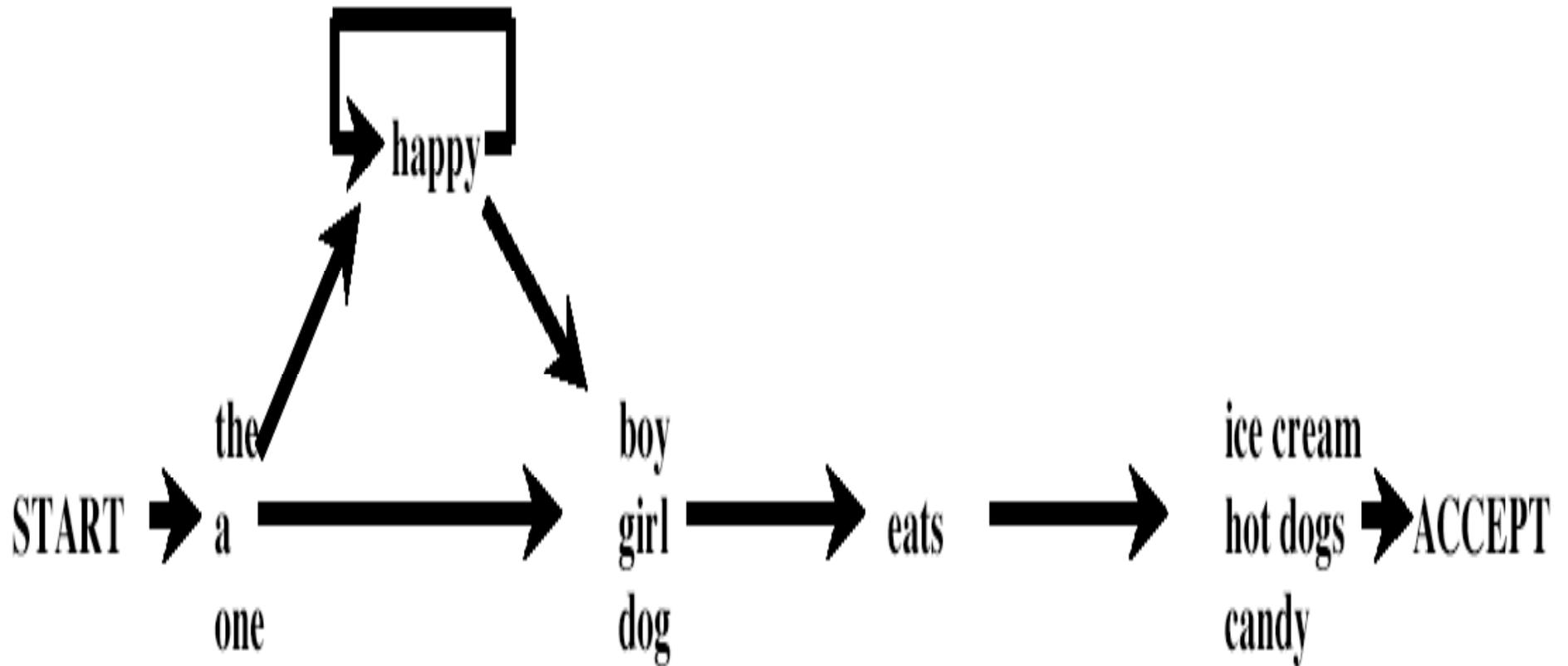


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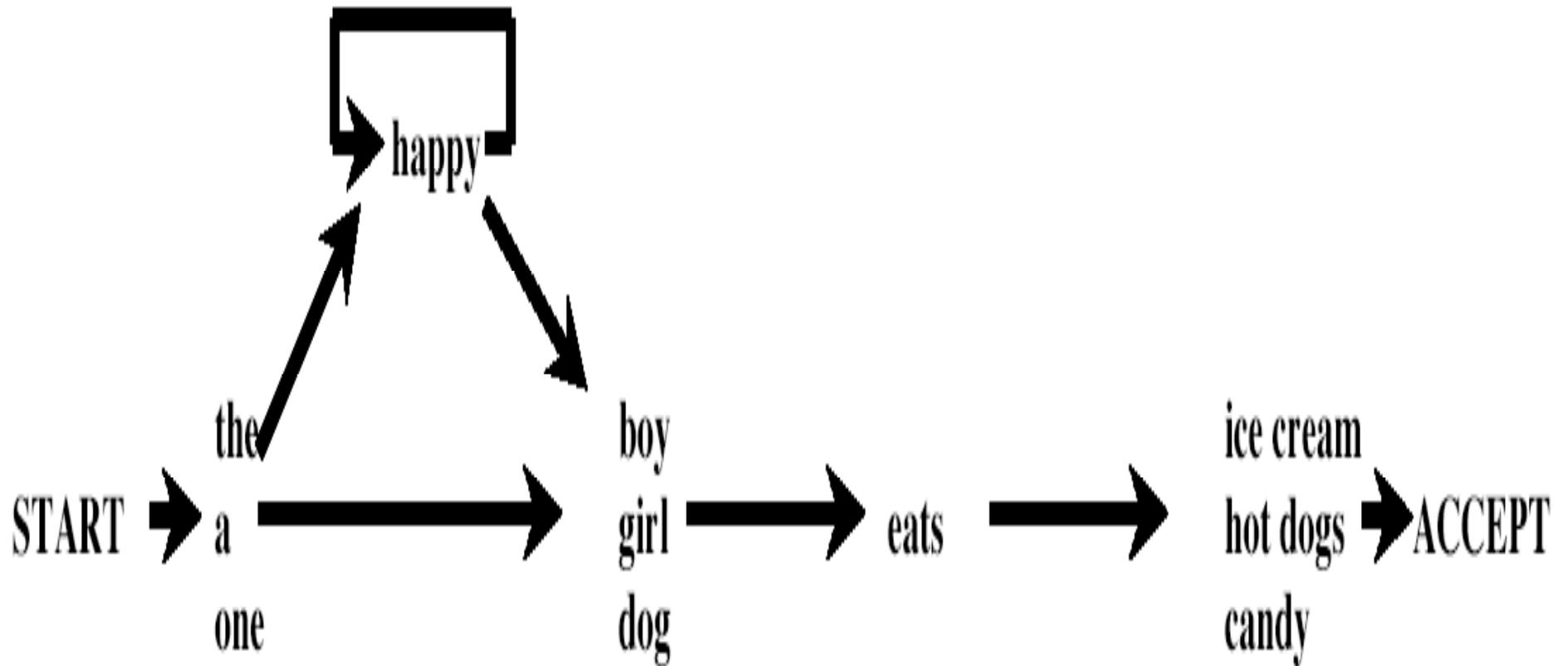
Le Modèle à États Finis



■ Phrases grammaticales engendrées

- the boy eats ice cream
- the happy boy eats ice cream
- the happy happy boy eats hot dogs
- a happy happy girl eats candy

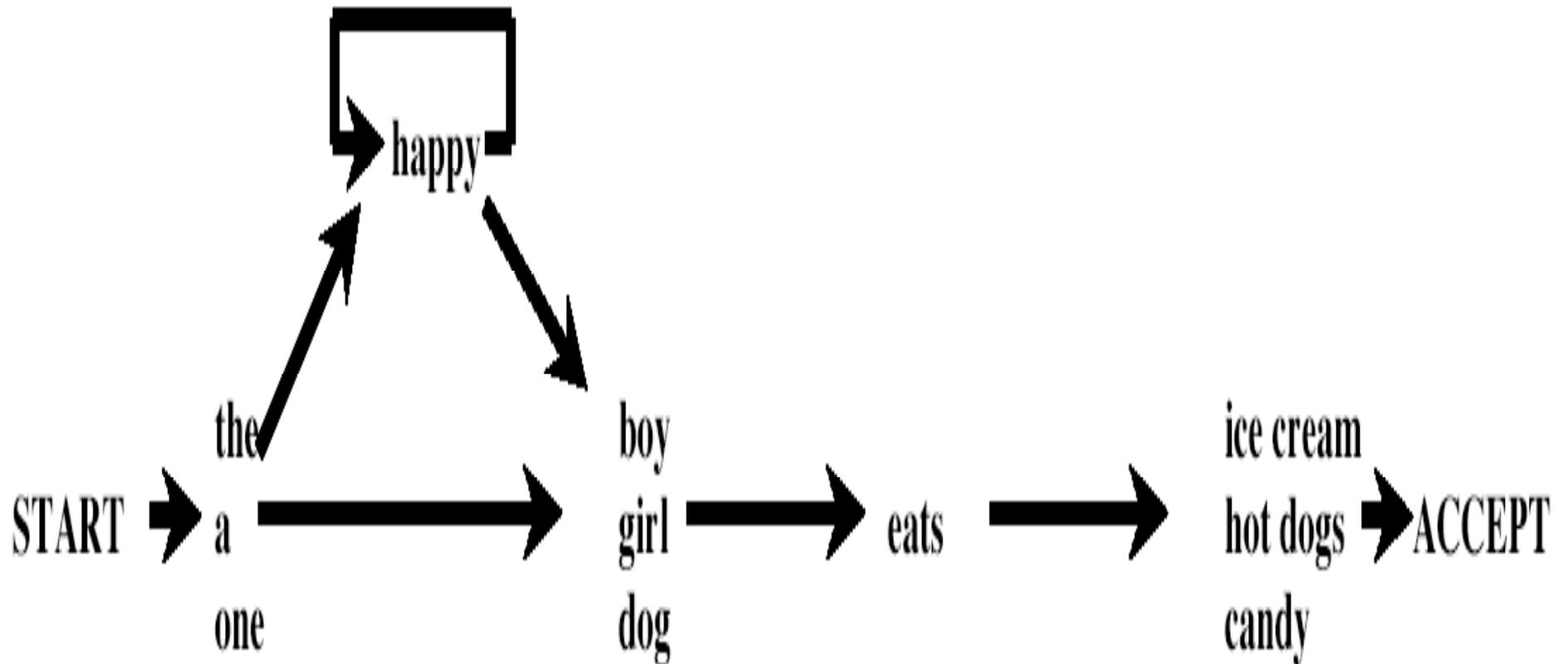
Le Modèle à États Finis



■ Phrases agrammaticales non engendrées

- a. *boy the eats ice cream
- b. *happy boy eats hot dogs
- c. *hot dogs eats the dog

Le Modèle à États Finis



■ Phrases grammaticales non engendrées (!!!):

- some boy eats ice cream
- the dog that the dog eats eats ice cream
- either the boy eats ice cream or the girl eats candy

Le Modèle à États Finis: Objections

-Argument 1: Ne rend pas compte de la structure arborescente des phrases

-Argument 2: Ne rend pas compte des dépendances 'à longue distances', dans lesquelles deux mots dans une relation de dépendance grammaticale peuvent être séparés par un nombre arbitraire de mots

■ Exemple de relation à longue distance: either ... or...

a. Either John is sick or he is depressed

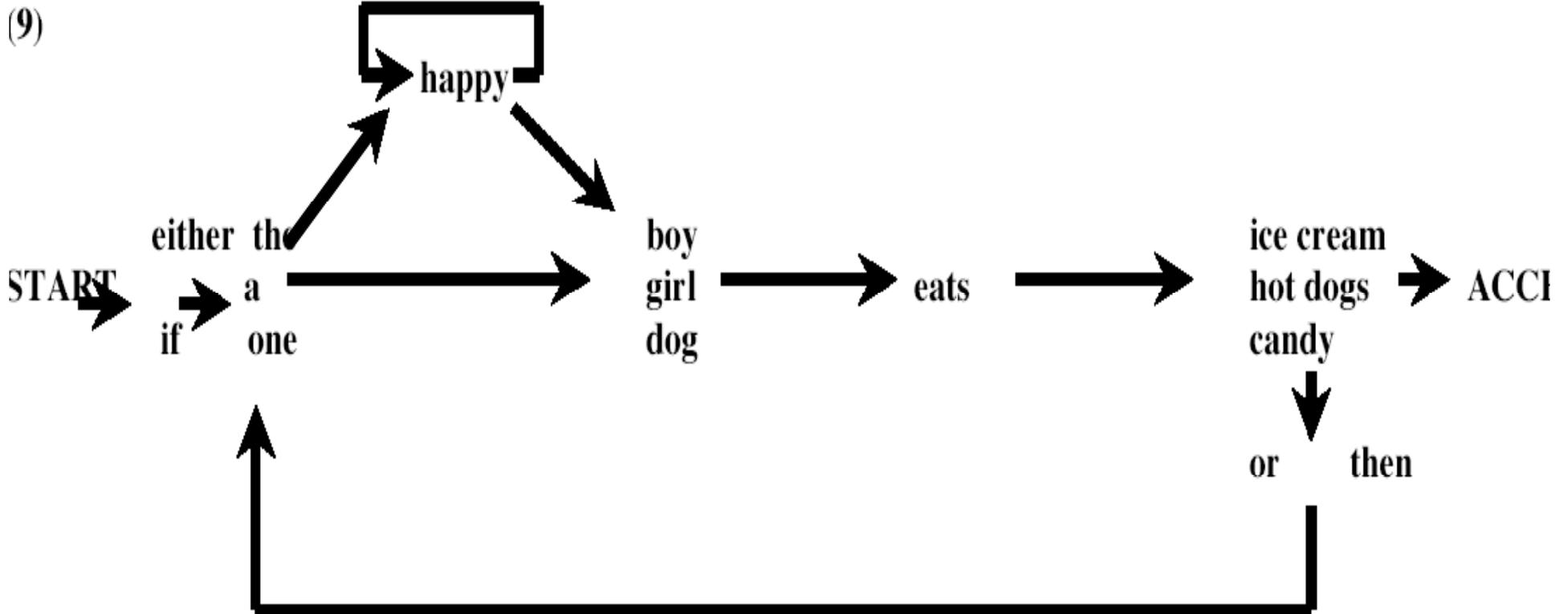
b. Either John thinks that he is sick or he is depressed

c. Either Mary knows that John thinks that he is sick or she is depressed

d. Either the boy eats hot dog or the dog eats hot dog

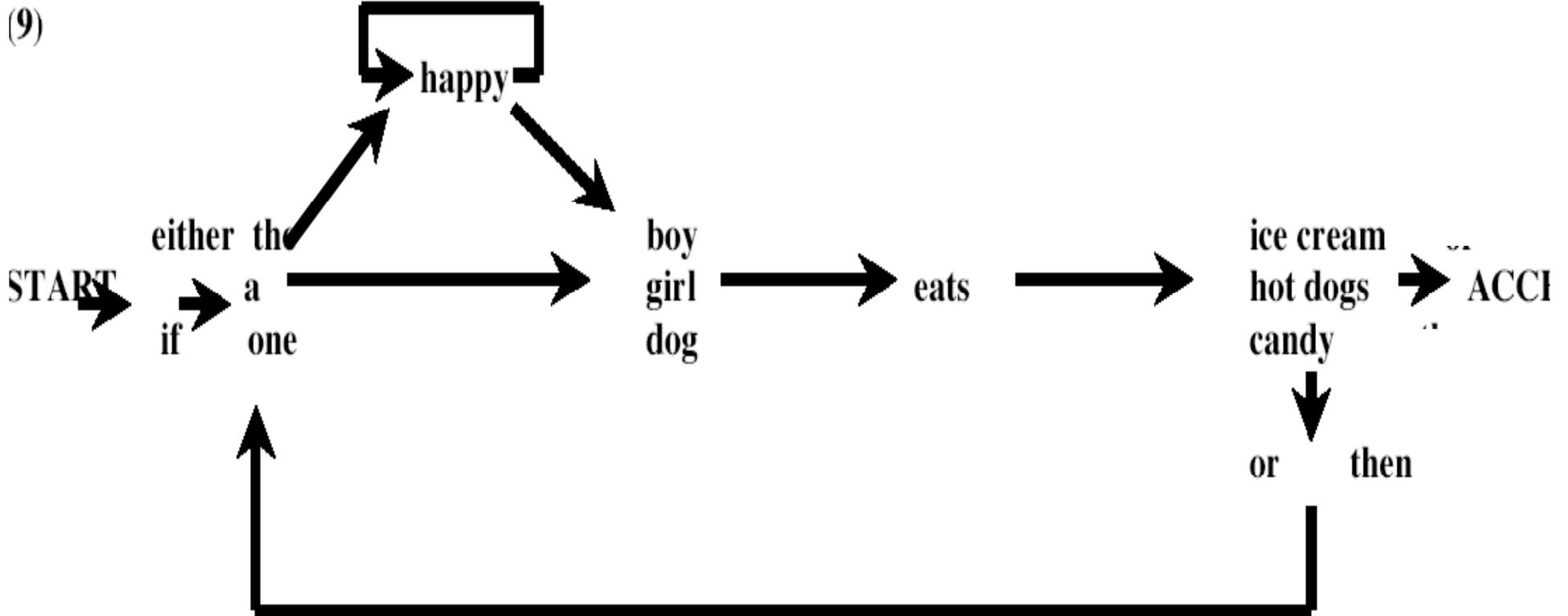
e. Either the happy happy boy eats hot dog or the dog eats

Le Modèle à États Finis: Objections



- Phrases grammaticales engendrées par (9)
 - Either a girl eats candy or a boy eats hot dogs
 - Either a happy girl eats candy or a boy eats hot dogs

Le Modèle à États Finis: Objections



- Phrases agrammaticales engendrées par (9):
 - *Either a girl eats candy
 - *Either a happy girl eats candy

Acquisition de Grammaires à États Finis par les Singes

Source: Fitch, W.T. & Hauser, M.D. (2004). Computational constraints on syntactic processing in nonhuman primates. *Science* 303: 377-380.



