Psycholinguistics: Syntax III

9.59; 24.905

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Syntax lectures

1. Lecture 1
    1. Parts of speech
    2. Constituent structure
    3. **Argument structure** of words

2. Lecture 2
    1. Argument structure of words (continued)
    2. Cross-linguistic word order differences
    3. Arguments vs. Modifiers: **X-bar theory**

3. Lecture 3
    1. The categories Infl and Comp
    2. Constructions
        1. Yes-no questions
        2. Wh-questions
        3. Topicalization
        4. Relative clauses
        5. Passive
    3. Practice sentences

Syntax lectures

4. Lecture 4
    1. Representational issues
        1. Finite state transition networks?
        2. Trees?
        3. Empty categories?
    2. Sentence parsing

X-bar Theory

The structure of an X-bar category, including modifiers:
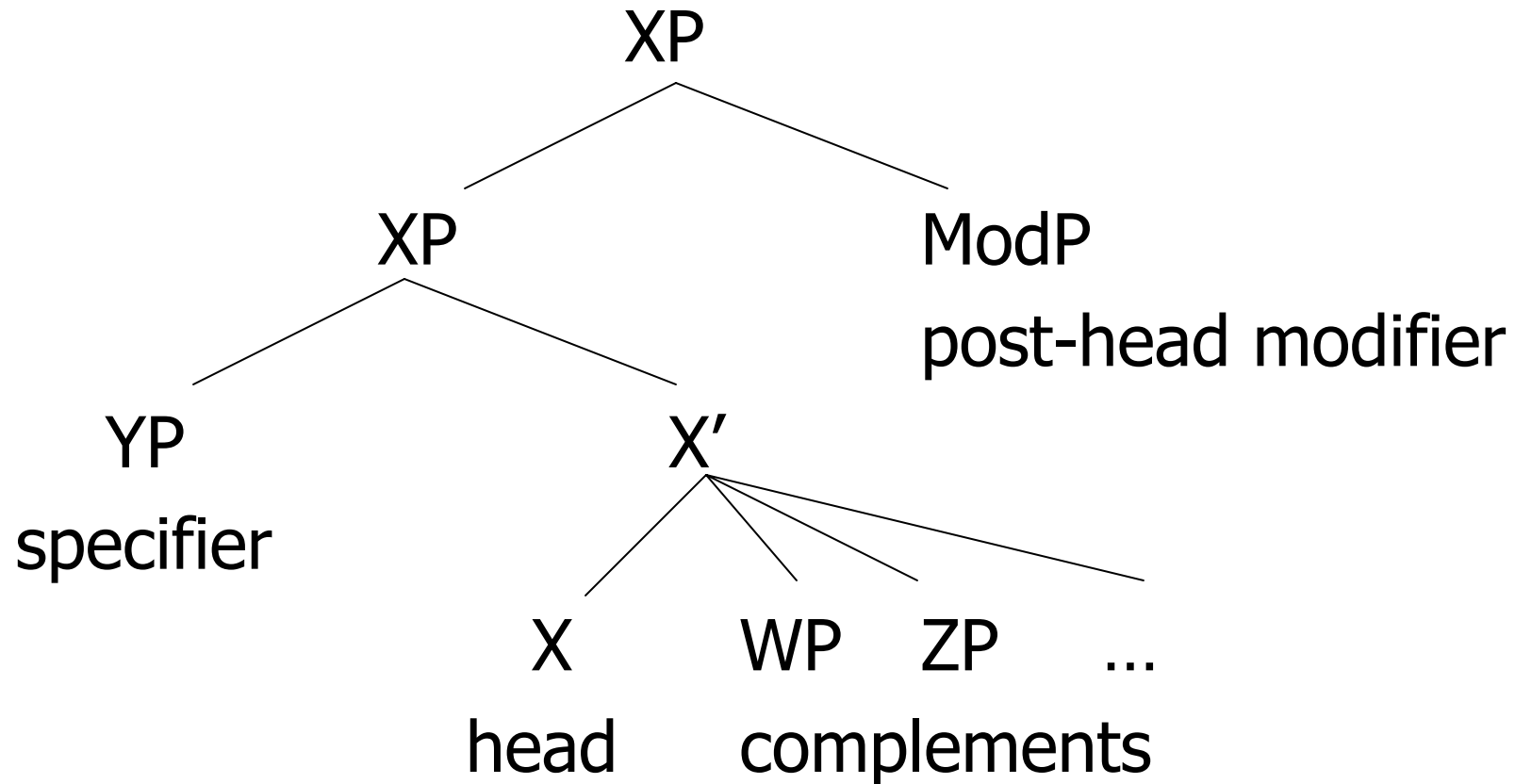
X-bar Theory

X-bar: A general notation for all phrase structure.

Note: X-bar may be **wrong**.

Reasons to know it:

➢ It is simple.

➢ It is general: It covers all of phrase structure.

➢ It provides a notation for important phrase structure generalizations (which are probably correct): Arguments vs. modifiers.

X-bar Theory

X-bar rules (English word order):

Complement rule: X′ → X WP*
Specifier rule: XP → YP X′

Modifier rules:
Post head: XP → XP ZP; X′ → X′ ZP
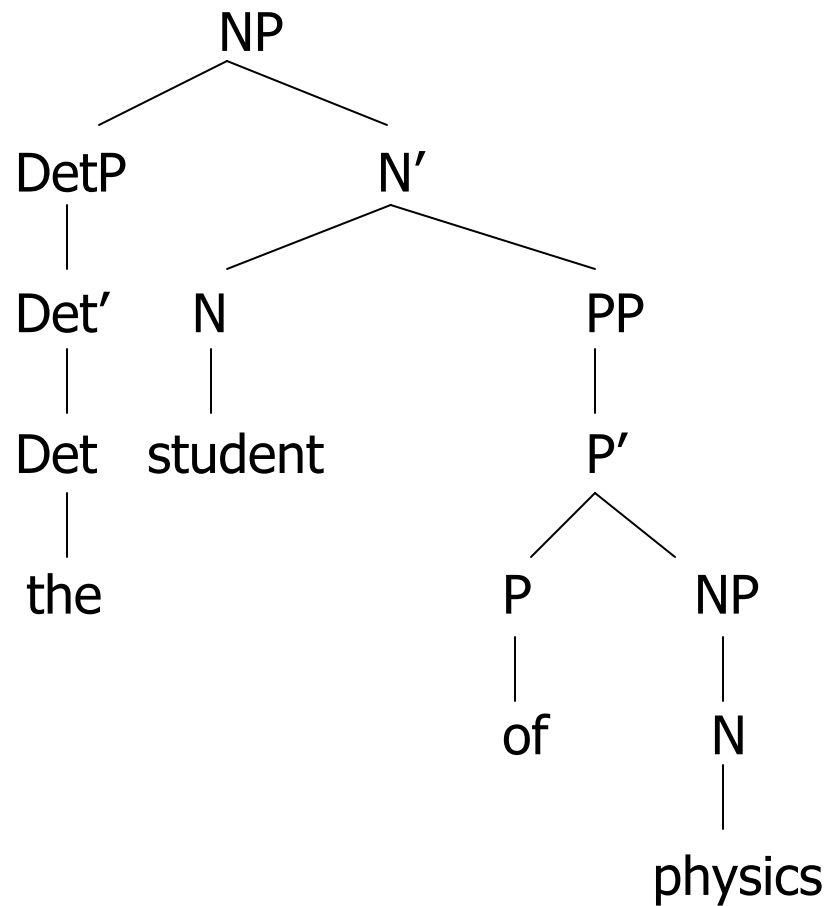Pre-head: XP → ZP XP; X′ → ZP X′

Examples: X-bar structures of NPs

More complex NPs: "the student of physics"

(Note: "of physics" is an argument, because it is part of the core meaning of "student" that a student studies something.)