Acquisition de Grammaires à États Finis vs. Syntagmatiques: Humains vs. Singes

A

Finite State Grammar (AB)ⁿ



AB AB
AB AB AB

no li ba pa
la pa wu mo no li

Syllabes A

ba di
yo tu
la mi
no wu

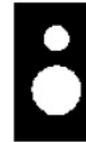
Syllabes B

pa li
mo nu
ka bi
do gu.

B

Look

No Look



A.2'. Hypothèse alternative

Grammaires Syntagmatiques 1: IP

IP → NP I'

=a sentence consists of a Noun Phrase followed by an I bar

I' → I VP

=an I bar consists of an Inflection (=Auxiliary) followed by a Verb Phrase.

I → a, avait

- a. [Jean] [a dormi]
- b. [Le directeur] [avait dormi]
- c. [Marie] [a [frappé Jean]]
- d. [Le directeur] [a [critiqué Jean]]

Grammaires Syntagmatiques 2: NP

NP → PN, D N

=a Noun Phrase comprises either

(i) a Proper Name/ProNoun alone, or

(ii) a Determiner and a Noun

PN → Jean, Pierre, Marie, Sam, il, elle

N → Président, directeur, garçon, fille, Doyen, ami, mère

D → le, un, chaque, mon, son

Grammaires Syntagmatiques 3: VP

VP \rightarrow V_i , V_t NP, V_s CP

=a Verb Phrase comprises either

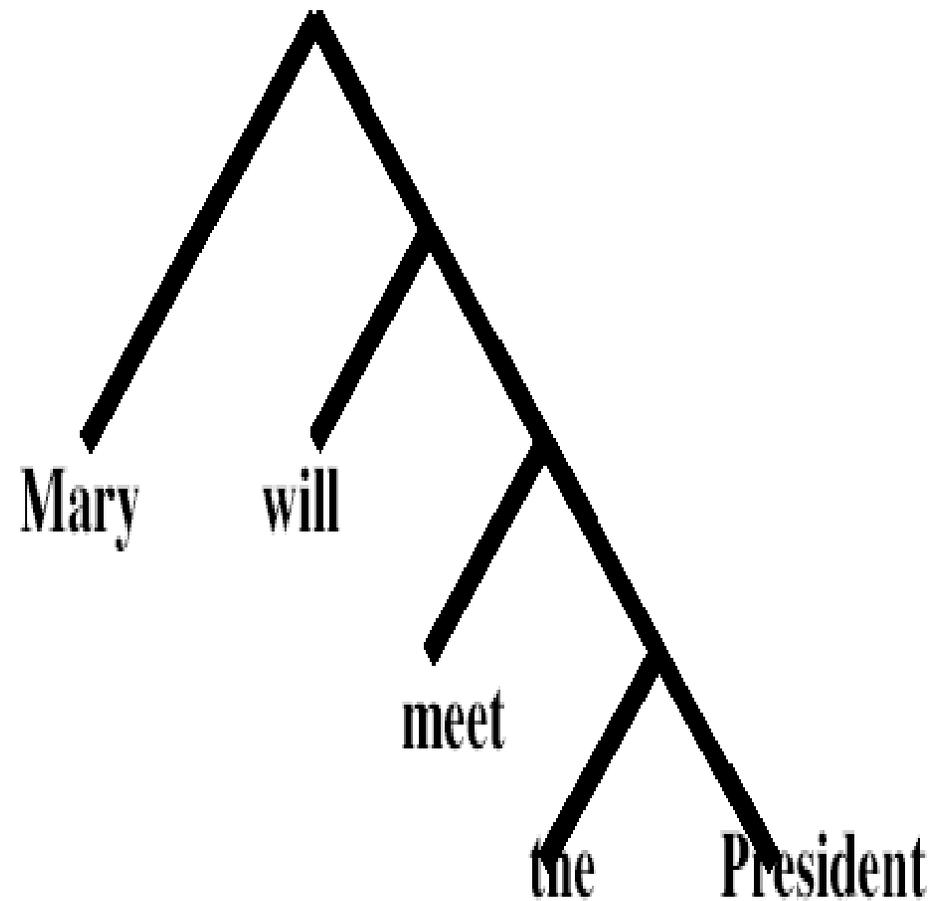
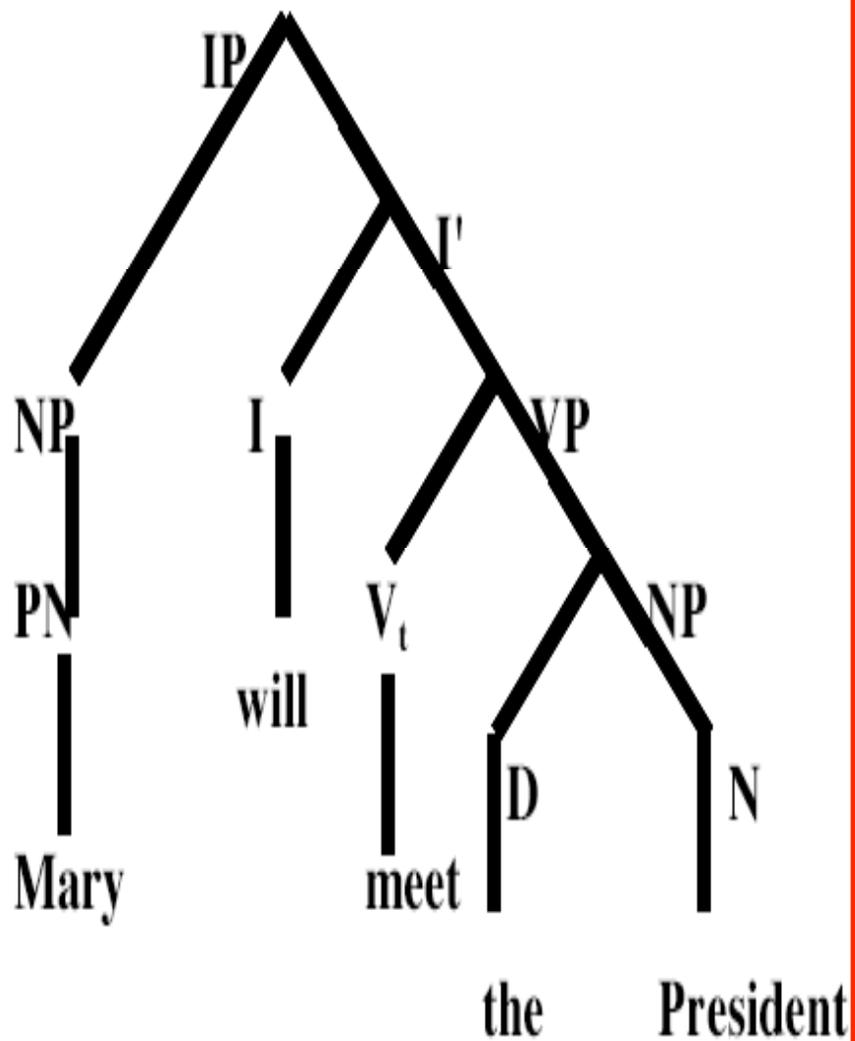
- (i) an intransitive verb alone, or**
- (ii) a transitive verb followed by a Noun Phrase, or**
- (iii) a verb of speech/thought followed by Complementizer Phrase**

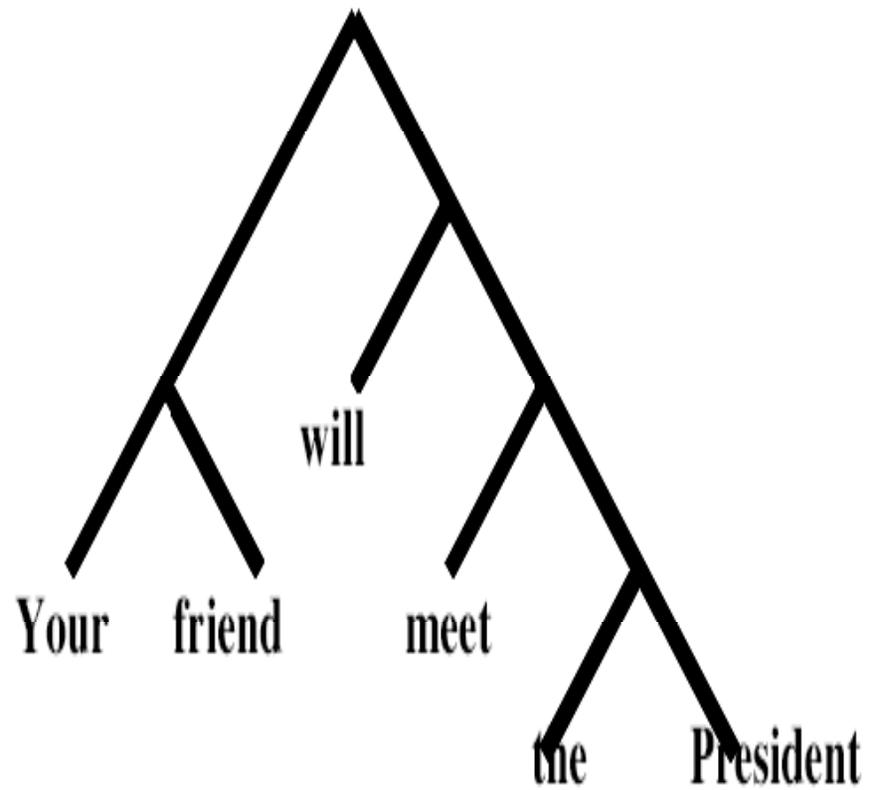
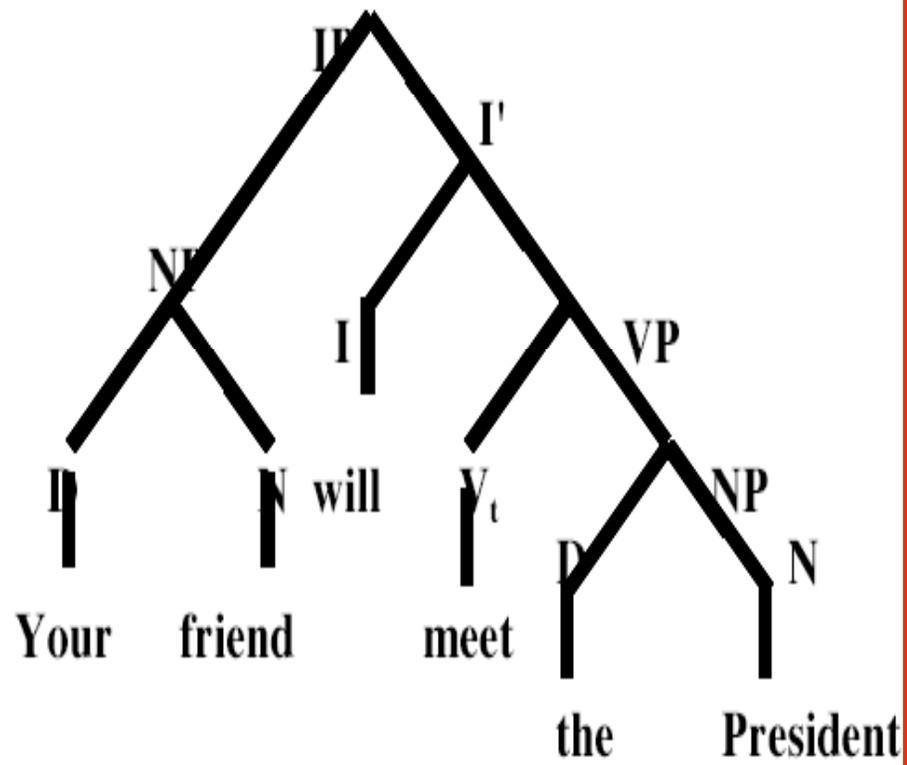
$V_i \rightarrow$ dormi, couru, ronflé, échoué

$V_t \rightarrow$ rencontré, frappé, tué, critiqué

$V_s \rightarrow$ dit, pensé, cru

Relations de Constituance





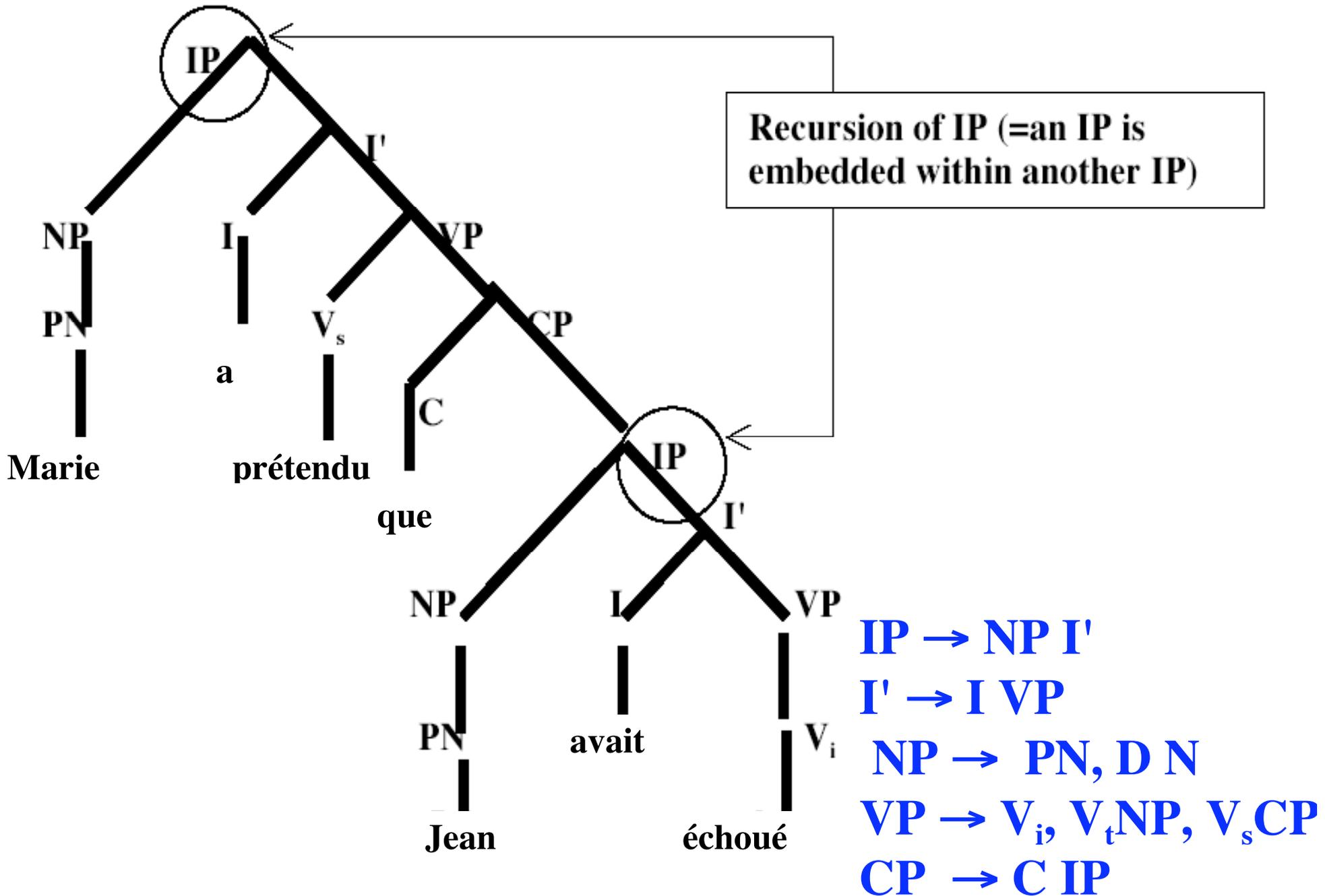
Grammaires Syntagmatiques 4: CP

CP → C IP

=a Complementizer Phrase comprises a Complementizer followed by an Inflection Phrase

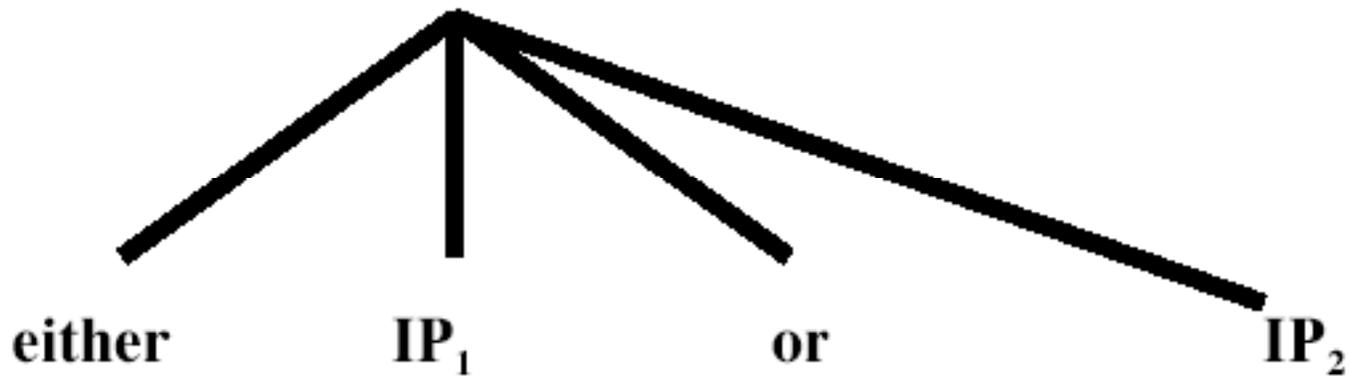
C → que

Réursion



Dépendances à Longue Distance

IP \rightarrow either IP₁ or IP₂, if IP₁ then IP₂



(Absence d') Acquisition de Grammaires Syntagmatiques par des Singes

A

Finite State Grammar $(AB)^n$



AB AB no li ba pa
 AB AB AB la pa wu mo no li

Phrase Structure Grammar: $A^n B^n$



AA BB yola pa do
 AAA BBB ba la tu li pa ka

B

Look



No Look



Conclusions

- **Les Grammaires à États Finis** sont **inadéquates** car:
 1. Elles ne rendent pas compte de la structure des phrases
 2. Elles ne rendent pas compte des dépendances à longue distance

- **Les Grammaires Syntagmatiques** sont **meilleures** car:
 1. Elles rendent compte de la structure arborescente des phrases
 2. Elles rendent compte des dépendances à longue distance

- **Conséquences** (non discutées):
 1. Langage et cognition
 2. Evolution du langage

B. Quelques phénomènes

B.1. Ambiguïté de structure

B.2. Les pronoms: `condition C”

B.3. Interaction

B.1. Ambiguïtés

Ambiguïtés Lexicales

- a. louer 1: emprunter / prêter contre de l'argent
- b. louer 2: faire l'éloge de

Ambiguïtés Structurales

- Marie a regardé le type sans lunettes
 - a. Signification 1: Marie a regardé le type. Elle l'a fait sans lunettes.
 - b. Signification 2: Marie a regardé le type qui ne portait pas de lunettes.

Ambiguïtés dans la Perception



[Credits: <http://www.geocities.com/SouthBeach/Port/2701/illusions.htm>]



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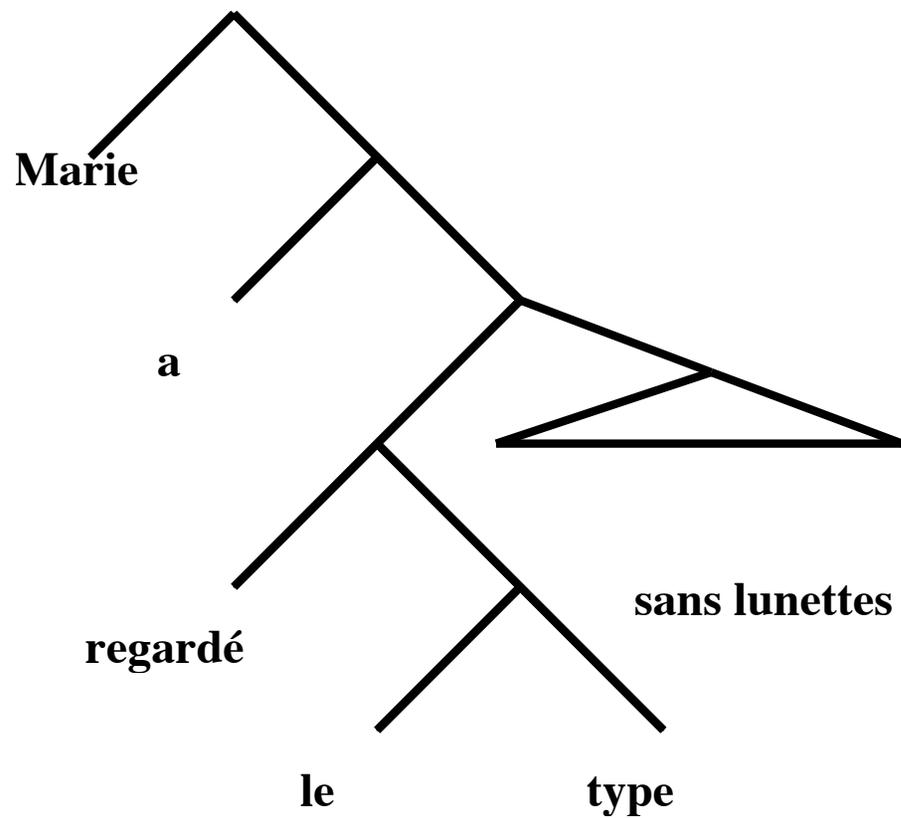


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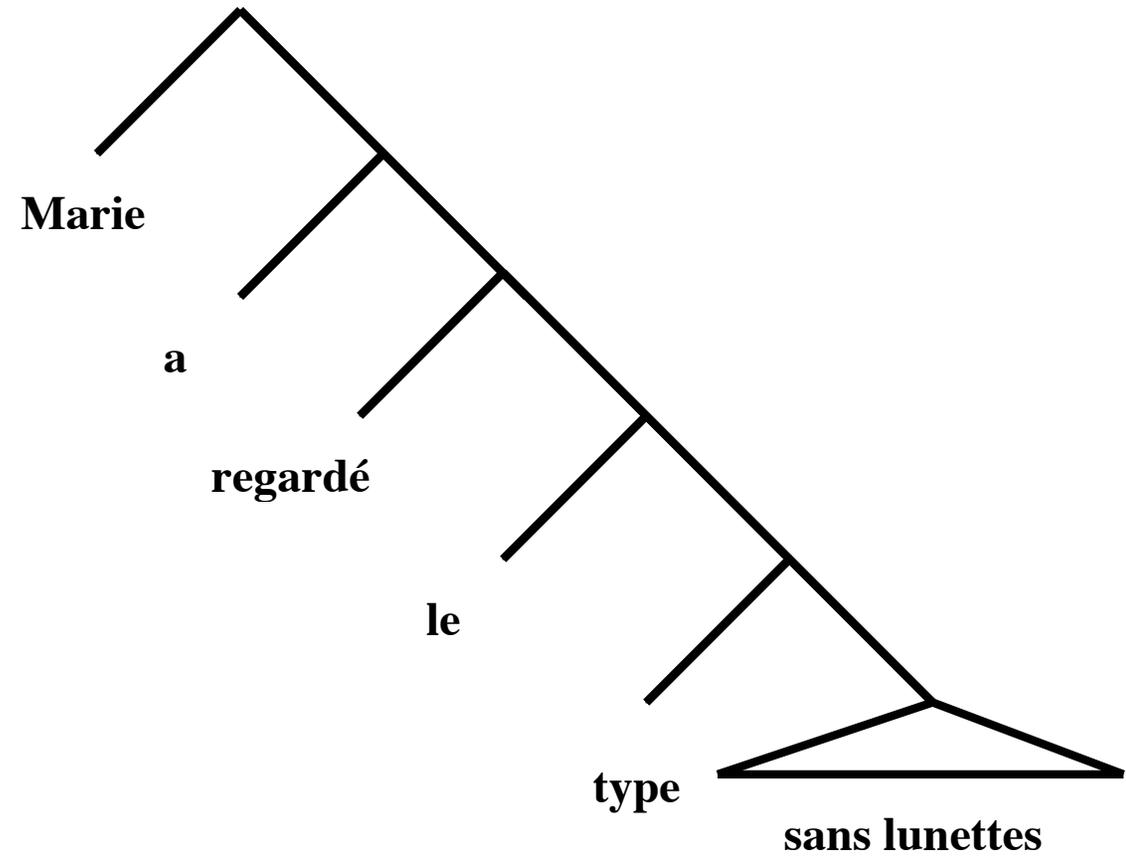
Ambiguïtés de Structure

Marie a regardé le type sans lunettes

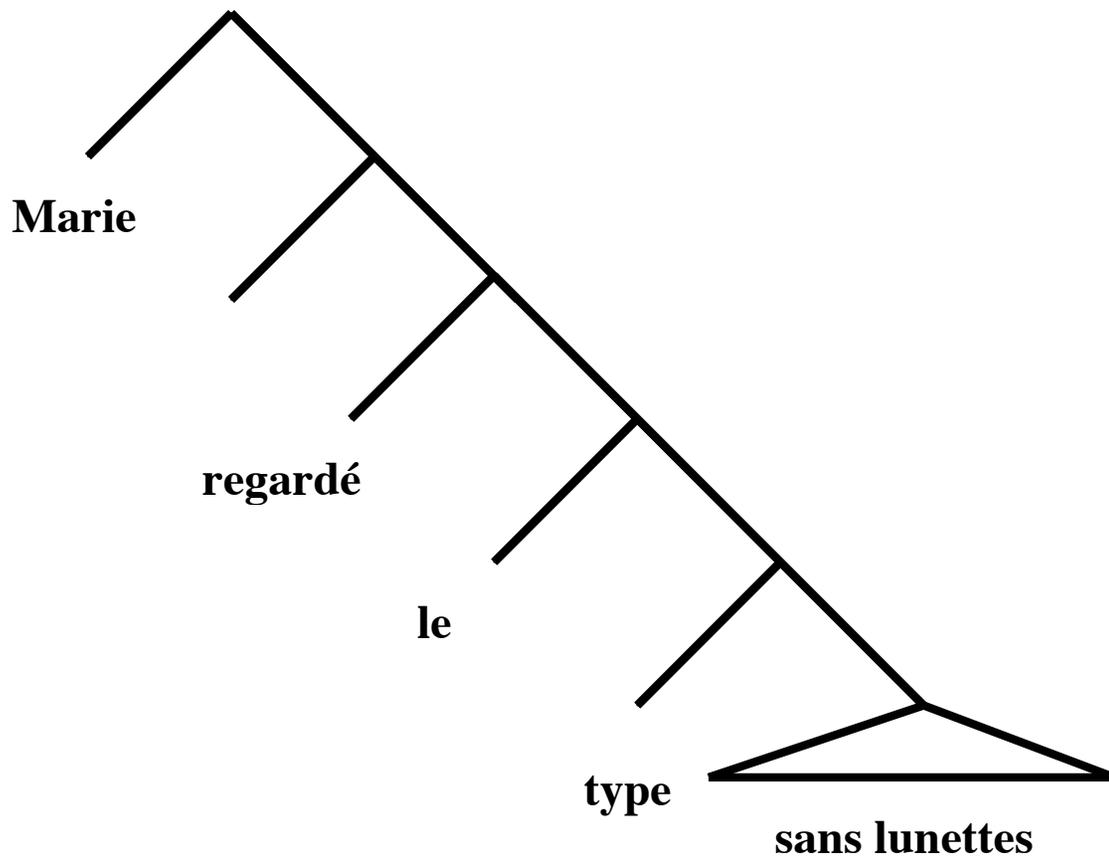
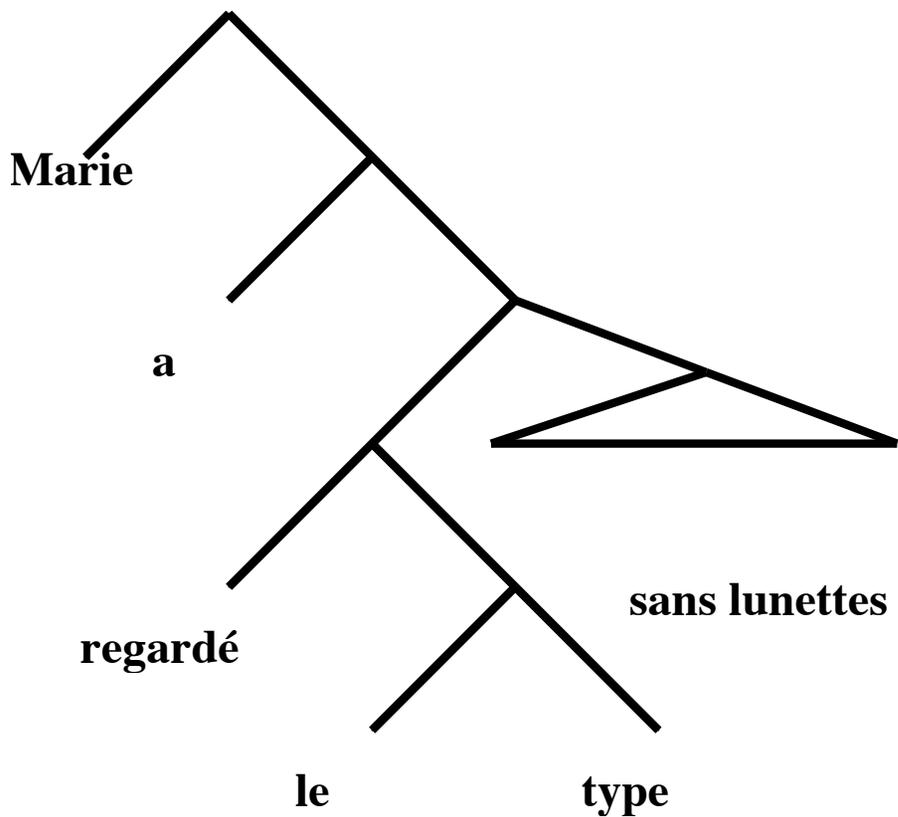
Ambiguïtés de Structure



Ambiguïtés de Structure

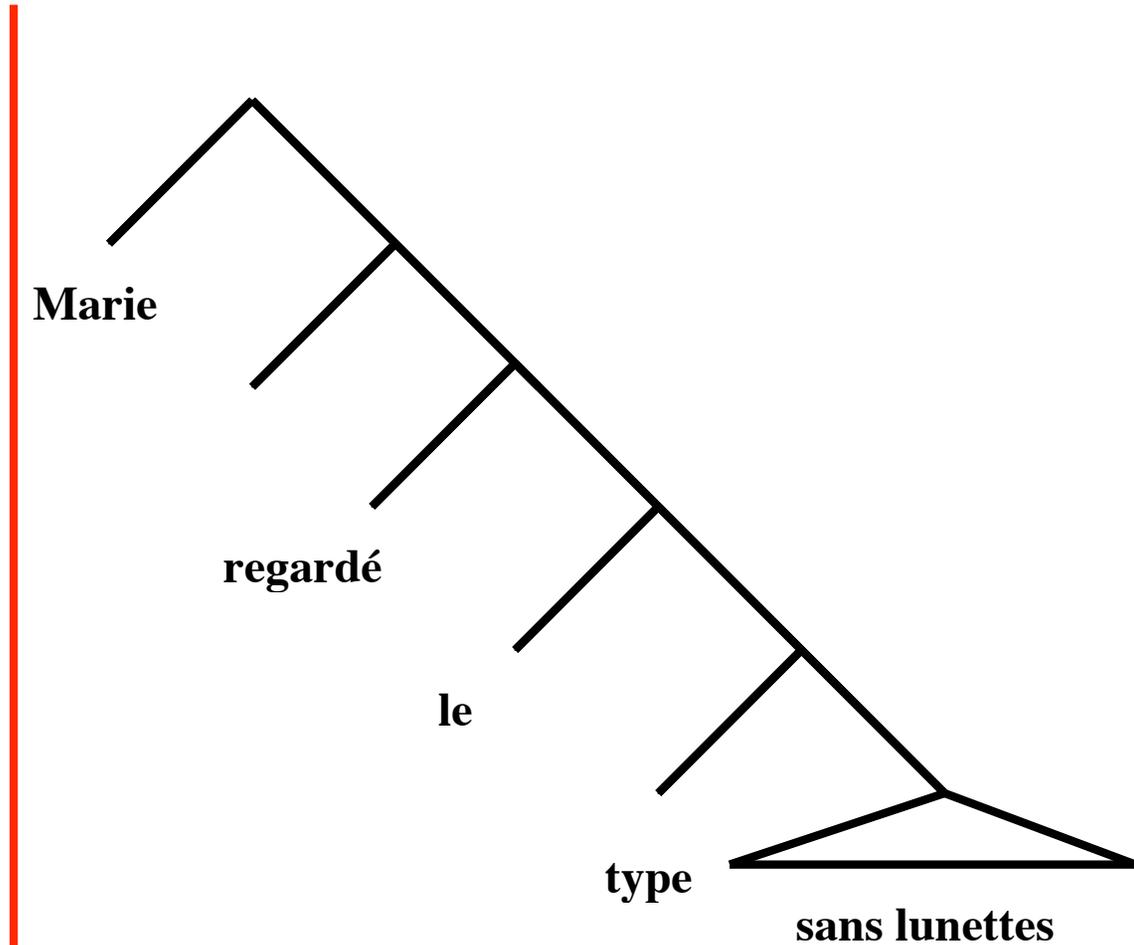
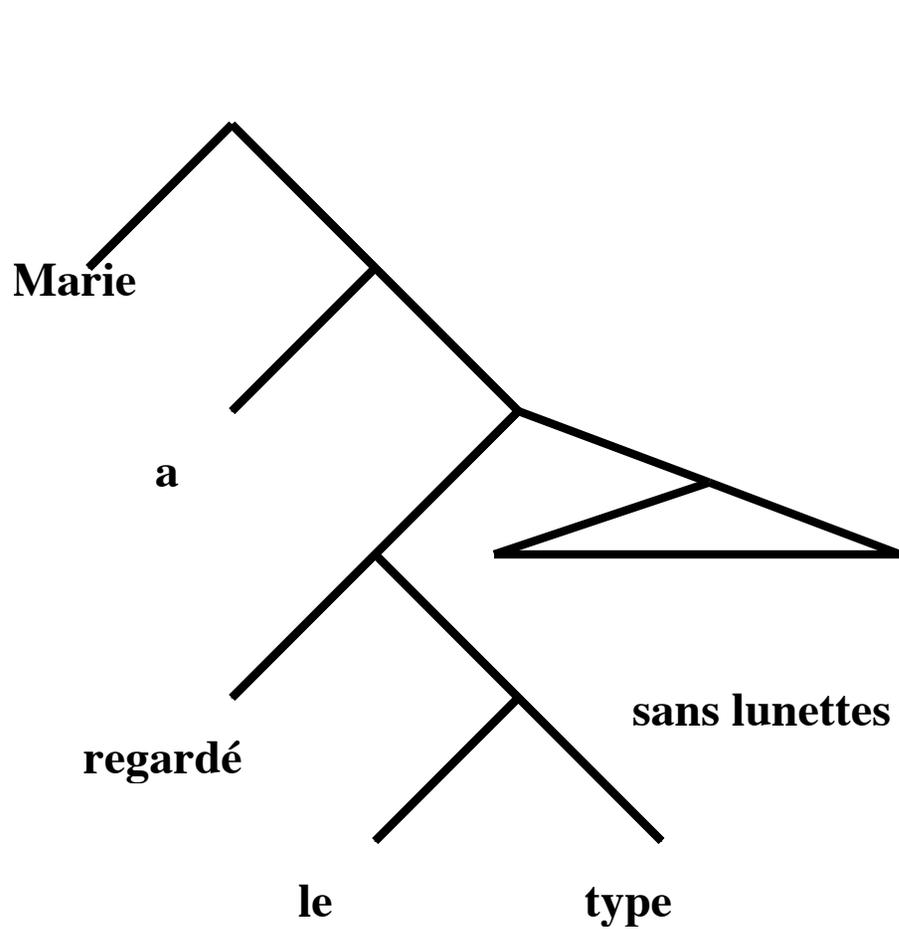