Examples: X-bar structures of NPs

More complex NPs: "the student of physics"

```
                    NP
              ╱          ╲
          DetP            N′
            │          ╱      ╲
          Det′       N         PP
            │        │          │
          Det     student      P′
            │                ╱     ╲
           the             P        NP
                           │         │
                           of        N
                                     │
                                  physics
```
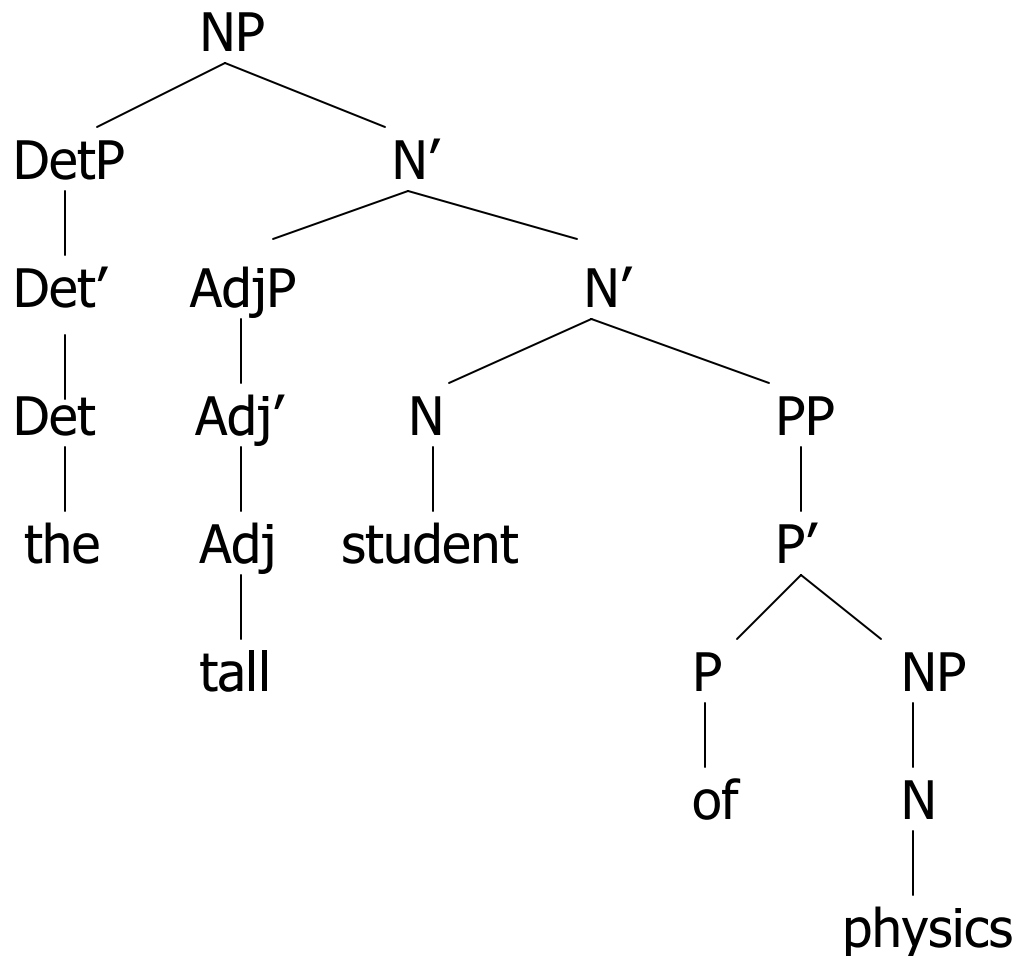
Examples: X-bar structures of NPs

More complex NPs: "the tall student of physics"
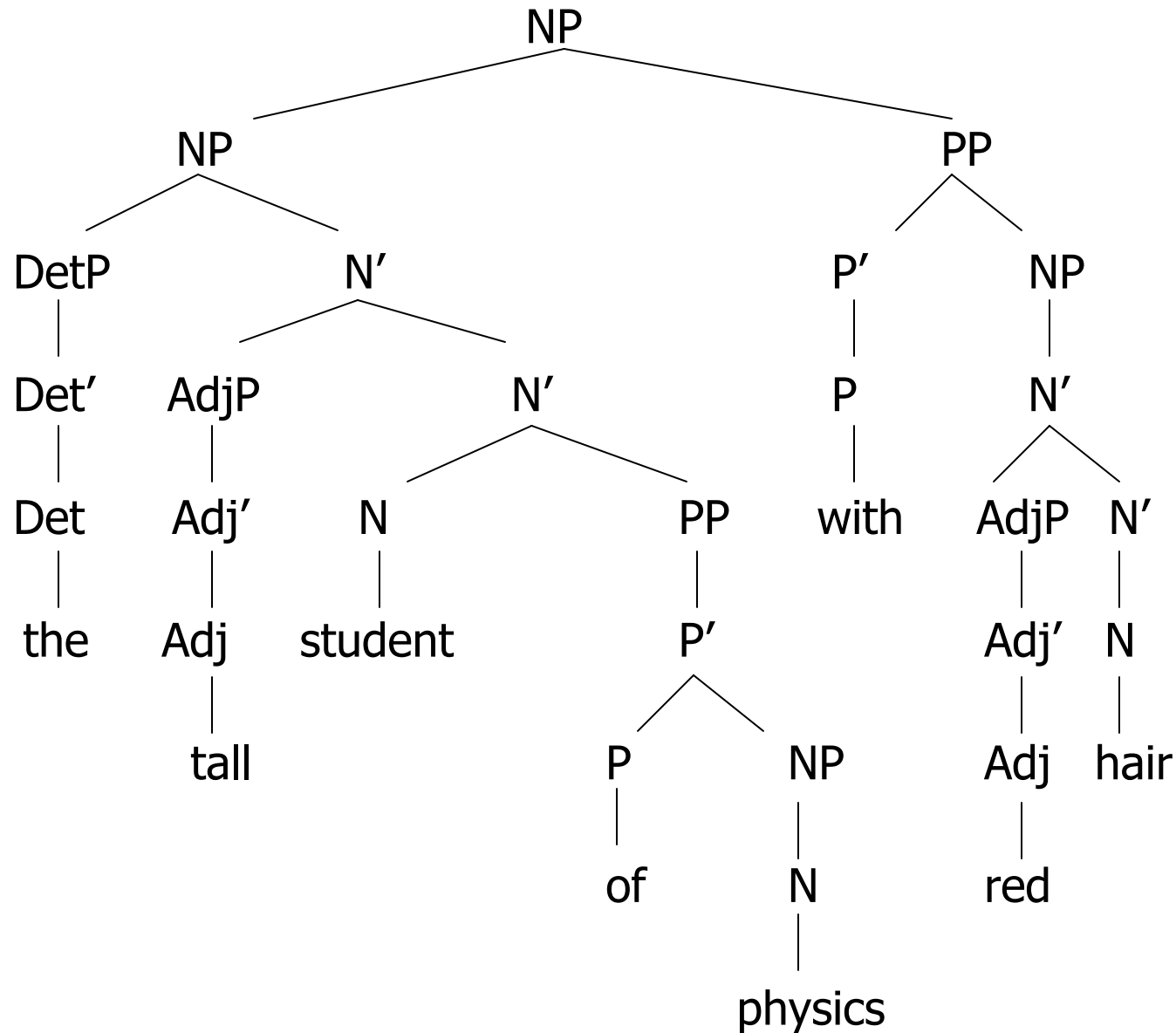
Examples: X-bar structures of NPs

More complex NPs: "the tall student of physics"

```
                      NP
            _____
         DetP                      N'
          |              _____
        Det'    AdjP                        N'
          |      |                 _____
         Det    Adj'         N                      PP
          |      |           |                       |
         the    Adj       student                   P'
                 |                             _____
                tall                          P          NP
                                              |           |
                                              of          N
                                                          |
                                                       physics
```

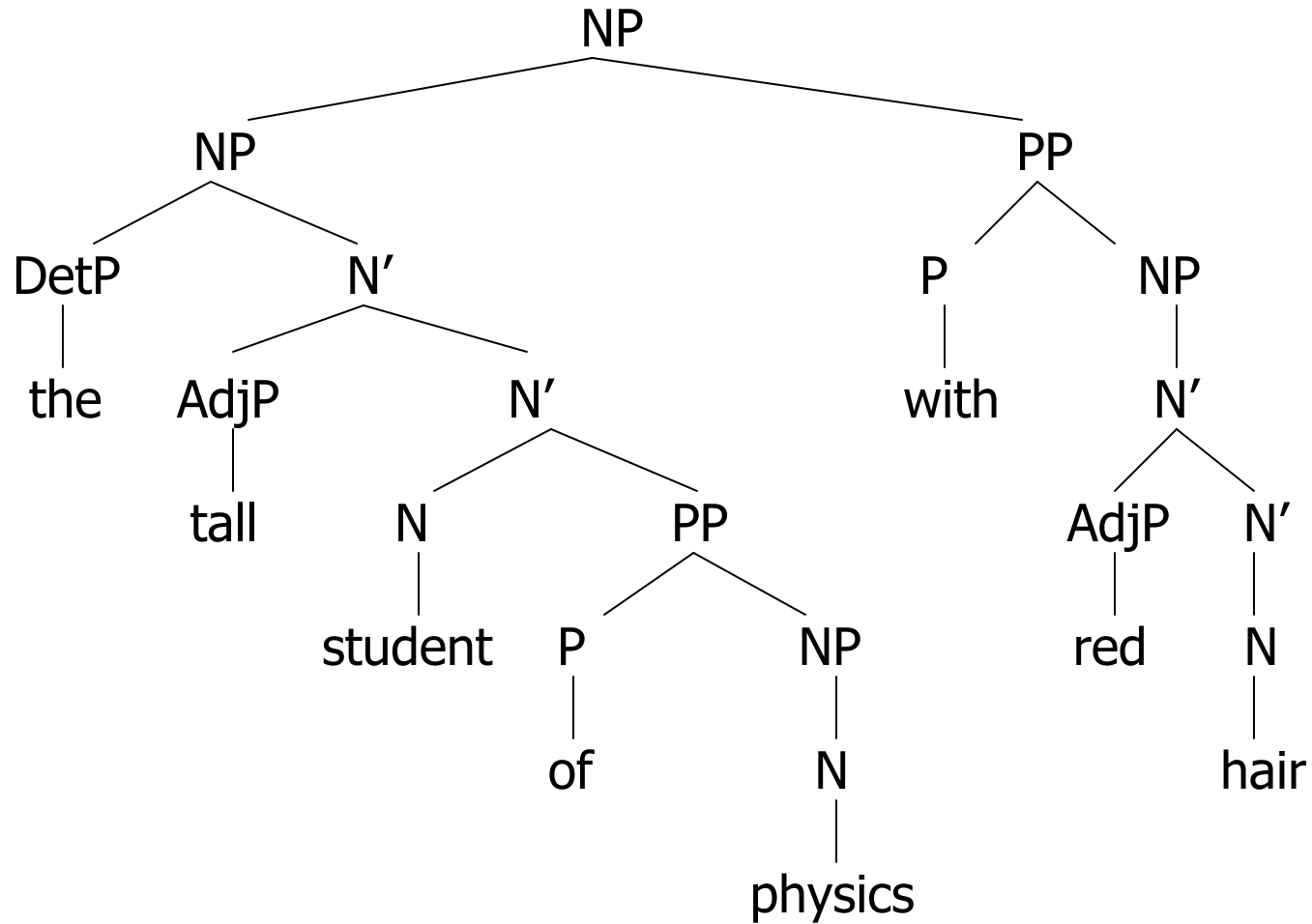More complex NPs: "the tall student of physics with red hair"