Ambiguïtés de Structure



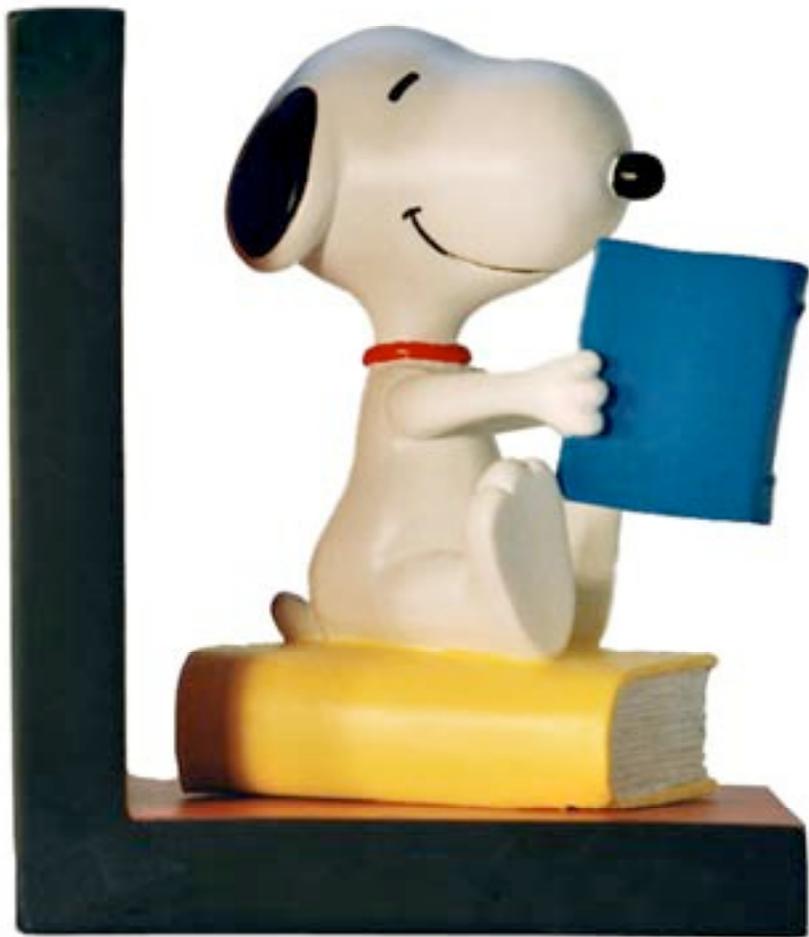
Prédiction:

Le type sans lunettes, Marie l'a regardé



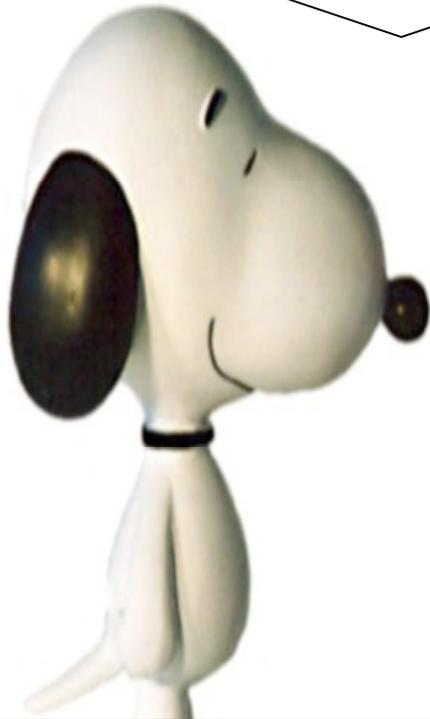
Ambiguïtés de Structure: Anglais

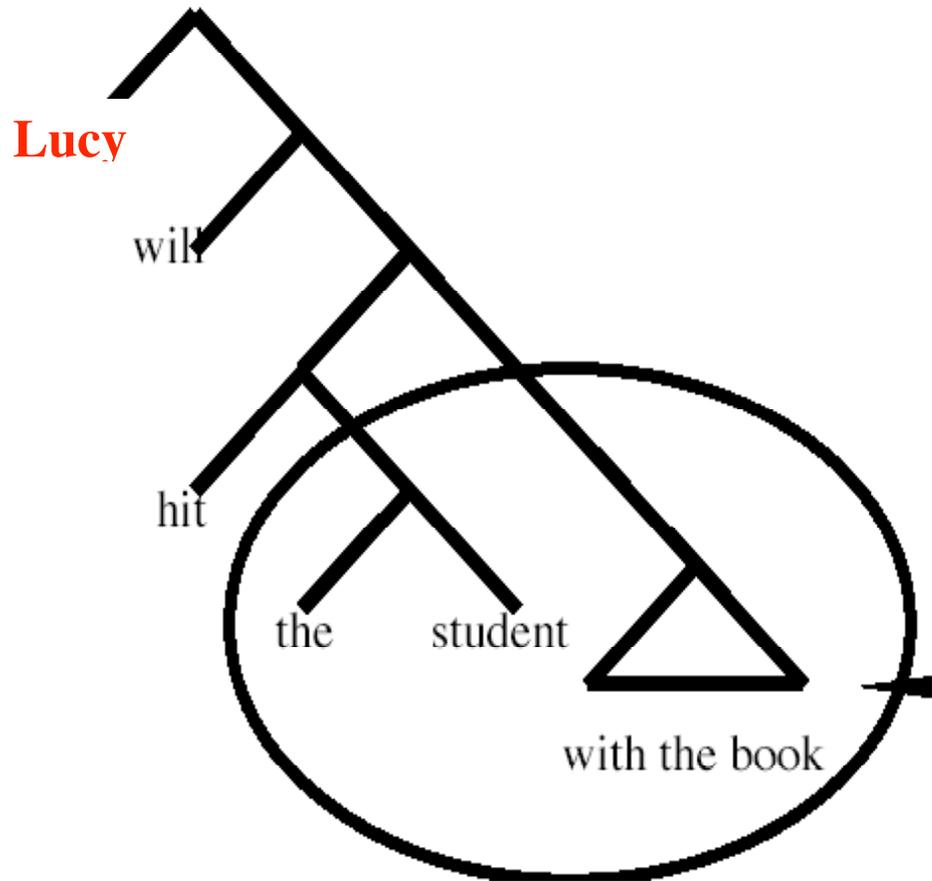
Lucy will hit the student with the book



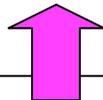
[Credits: http://www.a-bd.com/en/shop/product.php?product_id=2688; http://www.snoopy.co.jp/fun&games/html/images/c4b_football.gif]

ASPECTS
OF THE
THEORY OF
SYNTAX





The **hitting** is done
with the book



The **student** is
holding the book

- The student with the book, Mary will hit
 - a. *Meaning 1: the hitting is done with the book
 - b. Ok Meaning 2: the student is holding the book.

B.2. Exemple d'application:

La condition C

Contrainte Structurelle sur la Coref erence

- a. *Il_i a critiqu  Jean_i ✓
- b. Il_k a critiqu  Jean_i ✓
- c. Sa_i m re a critiqu  Jean_i ✓ 
- d. Sa_k m re a critiqu  Jean_i ✓
- e. *Il_i a dit que Jean_i avait  chou  ✓
- f. Il_k a dit que Jean_i avait  chou  ✓
- g. Sa_i m re a dit que Jean_i avait  chou  ✓ 
- h. Sa_k m re a dit que Jean_i avait  chou 
- i. Jean_i a dit qu'il_i avait  chou  ✓
- j. Jean_i a dit qu'il_k avait  chou  ✓

Contrainte Structurelle sur la Coref rence

- a. *He_i might criticize John_i ✓
- b. He_k might criticize John_i ✓
- c. His_i mother might criticize John_i ⚡
- d. His_k mother might criticize John_i ✓
- e. *He_i will think that John_i might snore ✓
- f. He_k will think that John_i might snore ✓
- g. His_i mother will think that John_i might snore ⚡
- h. His_k mother will think that John_i might snore
- i. John_i will think that he_i might snore ✓
- j. John_i will think that he_k might snore ✓

IP → NP I'

I' → I VP

NP → PN, D N

VP → V_i, V_t NP, V_s CP

CP → C IP

I → will, might, can, should, does, did

PN → John, Bill, Mary, Sam, he, she...

N → President, director, boy, girl, Dean, friend, mother...

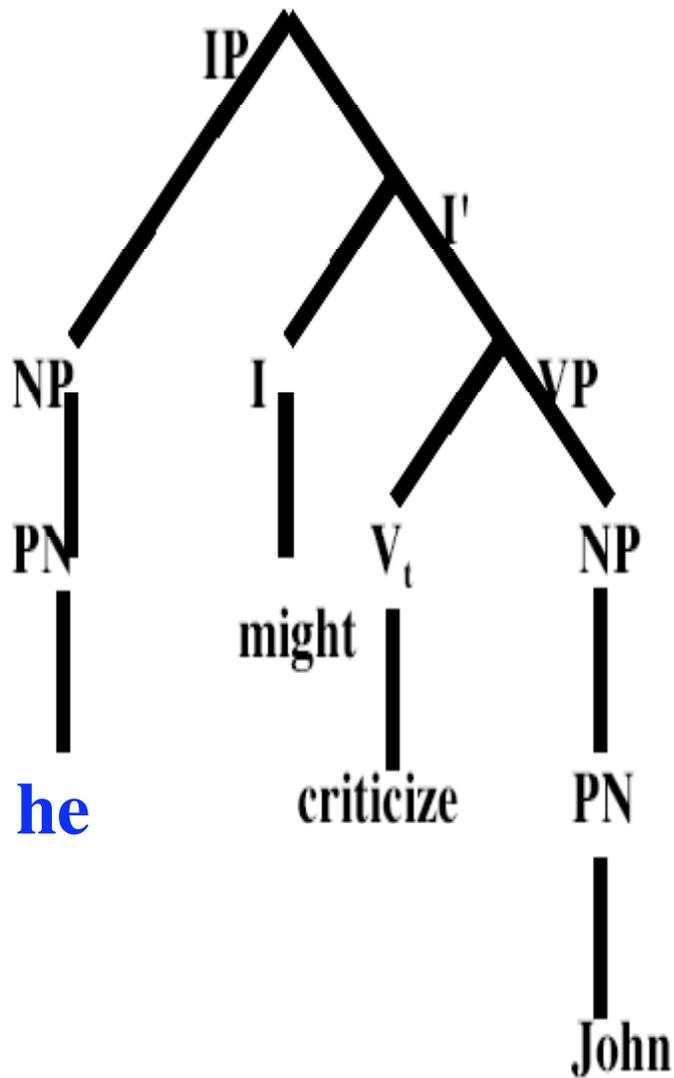
D → the, some, a, every, my, his, her...

V_i → sleep, run, snore, fall...

V_t → meet, date, hit, kill, criticize...

V_s → think, say, believe, claim...

C → that



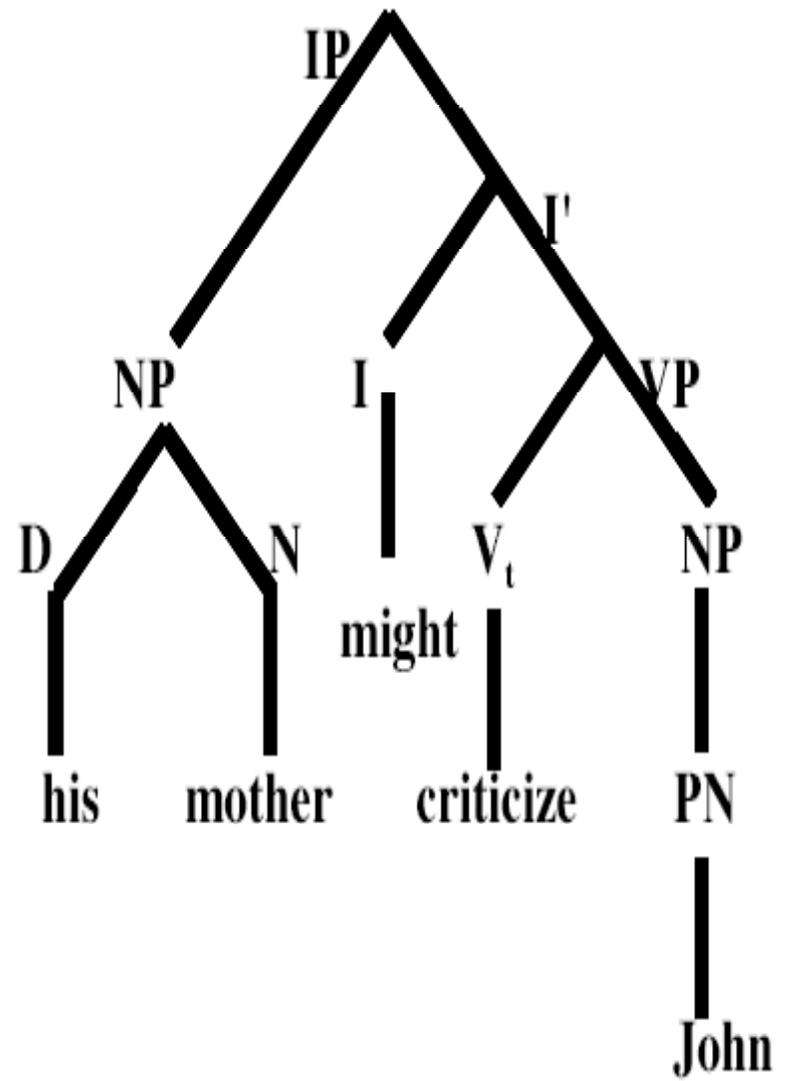
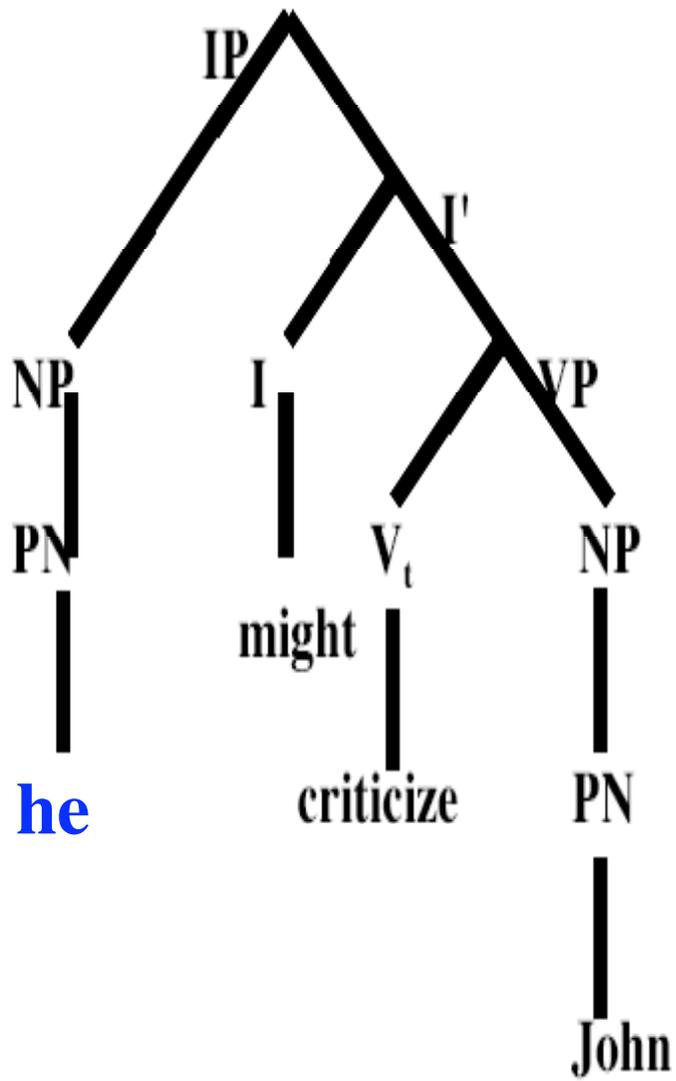
IP → NP I'

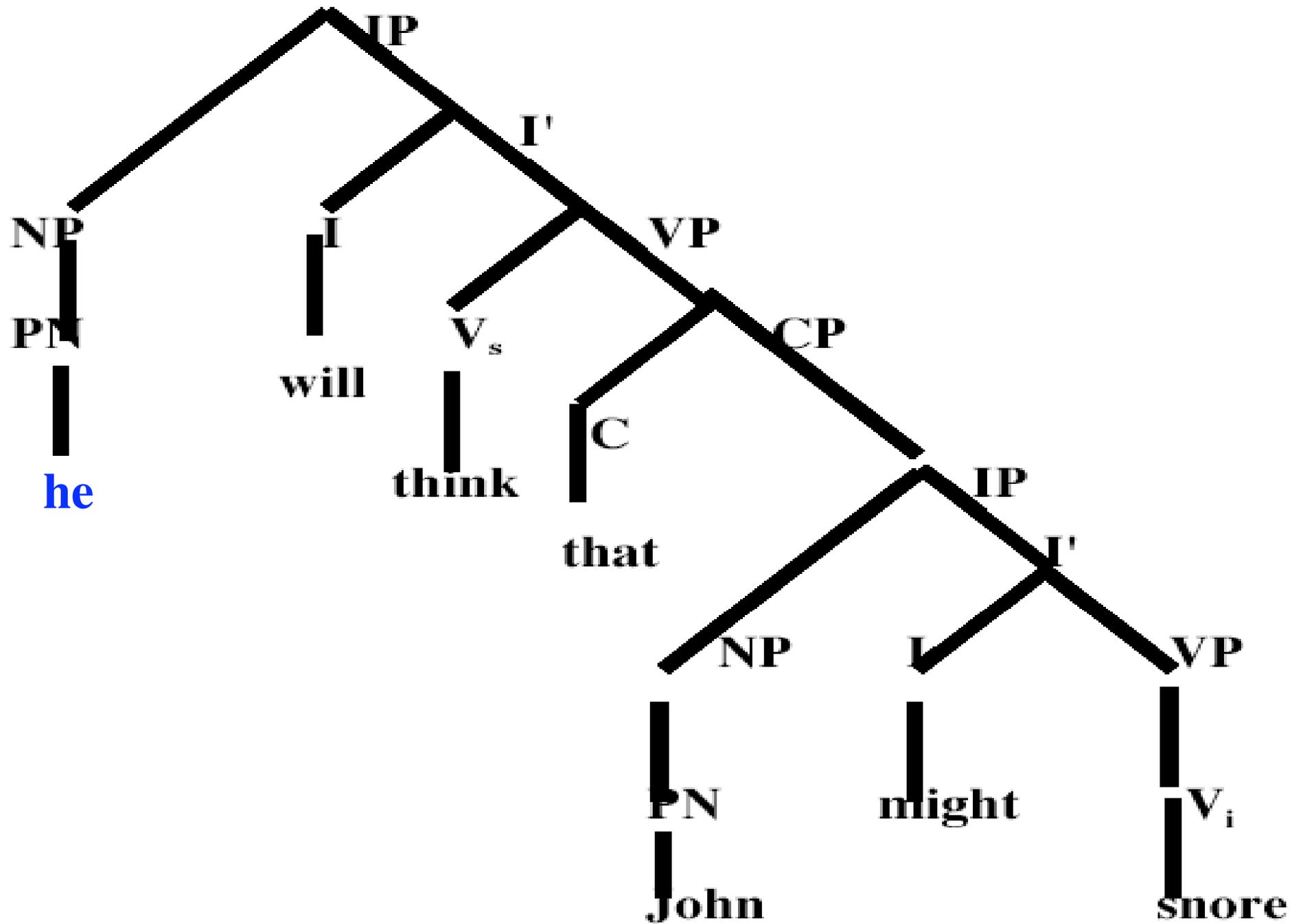
I' → I VP

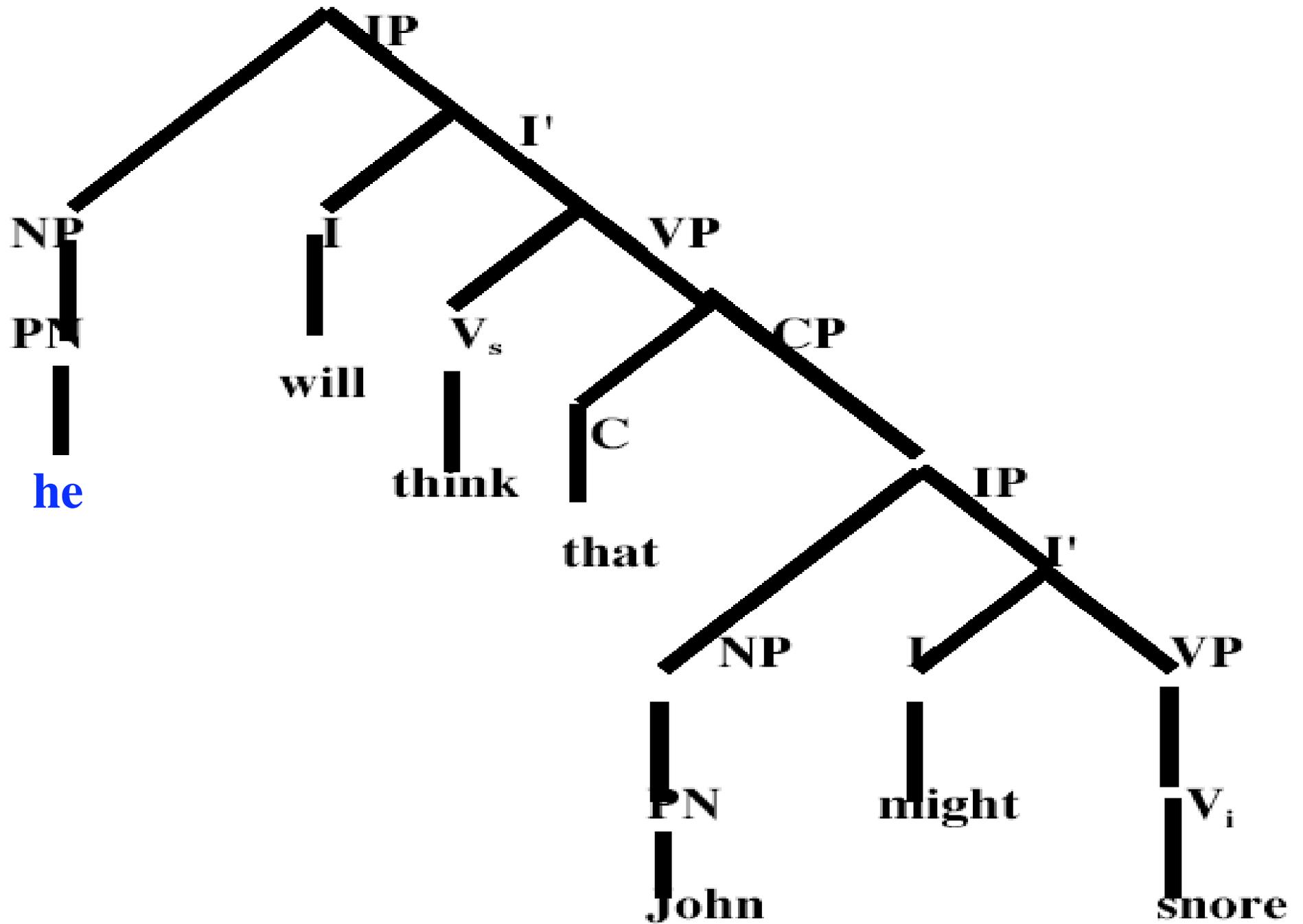
NP → PN, D N

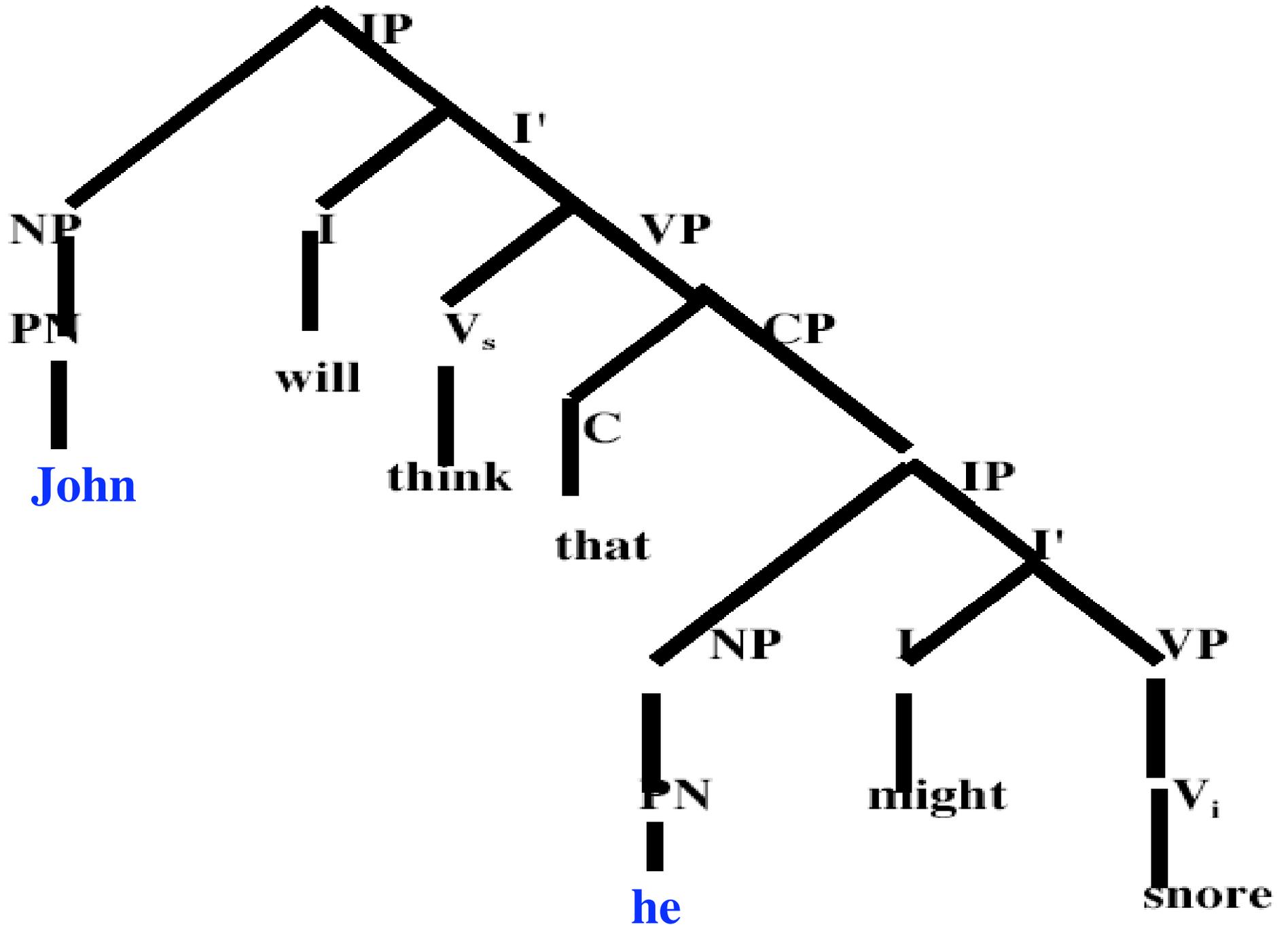
VP → V_i, V_t NP, V_sCP

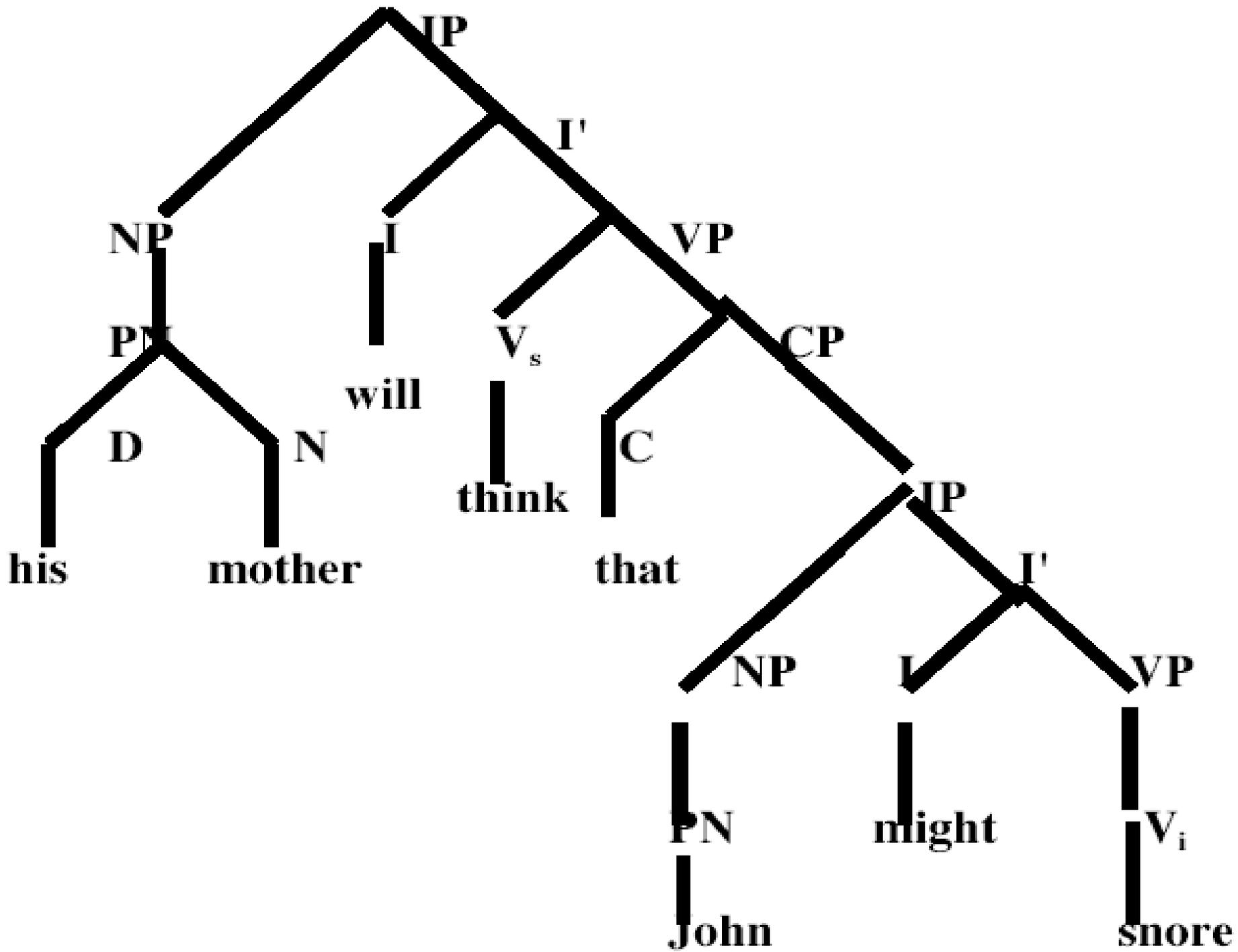
CP → C IP





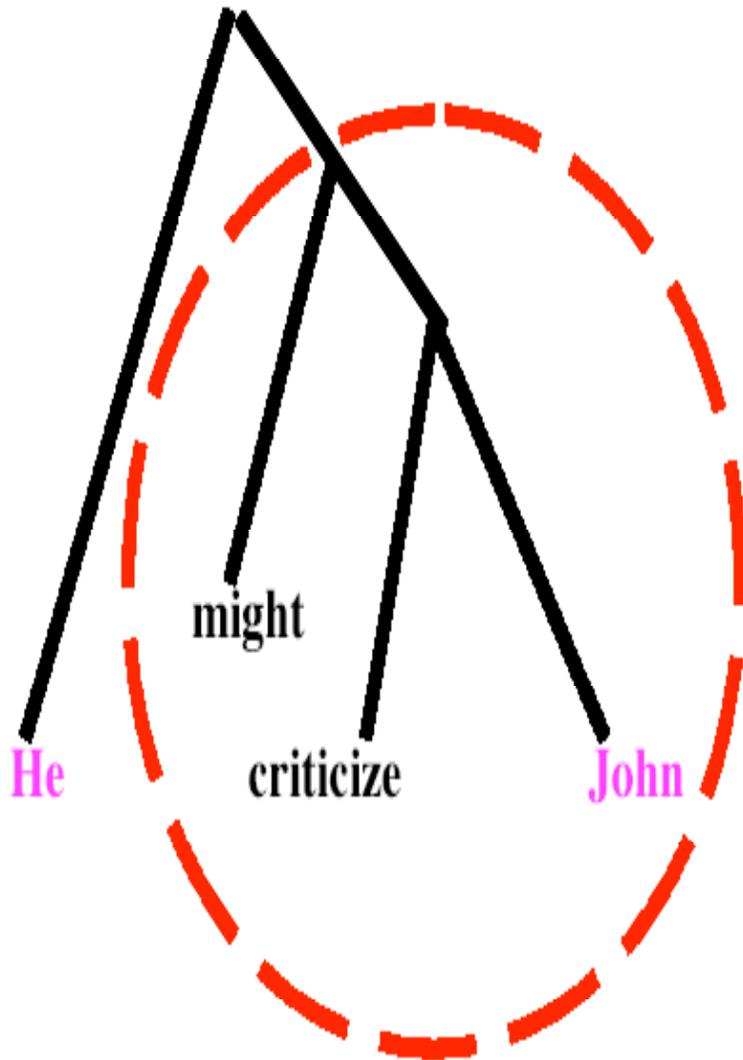




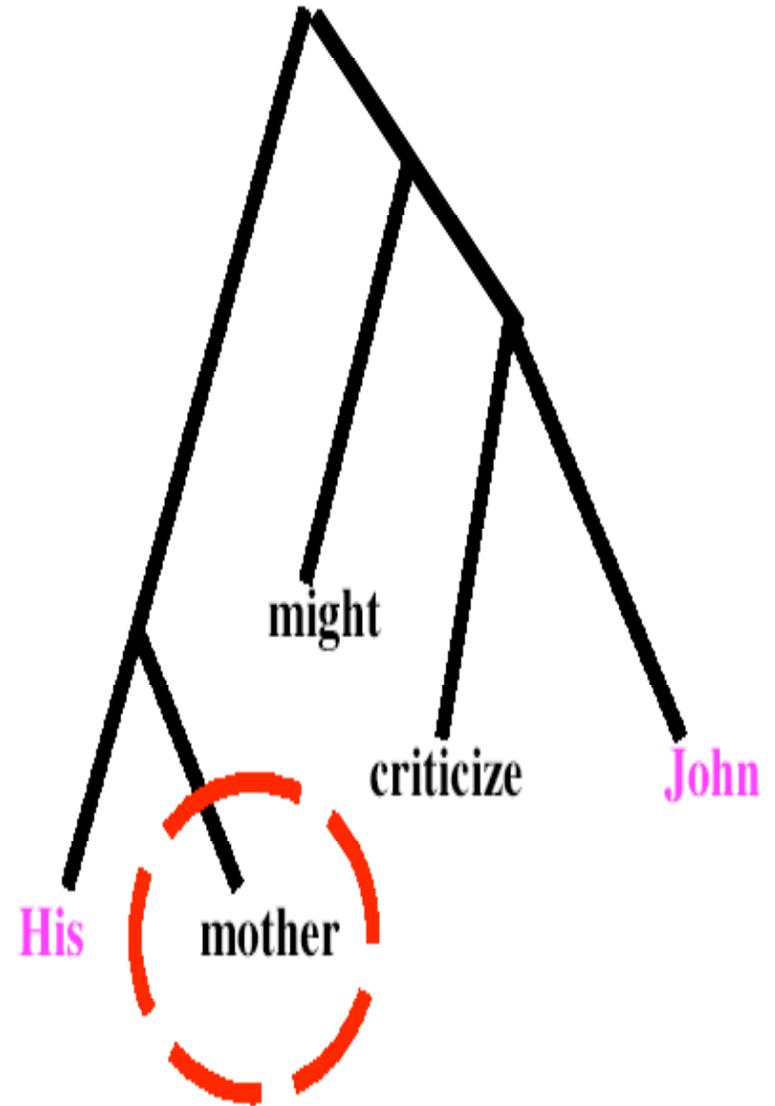
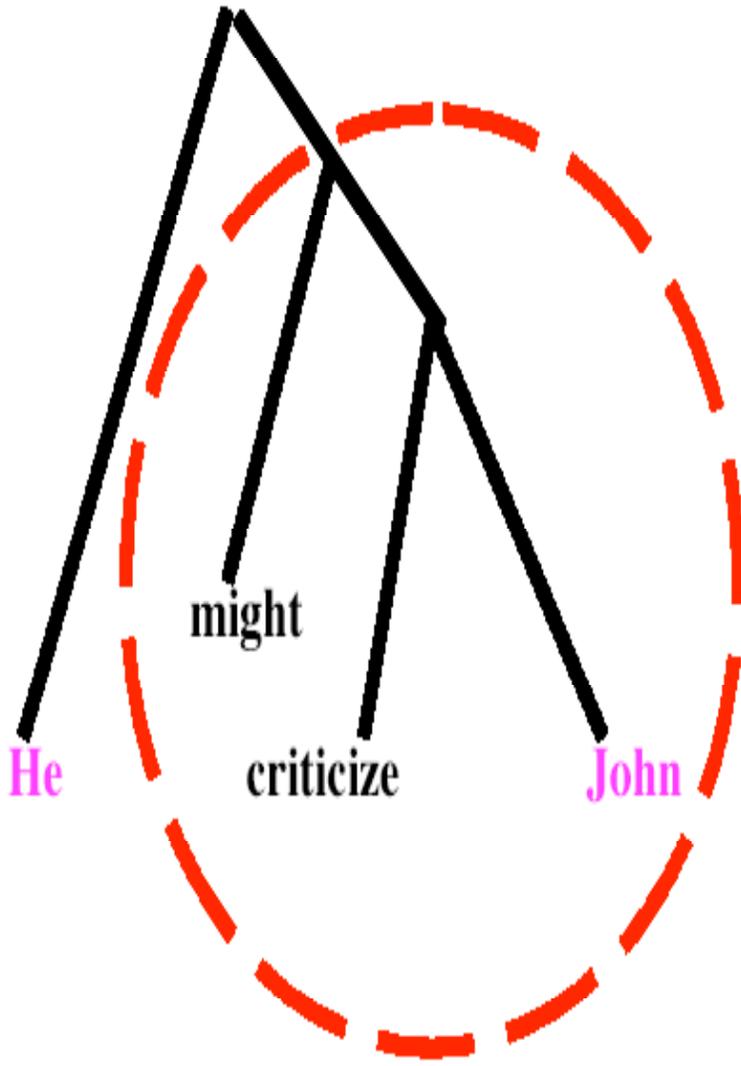


Condition C: Un nom propre (/une description) ne peut désigner la même chose qu'une expression dont le frère le domine.

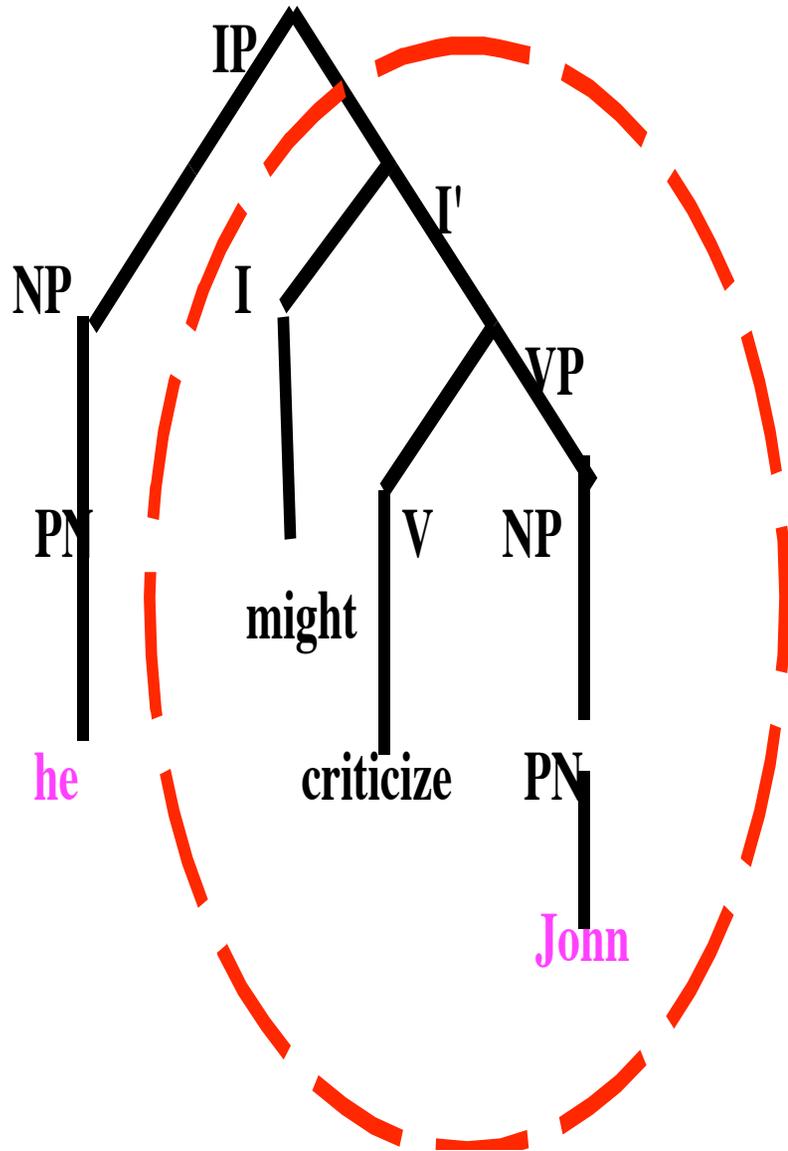