Note: "with red hair" is a modifier. It is not a necessary component of the meaning of "student".

More complex NPs: "the tall student of physics with red hair"

More complex NPs: "the tall student of physics with red hair"
Omitting redundant non-branching nodes

More complex NPs: "the tall student of physics with red hair"
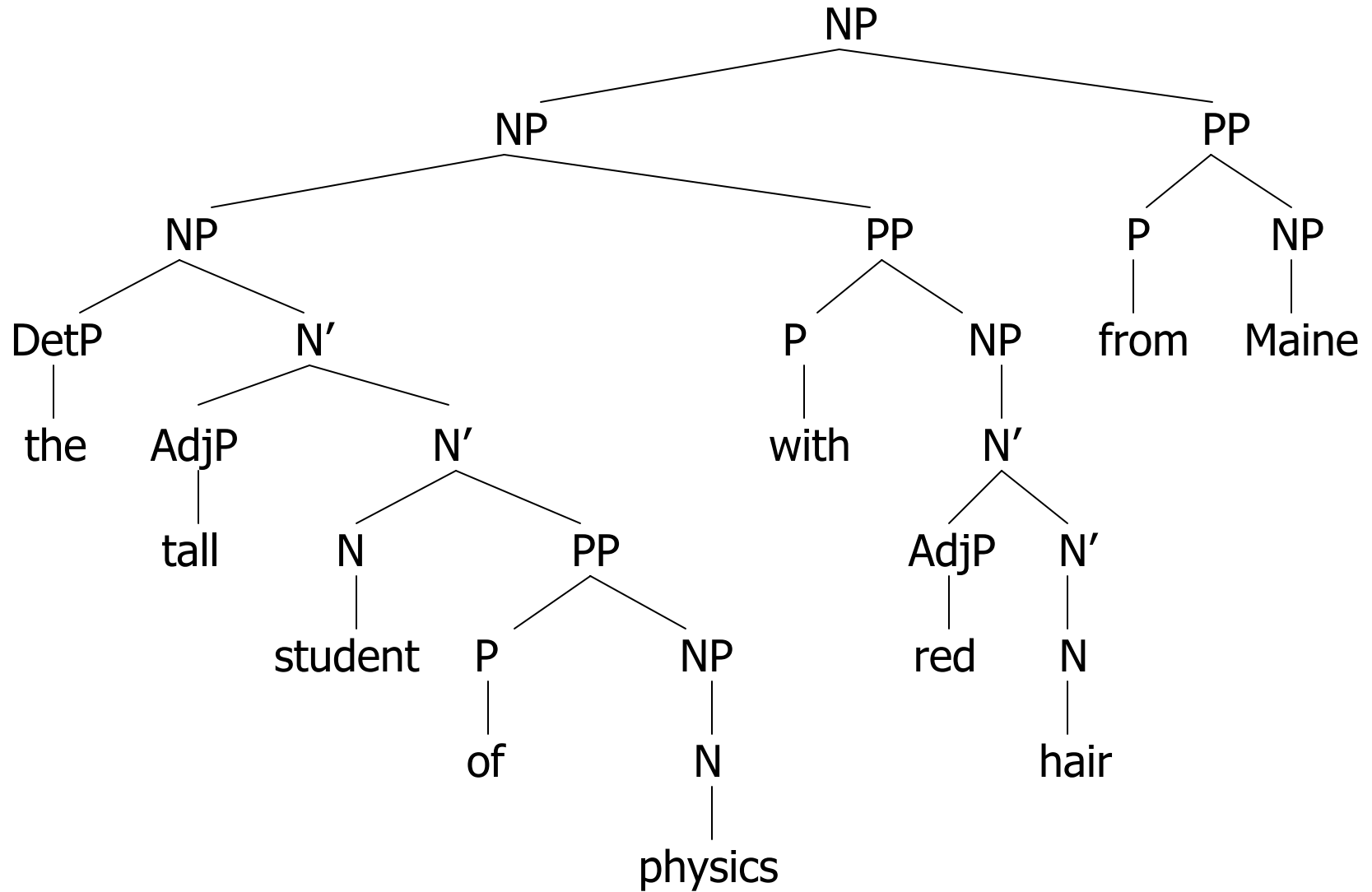## Omitting redundant non-branching nodes

More complex NPs:
"the tall student of physics with red hair from Maine"

More complex NPs:
"the tall student of physics with red hair from Maine"

The category Infl

Note that the expansion of the category "S" / "IP" does not follow X-bar theory:

S → NP (Infl) VP

X-bar theory: Every category has a head and a maximal projection. This is not true for the above rule.

Proposal for the head of S: Infl is the head; IP is the maximal projection. (Chomsky, 1986). Infl contains tense and agreement information.

Specifier of IP: NP
Complement of Infl: VP

IP → NP I'
I' → Infl VP

The category Infl

When an auxiliary verb is present, it acts like the head of IP.

1. It determines the agreement with the subject (specifier):

John has seen Mary.
* John have seen Mary.

2. It determines the form of the VP to follow:

John will see Mary.
*John will sees (saw, seen, seeing) Mary.

John is seeing Mary (progressive).
John is seen (by Mary) (passive).
* John is see, sees, saw.

Structure for "John will see Mary"
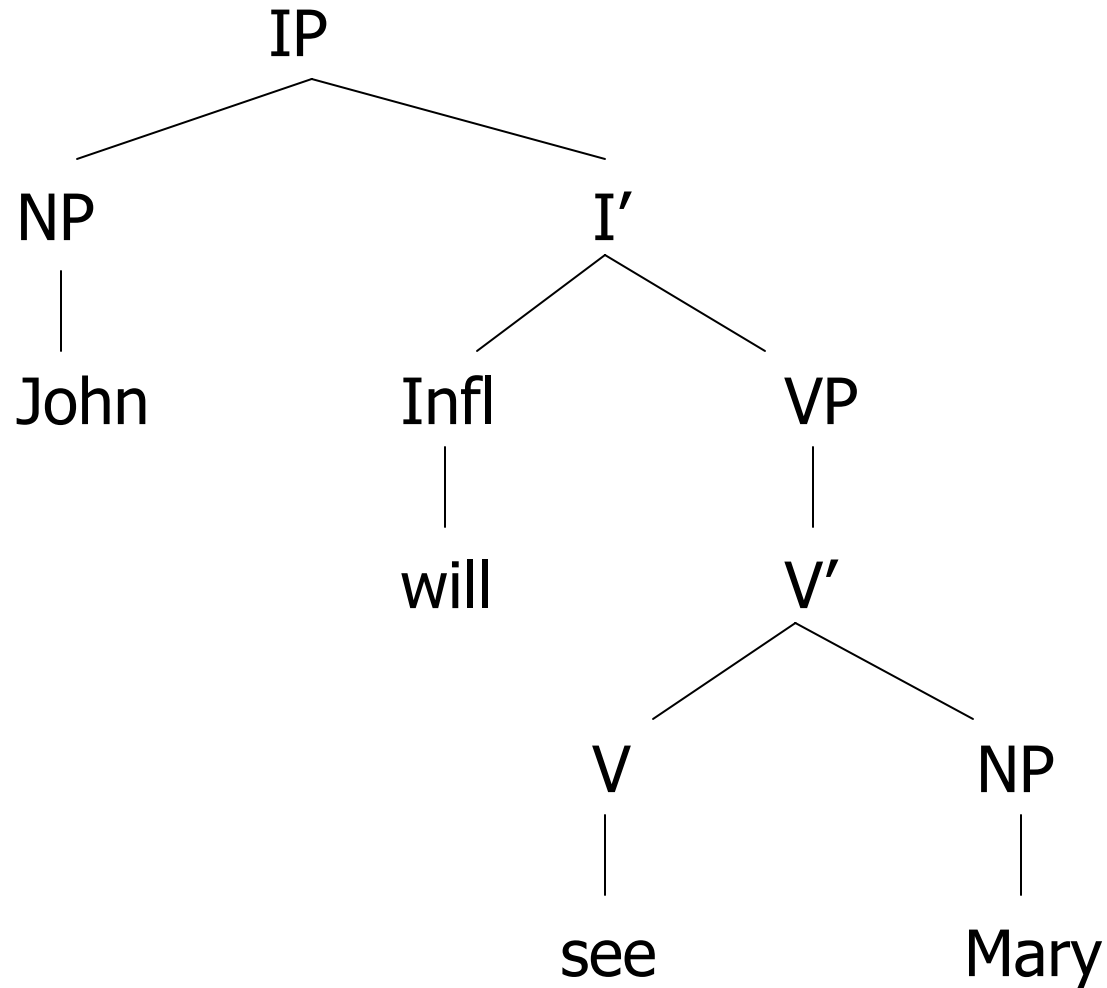
The category Infl

What happens if there is no Aux verb? Then the main verb must have tense and agreement information:

John sees Mary.

John saw Mary.

* John seeing Mary.

* John seen Mary.

* John see Mary.

Proposal: Infl contains the auxiliary verb (if there is one) or an empty category containing the tense and agreement information of the main verb.

Structure for "John sees Mary"
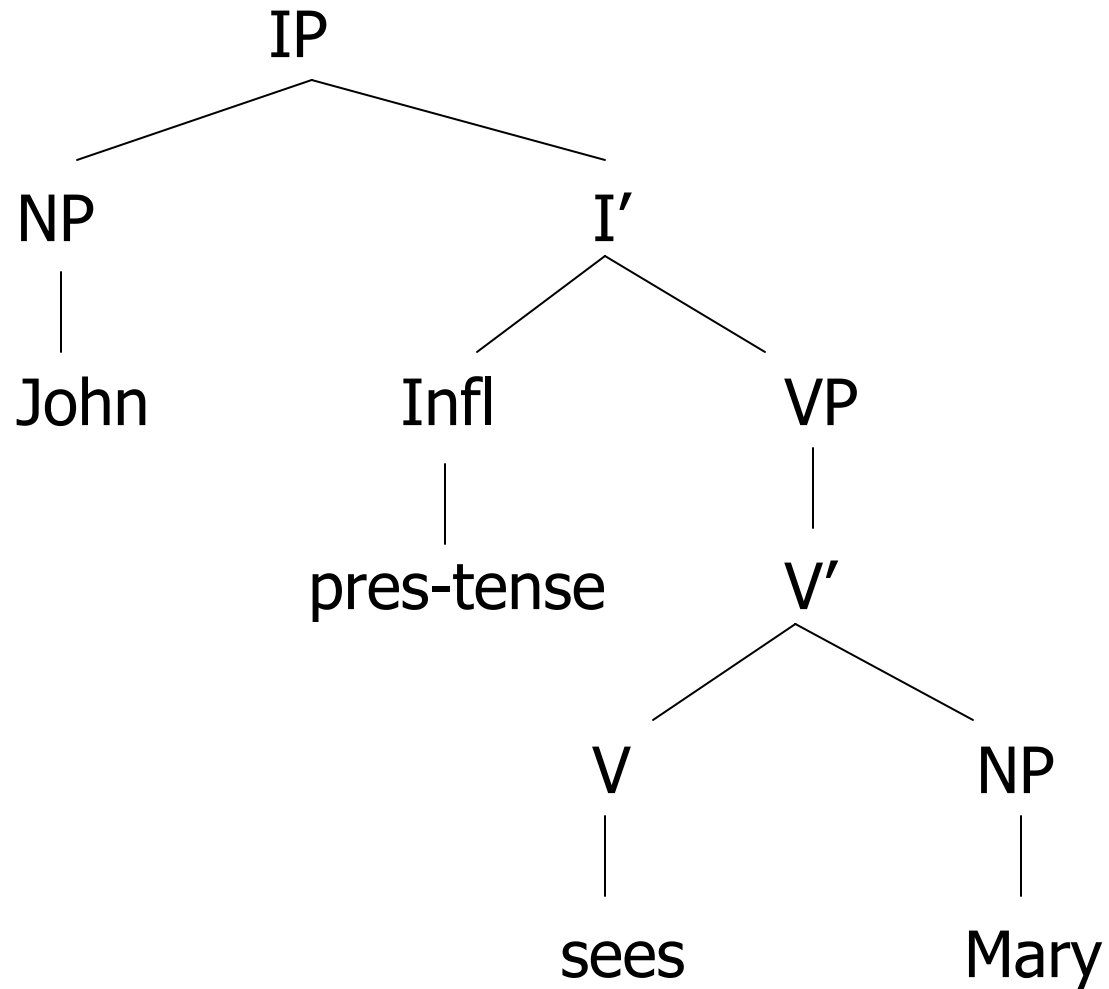
X-bar structure for "John put the book on the table on Wednesday"
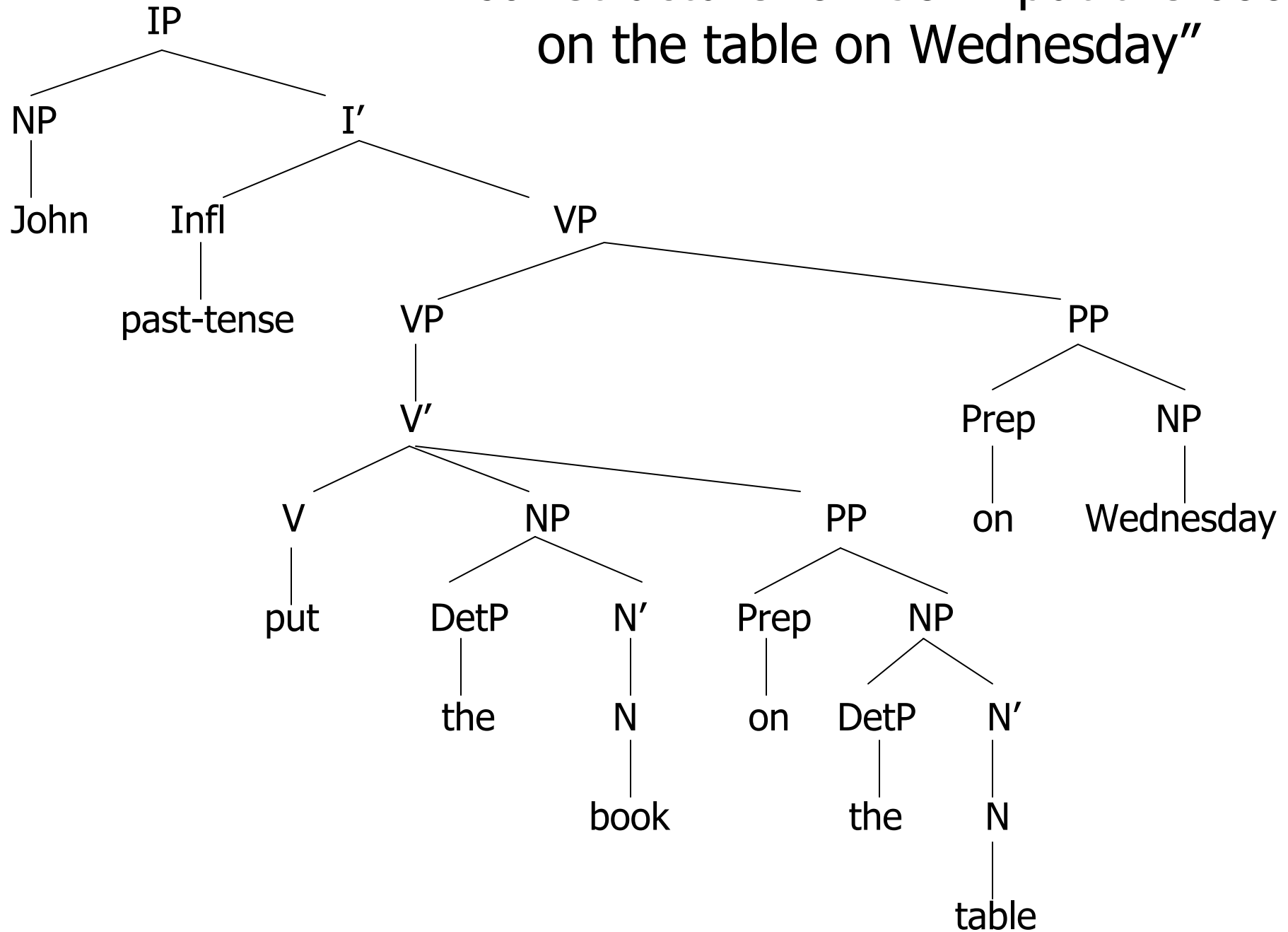
The categories Complementizer (C) and Complementizer Phrase (CP)

The words "that" and "whether" are complementizers: embedded clause markers.