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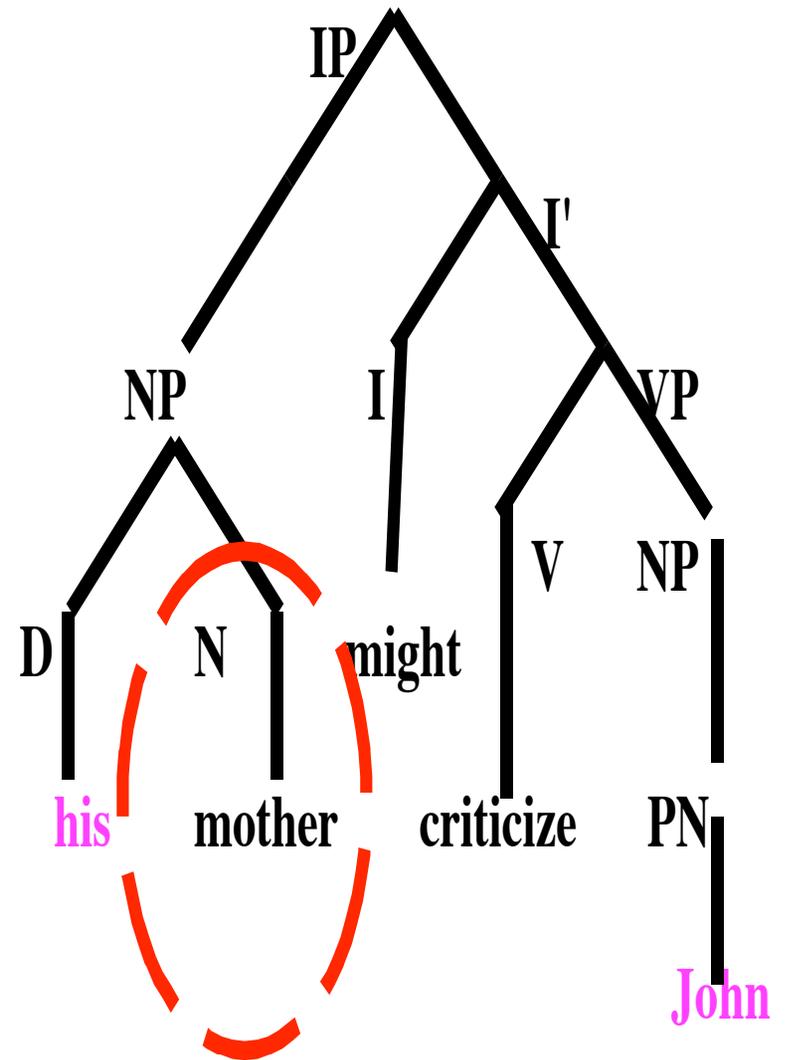
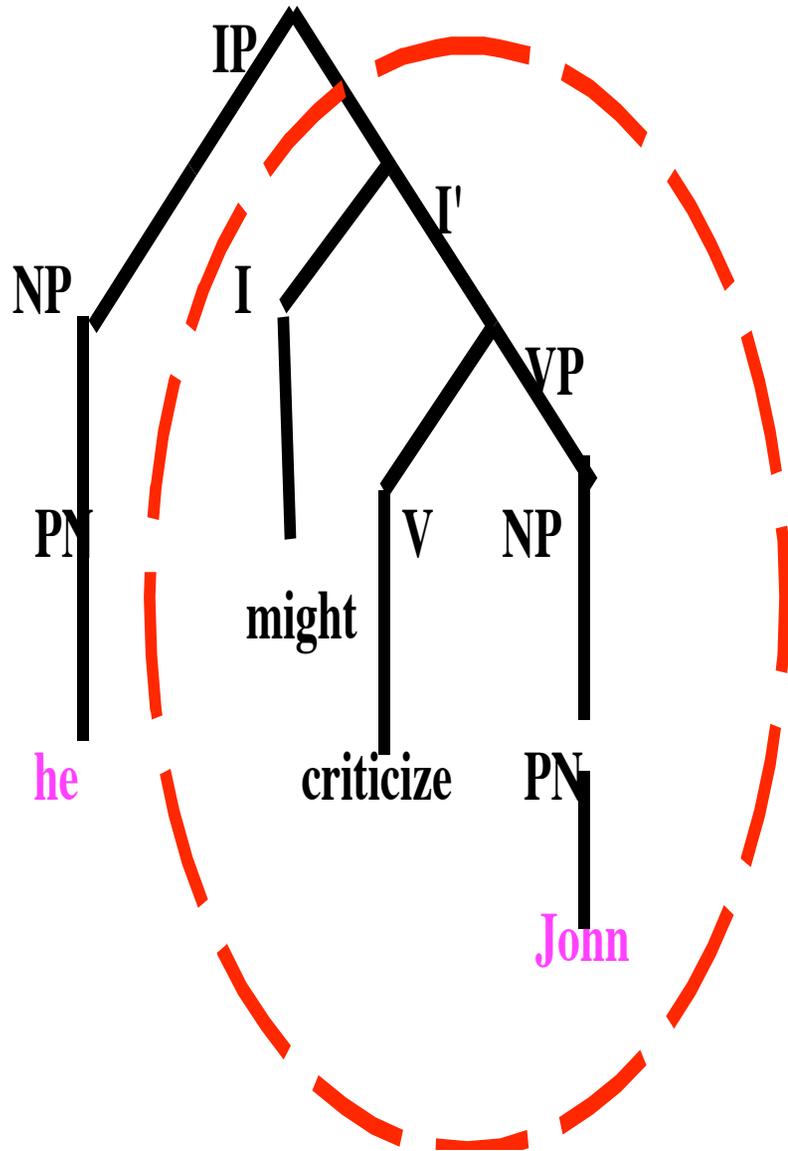
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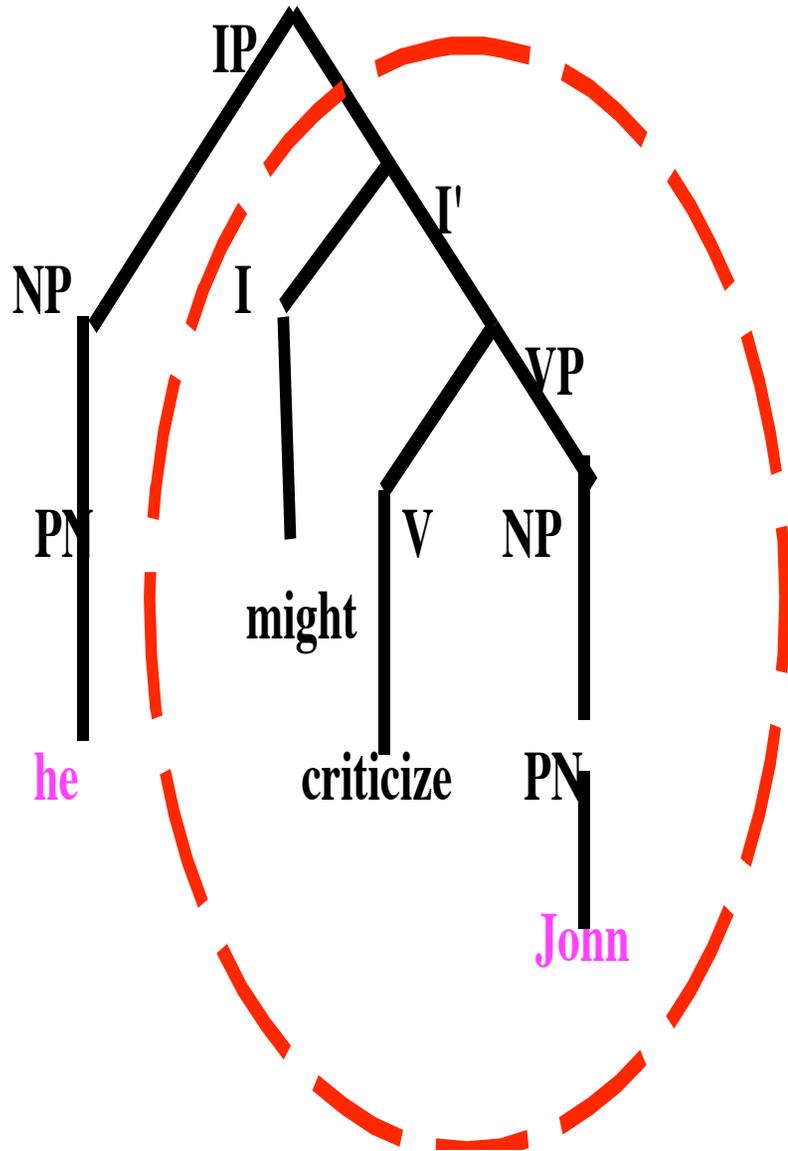
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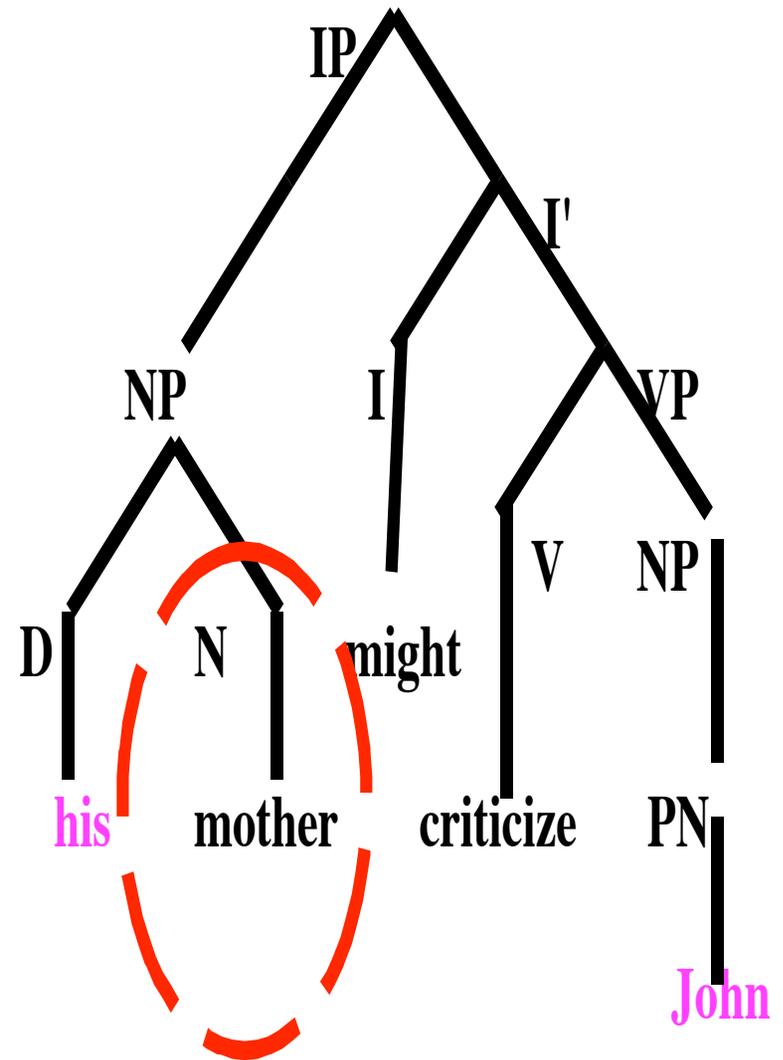
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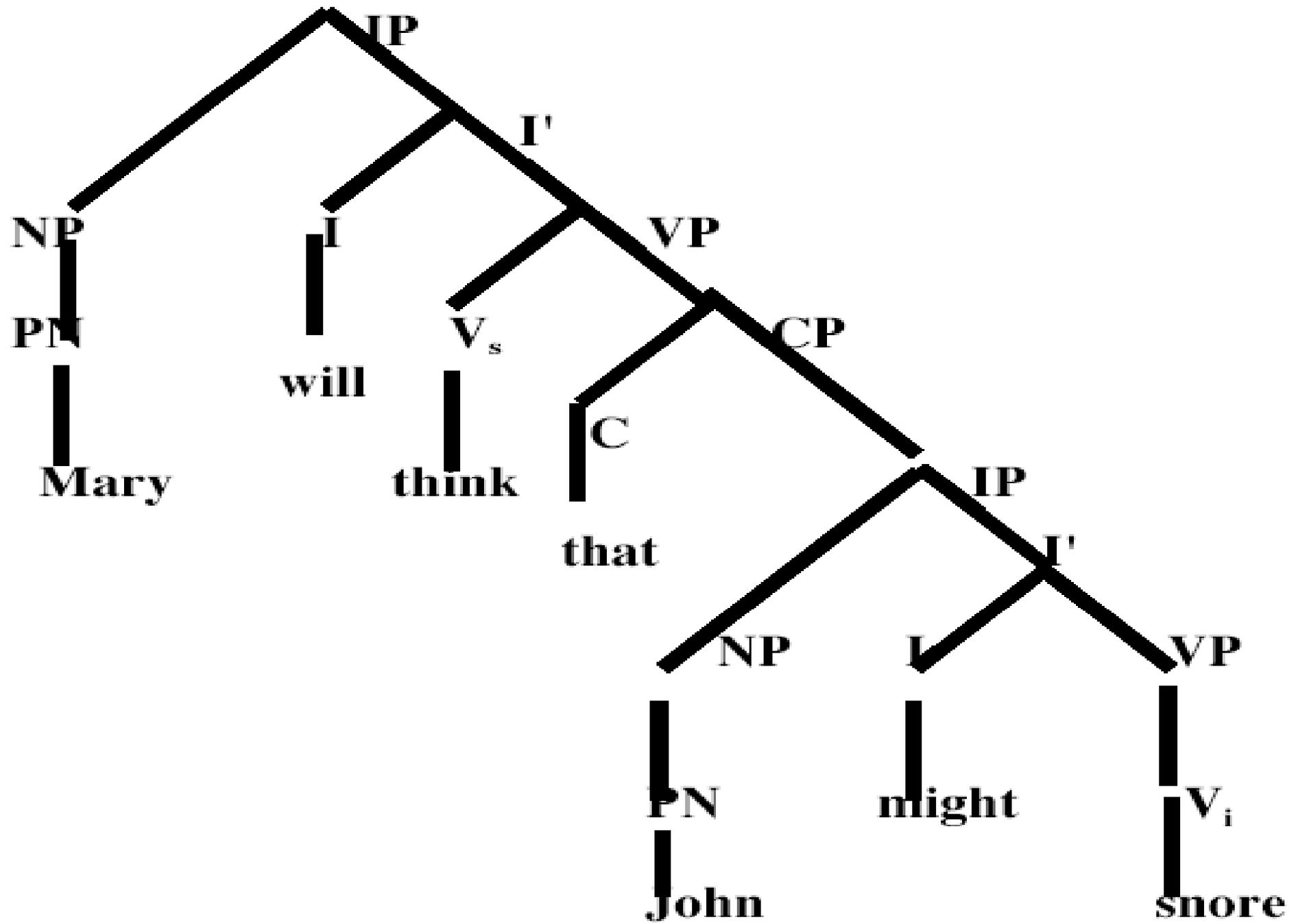
Condition C: Un nom propre (/une description) ne peut désigner la même chose qu'une expression dont le frère le domine.

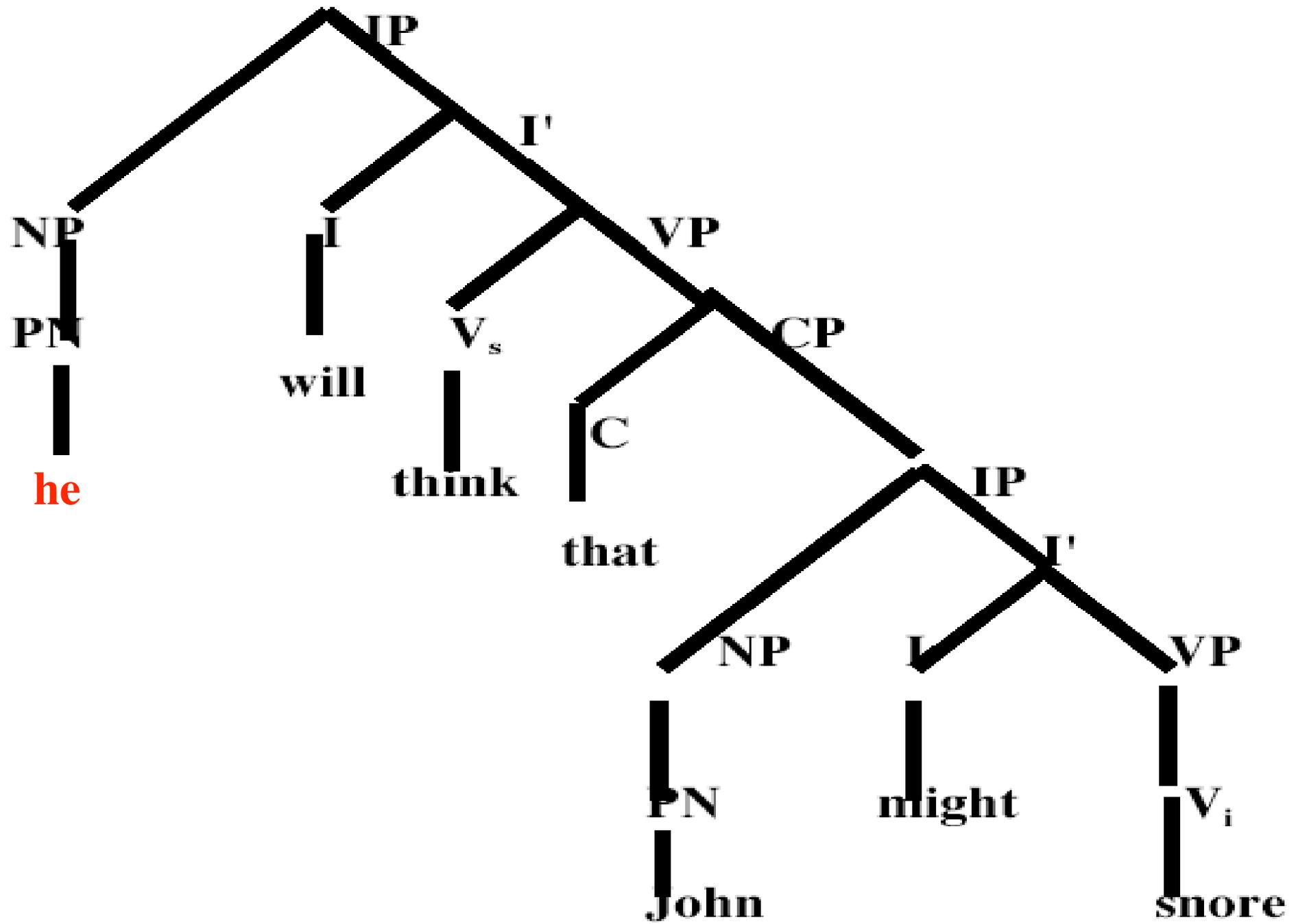


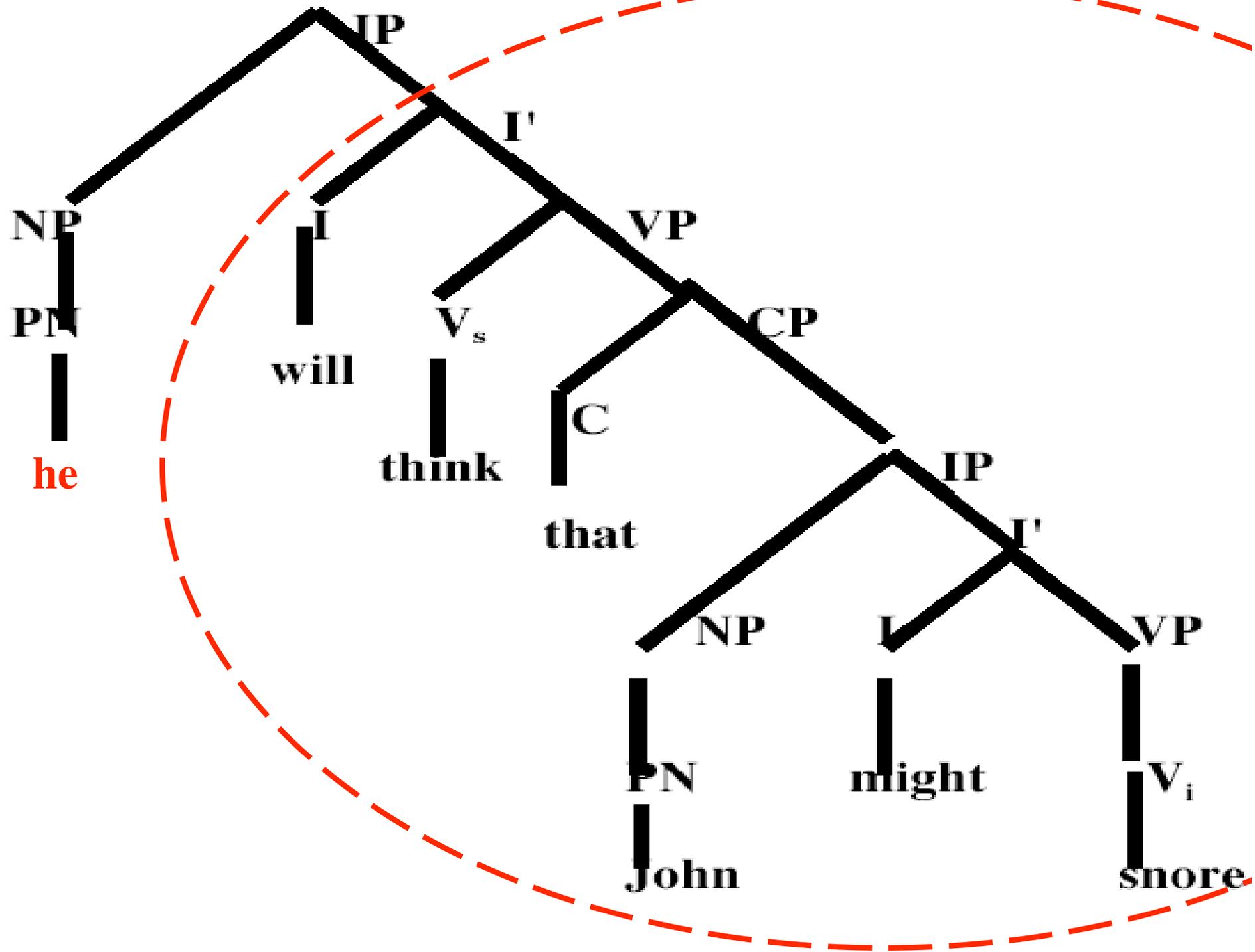
(1)

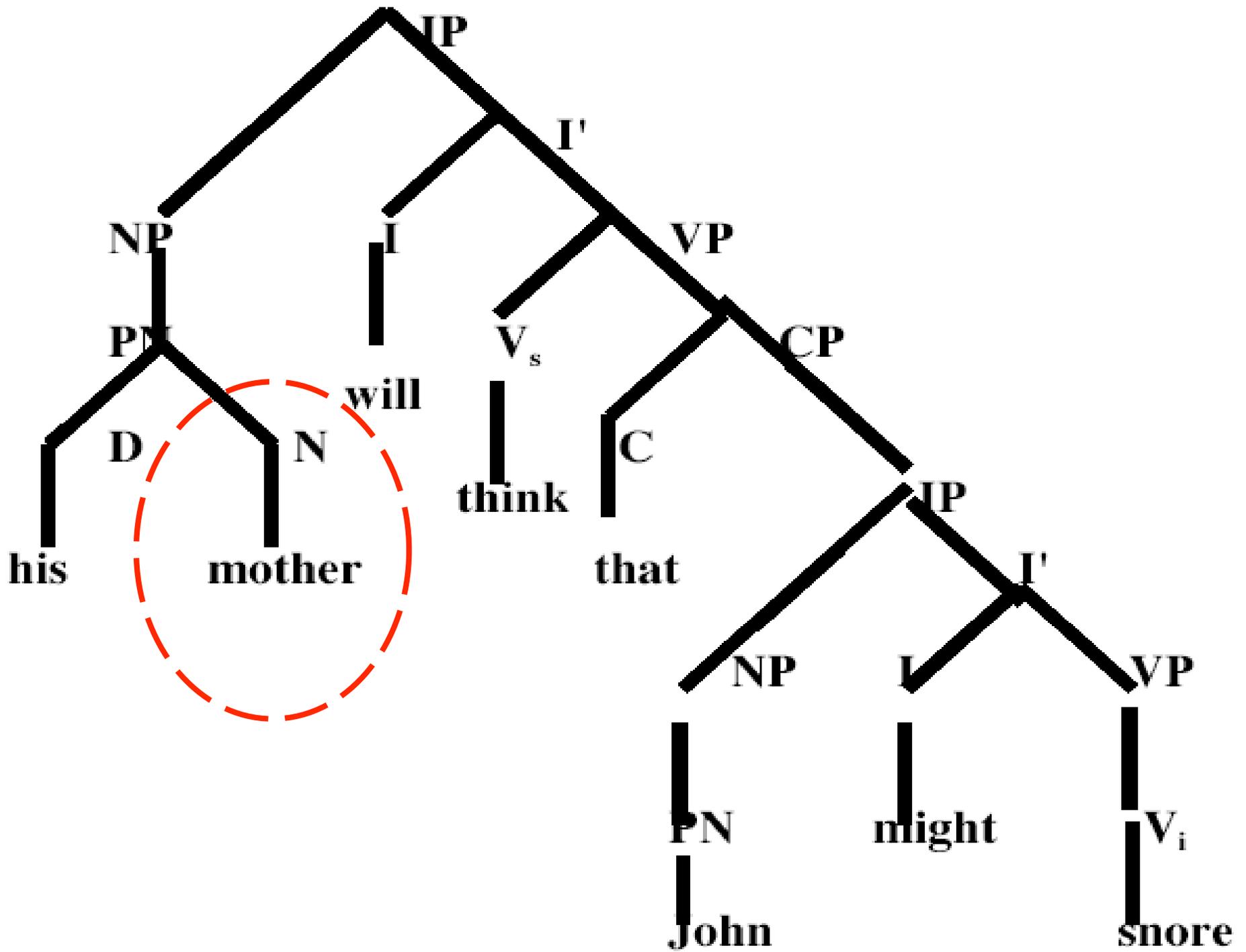


Un noeud non-branchant désigne la même chose que son fils!