John said that Mary left.

John wondered whether Mary left.

* That Mary left.

* Whether Mary left.

Category: complementizer. The complement of a C is an IP:

C' → Comp IP

The categories Complementizer (C) and Complementizer Phrase (CP)

The complementizer "that" can be left out in English.

The complementizer position is empty (null) in this case.

John said (that) Mary left.

```
                              IP
                    ┌─────────┴─────────┐
                   NP                    I′
                    │            ┌───────┴───────┐
                  John          Infl             VP
                                 │                │
                             past-tense           V′
                                         ┌────────┴────────┐
                                         V                 CP
                                         │                  │
                                       said                 C′
                                               ┌────────────┴────────────┐
                                               C                         IP
                                               │              ┌──────────┴──────────┐
                                               e             NP                      I′
                                                              │           ┌──────────┴──────────┐
                                                            Mary         Infl                   VP
                                                                          │                      │
                                                                      past-tense                 V
                                                                                                 │
                                                                                               left
```
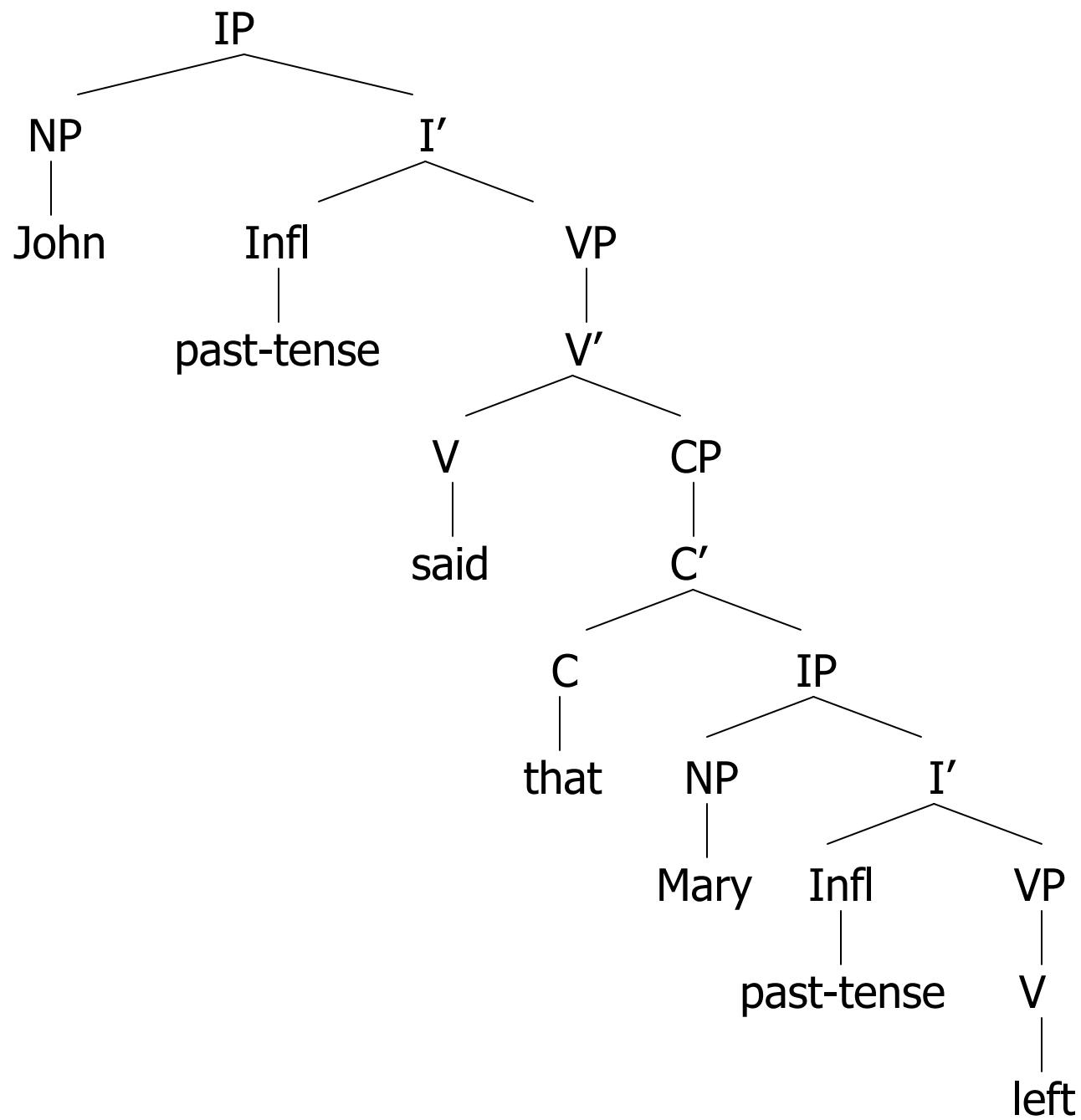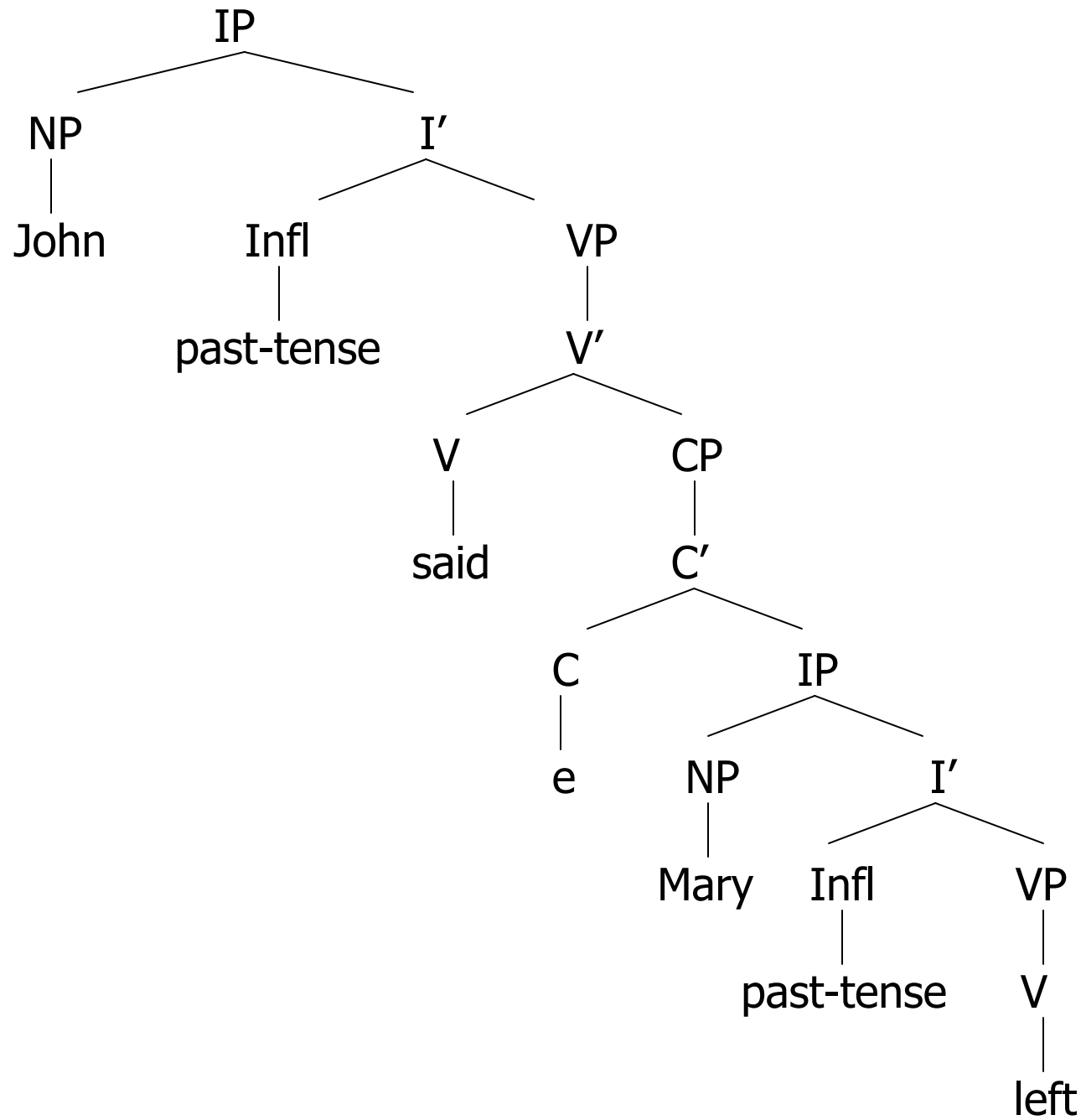
English Question-formation

Reverse the order of the subject and the top auxiliary verb (if there is one).