B.3. INTERACTION

Condition C
(sens restreint par la structure)

&

Ambiguïtés de structure

Condition C & Ambiguïtés de Structure

- **Je vais discuter de ton problème avec Jean**
 - a. **Dans son bureau, je vais discuter de ton problème avec Jean.**
 - b. **En son absence, je vais discuter de ton problème avec Jean.**

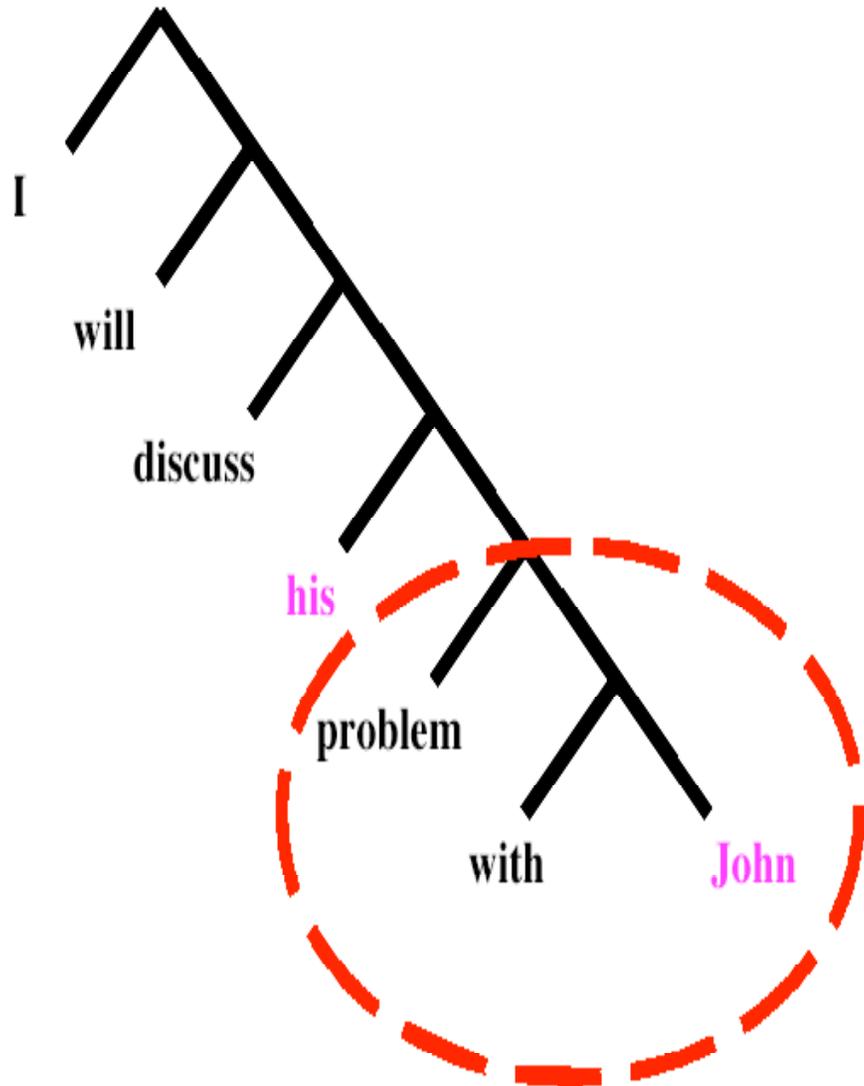
- **Ton problème avec Jean, je vais en discuter**

- **Je vais discuter de son problème avec Jean**
 - a. **Dans son bureau, je vais discuter de son problème avec Jean.**
 - b. ***En son absence, je vais discuter de son problème avec Jean.**

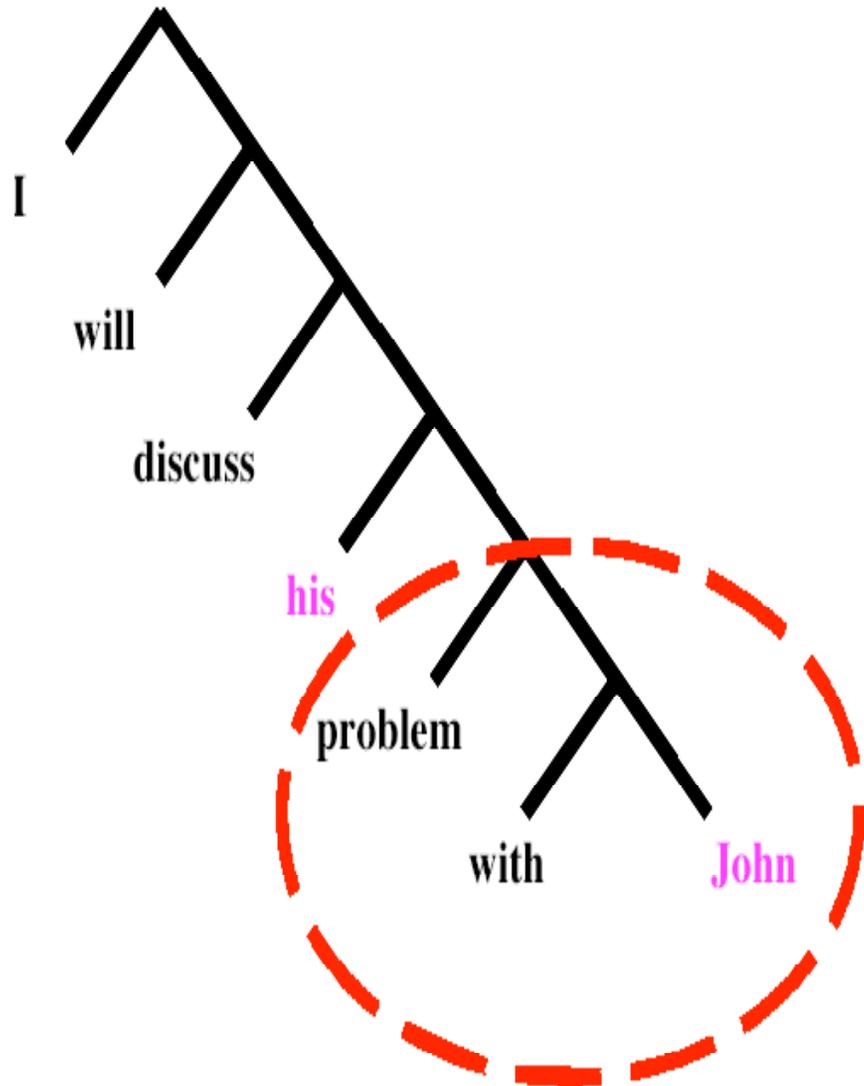
Condition C & Ambiguïtés de Structure

- I will discuss his problem with John

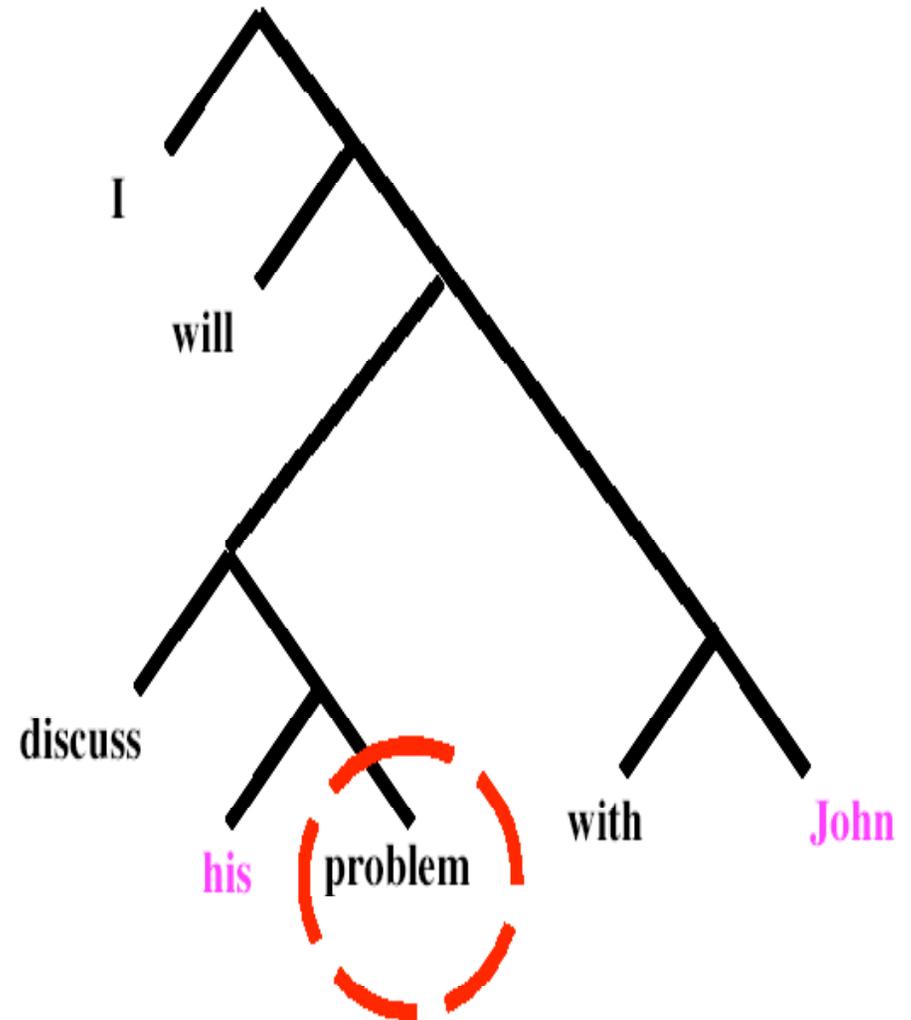
Reading 1: Bill has a problem with John. I'll discuss it



Reading 1: Bill has a problem with John. I'll discuss it



Reading 2: Bill has a problem. I'll discuss it with John



B.4. L'Acquisition de la Condition C: Approche Expérimentale

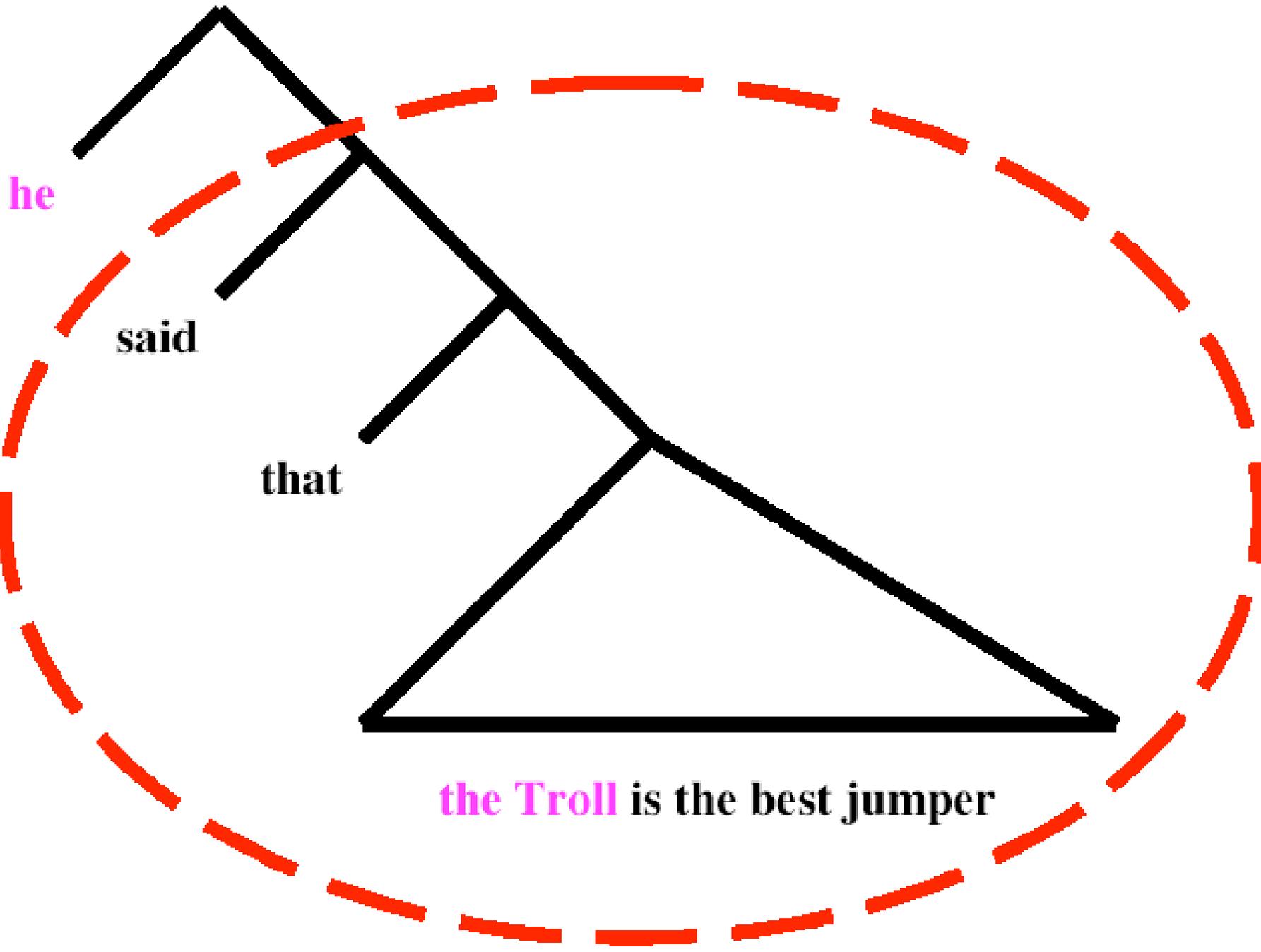
(S. Crain & collaborateurs, U. Maryland)

L'expérience doit:

(i) être divertissante

**(ii) ne pas forcer les enfants à corriger un adulte ->
marionnettes**

**(iii) expliquer que parfois la marionnette ne fait pas
attention et se trompe**



he

said

that

the Troll is the best jumper

The Jumping Competition



The characters and the set-up are introduced to the child and the puppet

[Courtesy of Stephen Crain & co-workers, U. of Maryland]

The Prize for the Best Jumper



The judge, Robocop, introduces the prize: colored pasta!

[Courtesy of Stephen Crain & co-workers, U. of Maryland]

The First Contestant: Cookie Monster



Robocop: You go first, Cookie Monster.

Cookie Monster: OK, here I go. I made the log! Oh no, I crashed into the barrels... Now let me try the benches....

[Courtesy of Stephen Crain & co-workers, U. of Maryland]

The Second Contestant: The Troll

The troll clears the course successfully



Robocop: Your turn next, Troll.

Troll: OK, I'm a good jumper. This should be easy for me. Over the log I go! Yeah! Now the barrels. All right! Now the benches. Good, I didn't knock anything over.

[Courtesy of Stephen Crain & co-workers, U. of Maryland]

The Final Competitor

Grover clears the obstacles cleanly, in record time



Robocop: OK, Grover. Your turn.

Grover: I'm a good jumper. Watch me! See how easily I could jump over the log? Now I'll jump over the barrels and benches. Great. I didn't smash into anything, and I was really fast.

[Courtesy of Stephen Crain & co-workers, U. of Maryland]

Judging The Competition



Robocop: Line up, guys! I'm ready to judge the competition. Let's see who wins the colored pasta.

[Courtesy of Stephen Crain & co-workers, U. of Maryland]

Cookie Monster's Performance is Judged



Robocop: Cookie Monster, I'm afraid you aren't the winner. You crashed into the barrels. I think you've been eating too many cookies. Lose some weight, and you will be a better jumper.

[Courtesy of Stephen Crain & co-workers, U. of Maryland]

The Troll's Performance is Judged

Possible Outcome: The troll could be the best jumper
At this point, it is plausible that the assertion is true.



Robocop: Troll, you jumped very well. You didn't crash into anything. You could be the winner. But let me judge Grover before I decide...

[Courtesy of Stephen Crain & co-workers, U. of Maryland]

Grover's Performance is Judged

The **actual outcome** unfolds



Robocop: Grover, your jumps were very good. You didn't knock anything over, and you were very fast. I think you win the prize. Great job, Grover!

[Courtesy of Stephen Crain & co-workers, U. of Maryland]

The Troll Contests the Judge's Decision

The meaning ruled out by Principle C is presented



Troll: It's not fair, Robocop! I think I should get the prize. I think I was the best jumper. I'm going to take some colored pasta for myself.

[Courtesy of Stephen Crain & co-workers, U. of Maryland]

Kermit the Frog describes the Story

The characters are placed alongside the props to provide a reminder of the events that took place.



Kermit: Let me try to say what happened. That was a story about Robocop, who was the judge, and Cookie Monster, and Grover, and the Troll. I know one thing that happened. He said that the Troll was the best jumper.

◆ **Hypothèse 0: Pas de connaissance de la Condition C**

■ Prédiction de l'Hypothèse 0

- a. Ok He_i said that [the Troll]_i was the best jumper
- b. Ok He_i said that [the Troll]_k was the best jumper

◆ **Hypothèse 1: connaissance de la Condition C**

■ Prédiction de l'Hypothèse 1

- a. * He_i said that [the Troll]_i was the best jumper
- b. Ok He_i said that [the Troll]_k was the best jumper

The Child Tells Kermit if he was Right or Wrong

Notice the child thinks Kermit is the one who is being judged....



Child: No!

Kermit: No? Then what really happened?

[Courtesy of Stephen Crain & co-workers, U. of Maryland]

The Child's Explanation of the Events

This informs the experimenter if the child is saying "No" for the right reason



Child: Grover was the best jumper, not the Troll.

Kermit: Then why does the Troll have some pasta?

Child: Because he thought he was the best jumper, but the judge didn't think so.

[Courtesy of Stephen Crain & co-workers, U. of Maryland]

Kermit Sees the Light



Kermit: OK, I see. I guess I don't get the watermelon this time. Oh well, I'll eat the cherries. Cherries are good.

[Courtesy of Stephen Crain & co-workers, U. of Maryland]

Summary

He said that the Troll was the best jumper

***Meaning1:** The Troll said he was the best jumper.

-this was true in the story, so if children get this meaning, they would say Kermit is right.

Meaning 2: Robocop said that the Troll was the best jumper.

-this was false in the story, so if children are like adults, and get only this meaning, they would say Kermit is wrong.

**Sentences that the child would
accept WITHOUT Condition C
(=LESS restrictive grammar)**

**Sentences that the child would
accept WITH Condition C
(=MORE restrictive grammar)**