John will buy a present. → Will John buy a present?

John has bought a present. → Has John bought a present?

If there is no auxiliary, insert the agreeing form of "do", and change the main verb to its non-finite form:

John bought a present. → Did John buy a present?

English Yes-no-question formation

The position to which the auxiliary moves is hypothesized to be the Complementizer position (Comp, or C)
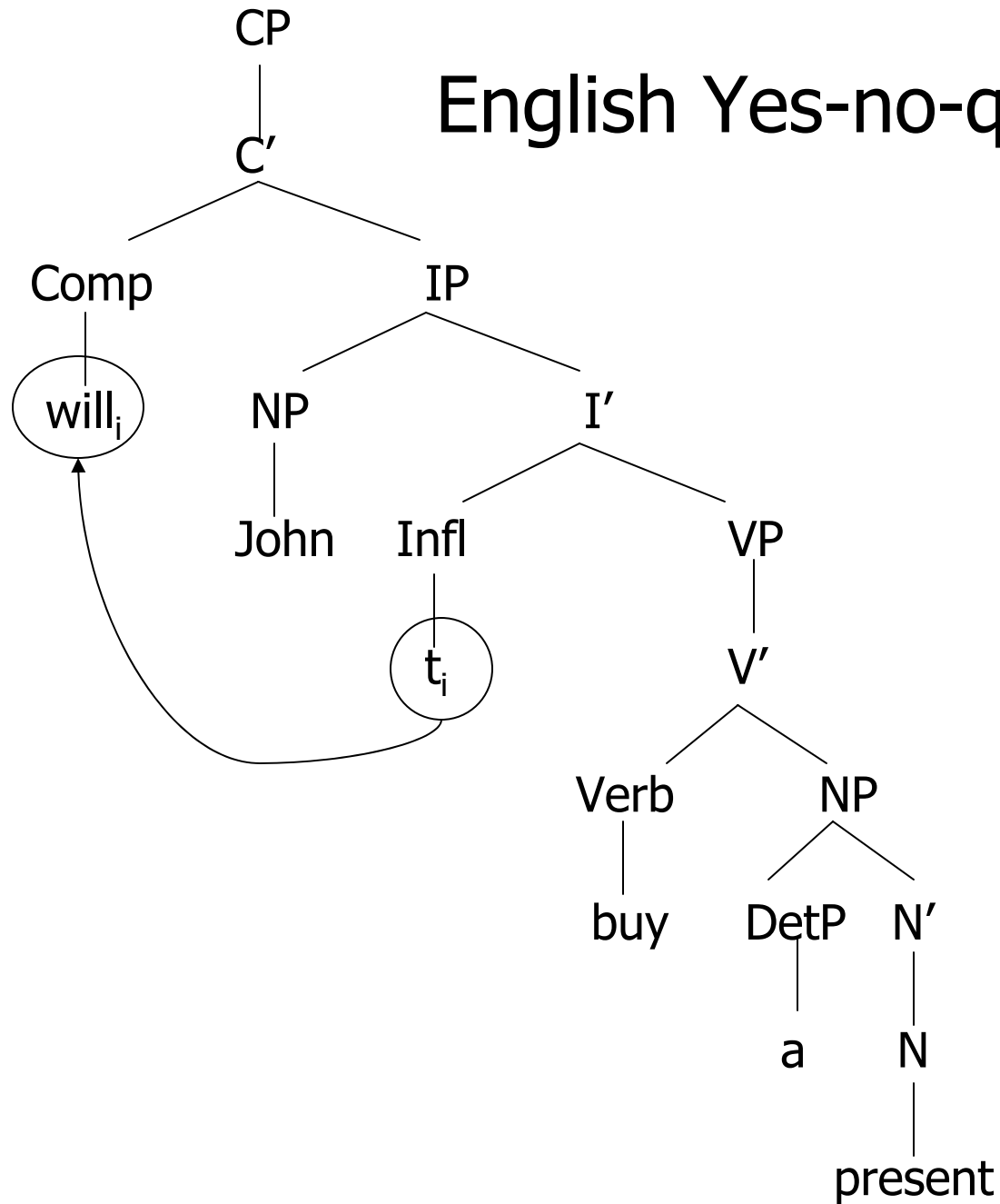
The meaning of a moved Comp position is an **interrogative** sentence: a question.

Evidence for this claim: Cannot have both a complementizer like "whether" or "that" and subject-auxiliary inversion in embedded questions:

John wondered whether Mary will come.
* John wondered whether will Mary come.

English Yes-no-question formation

CP
- C′
  - Comp
    - will_i
  - IP
    - NP
      - John
    - I′
      - Infl
        - t_i
      - VP
        - V′
          - Verb
            - buy
          - NP
            - DetP
              - a
            - N′
              - N
                - present

English Wh-question formation: Wh-movement

What will John buy?
Where will John put the books?
Who saw John?
Which reporter did the senator attack?

Definition: Question words and phrases like "who", "what", "which reporter", "where", etc. are called **wh-phrases.**

Wh-movement: the wh-phrase is said to "move" to the front of the sentence. It is thought that a question has the declarative form of a sentence as its source. The different kinds of movements are also called "transformations".

Convention: Linguists put an **empty category** or a **trace** in the position with which the fronted constituent is associated.

Specifier of CP: position to which wh-movement takes place.
CP → NP C′

English Wh-question formation

CP
NP
C'
what$_j$
Comp
IP
will$_i$
NP
I'
John
Infl
VP
t$_i$
V'
Verb
NP
buy
t$_j$
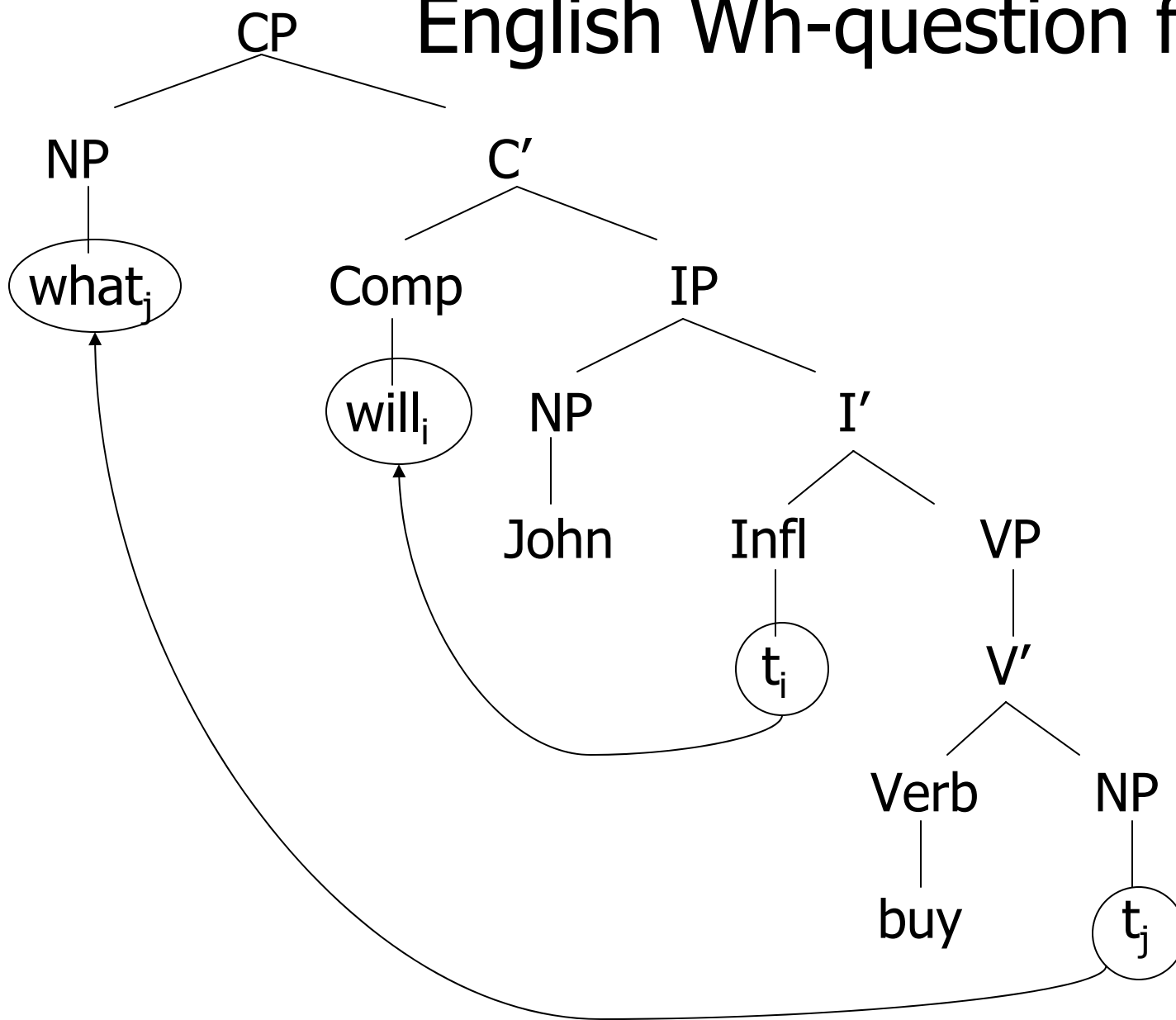
English Wh-question-formation
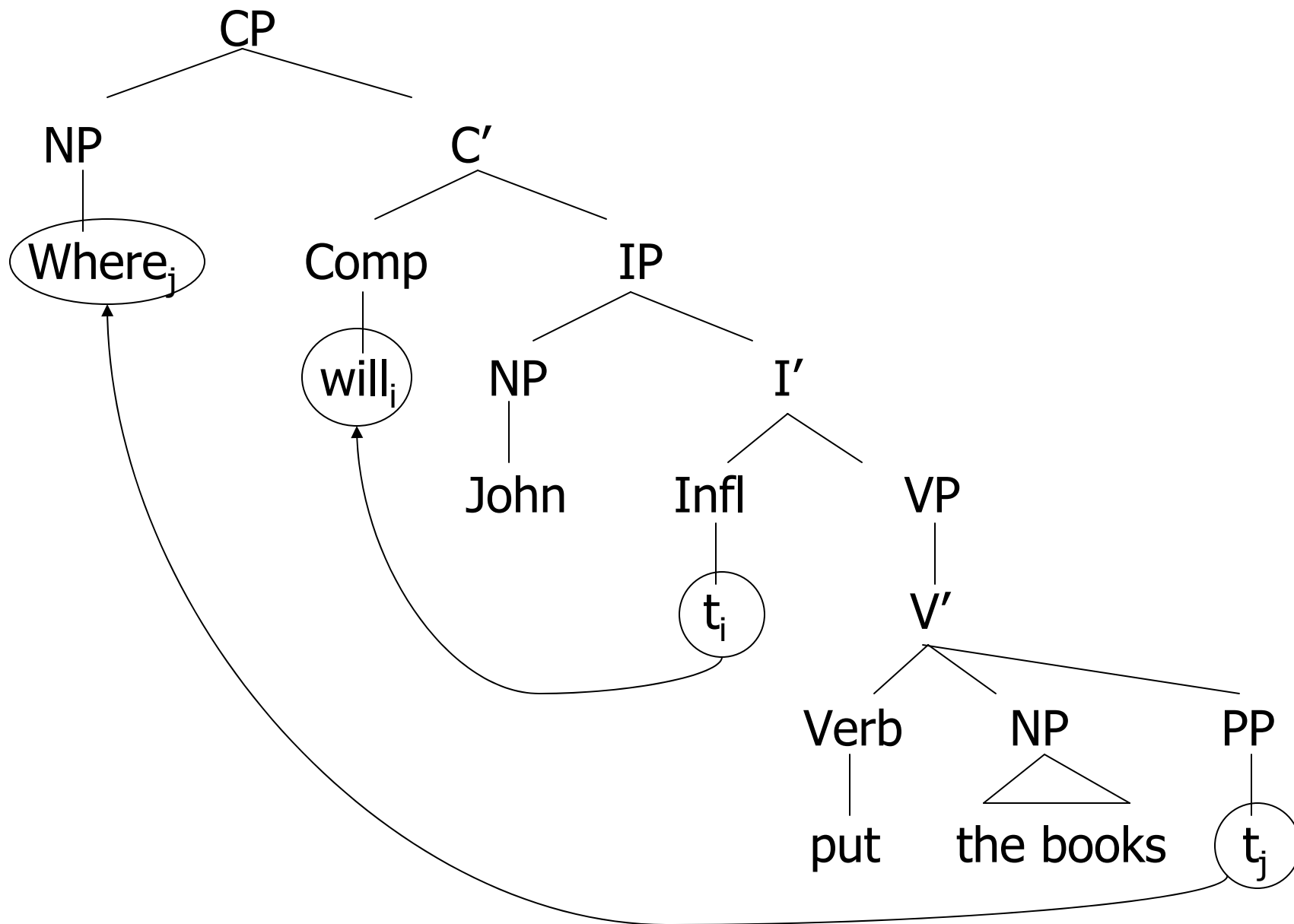
Topicalization

Topicalization: another instance of movement / long-distance dependency, like wh-question formation:

The books, John will buy.
Onto the table, John will put the books.

Topicalization

CP
- NP
  - The books$_j$
- C′
  - Comp
    - e
  - IP
    - NP
      - John
    - I′
      - Infl
        - will
      - VP
        - V′
          - Verb
            - buy
          - NP
            - t$_j$

Relative clauses

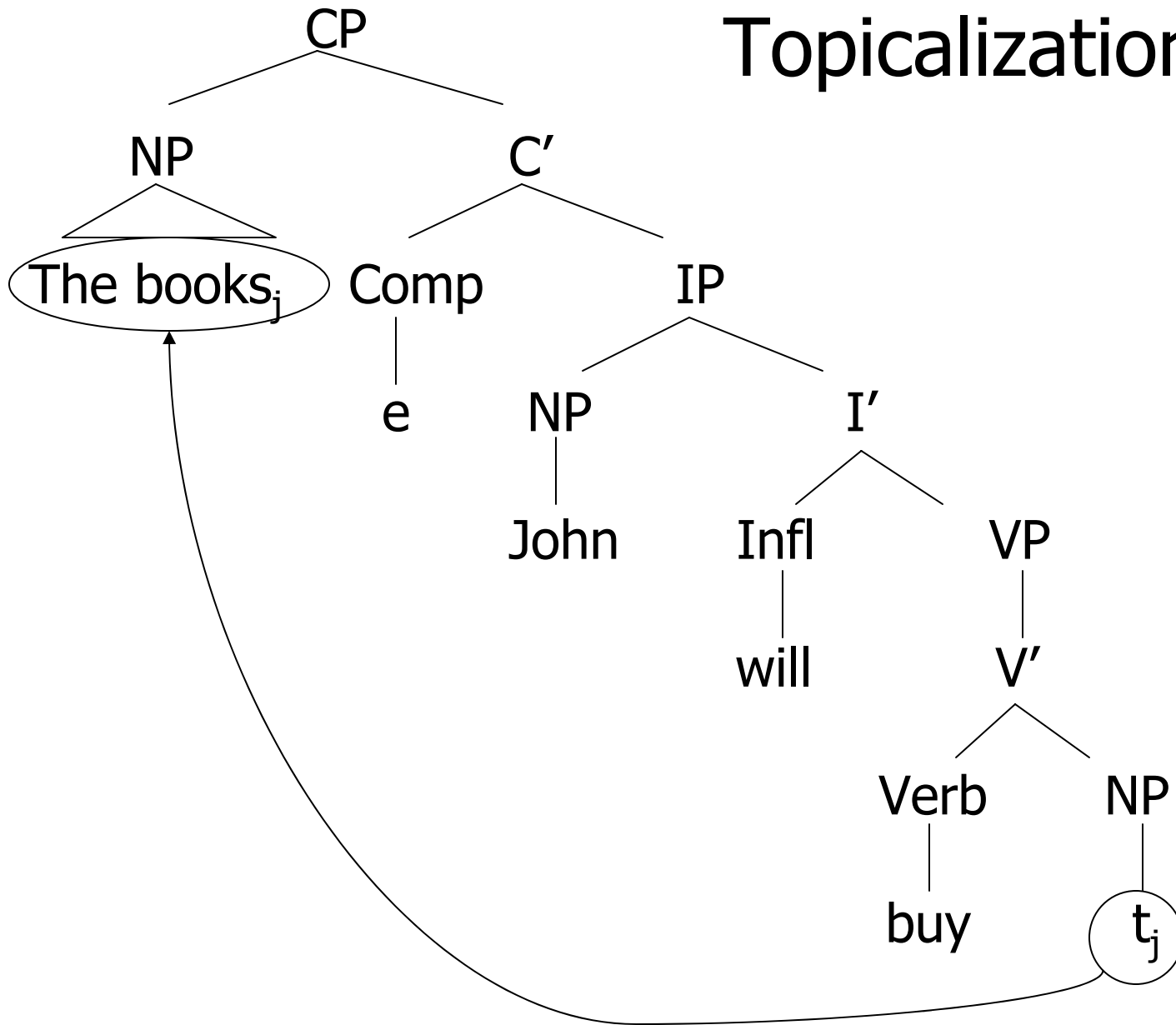- Relative clause: a clause modifying an NP initiated by a relative pronoun (e.g., "that", "who", "whom", "which").

  There is a long-distance dependency between the relative pronoun and a position in the relative clause.

  Object-extraction: The reporter who$_j$ the senator attacked t$_j$ disliked the editor.

  Subject-extraction: The reporter who$_j$ t$_j$ attacked the senator disliked the editor.

```
                            IP
                   ╱                  ╲
                 NP                    I′
            ╱          ╲          ╱          ╲
          NP            CP      Infl           VP
        ╱────╲        ╱    ╲      │             │
   The reporter     NP     C′  past-tense       V′
                    │    ╱    ╲              ╱      ╲
                  who_j  C      IP          V        NP
                        │    ╱     ╲        │      ╱────╲
                        e   NP      I′   disliked  the editor
                           ╱──╲    ╱    ╲
                       the senator Infl   VP
                                    │      │
                               past-tense  V′
                                        ╱     ╲
                                       V       NP
                                       │       │
                                   attacked    t_j
```
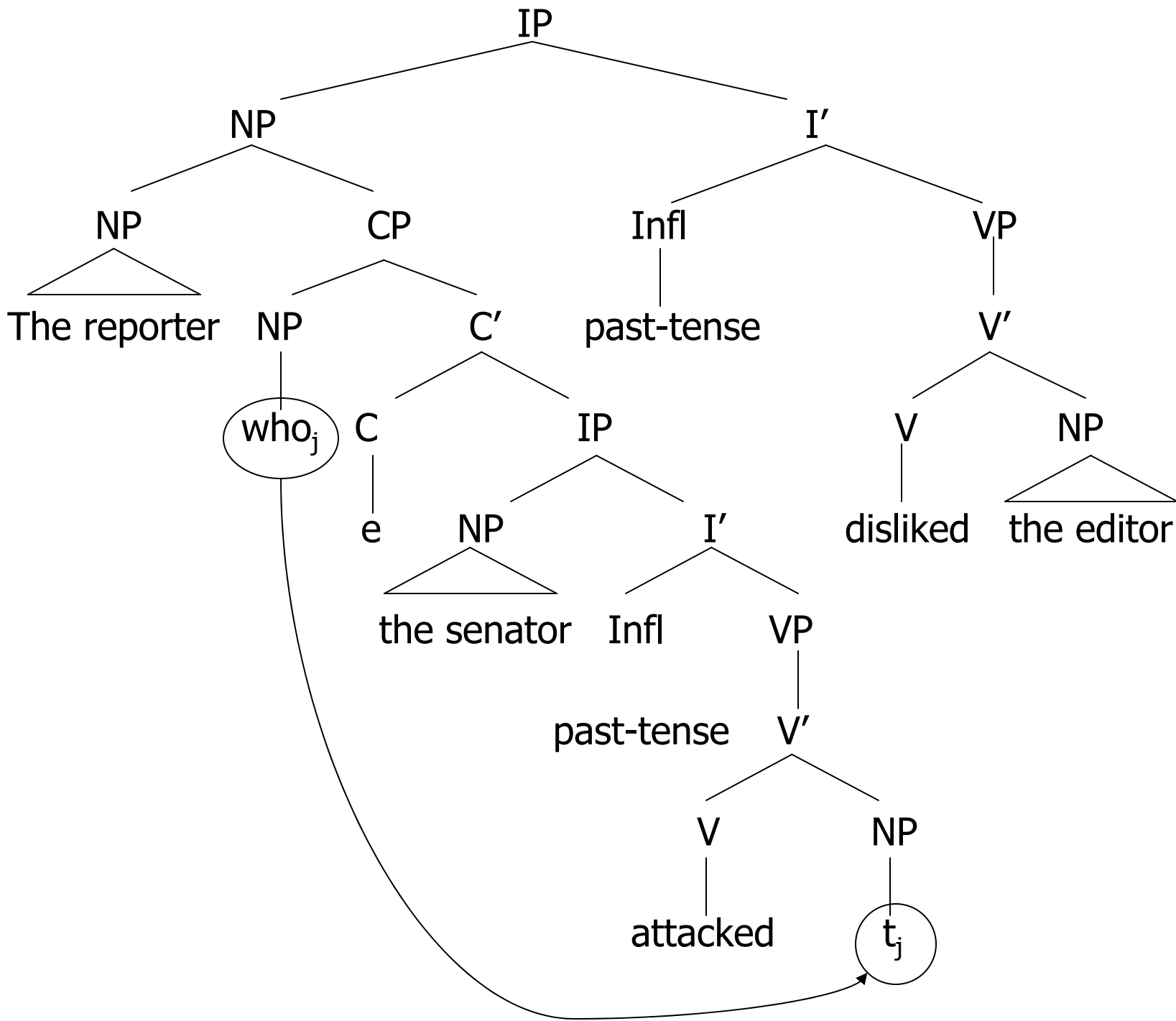
English relative clauses

wh-phrase is lexical, comp position is null:
The reporter who$_j$ the senator attacked t$_j$ disliked the editor.

wh-phrase is null, comp position is lexical:
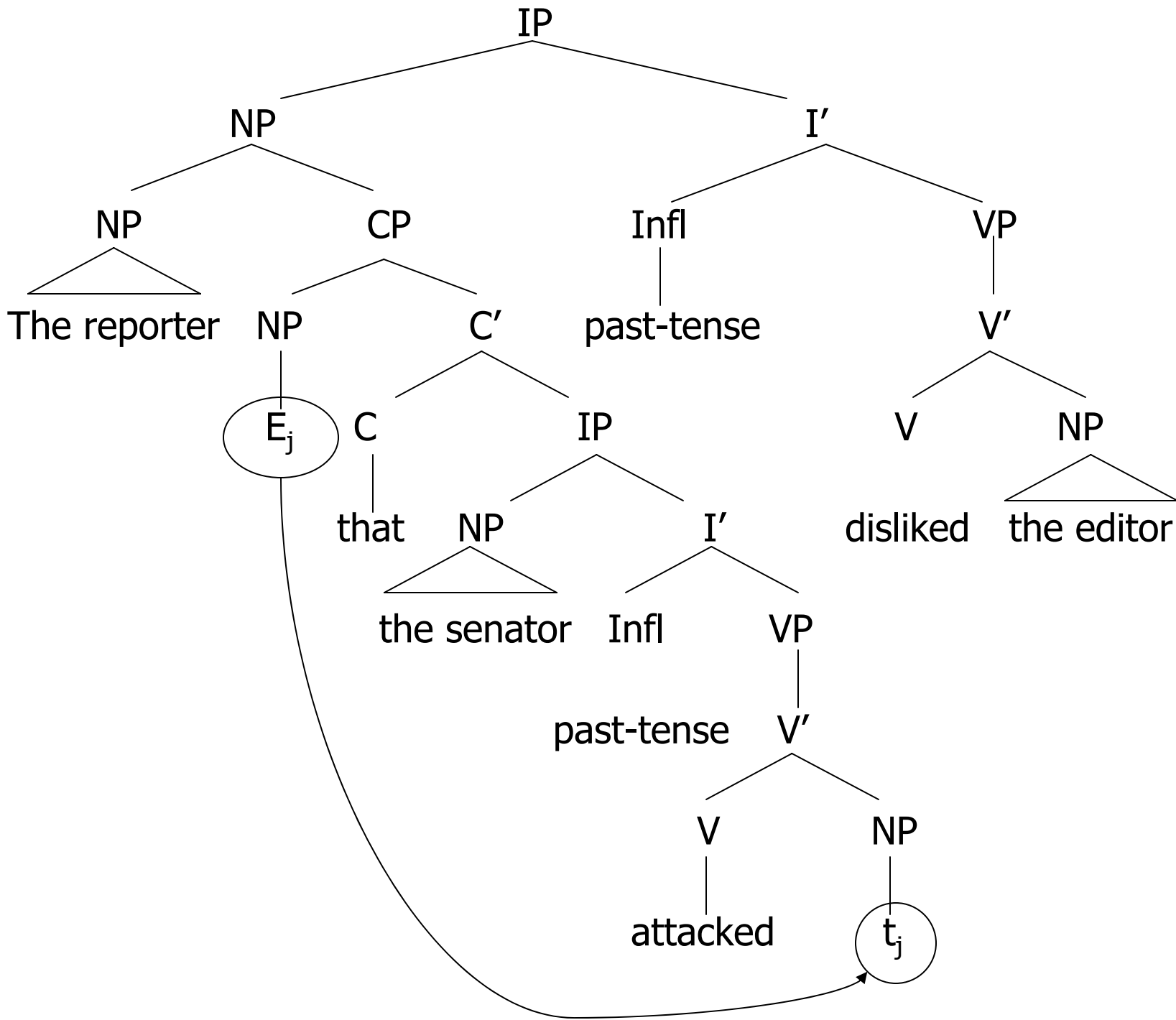The reporter that the senator attacked t$_j$ disliked the editor.

Both are null:
The reporter the senator attacked t$_j$ disliked the editor.

But it is not possible to include both positions in modern English:
* The reporter who$_j$ that the senator attacked t$_j$ disliked the editor.

This used to be possible in old English.

Passive: Another kind of movement
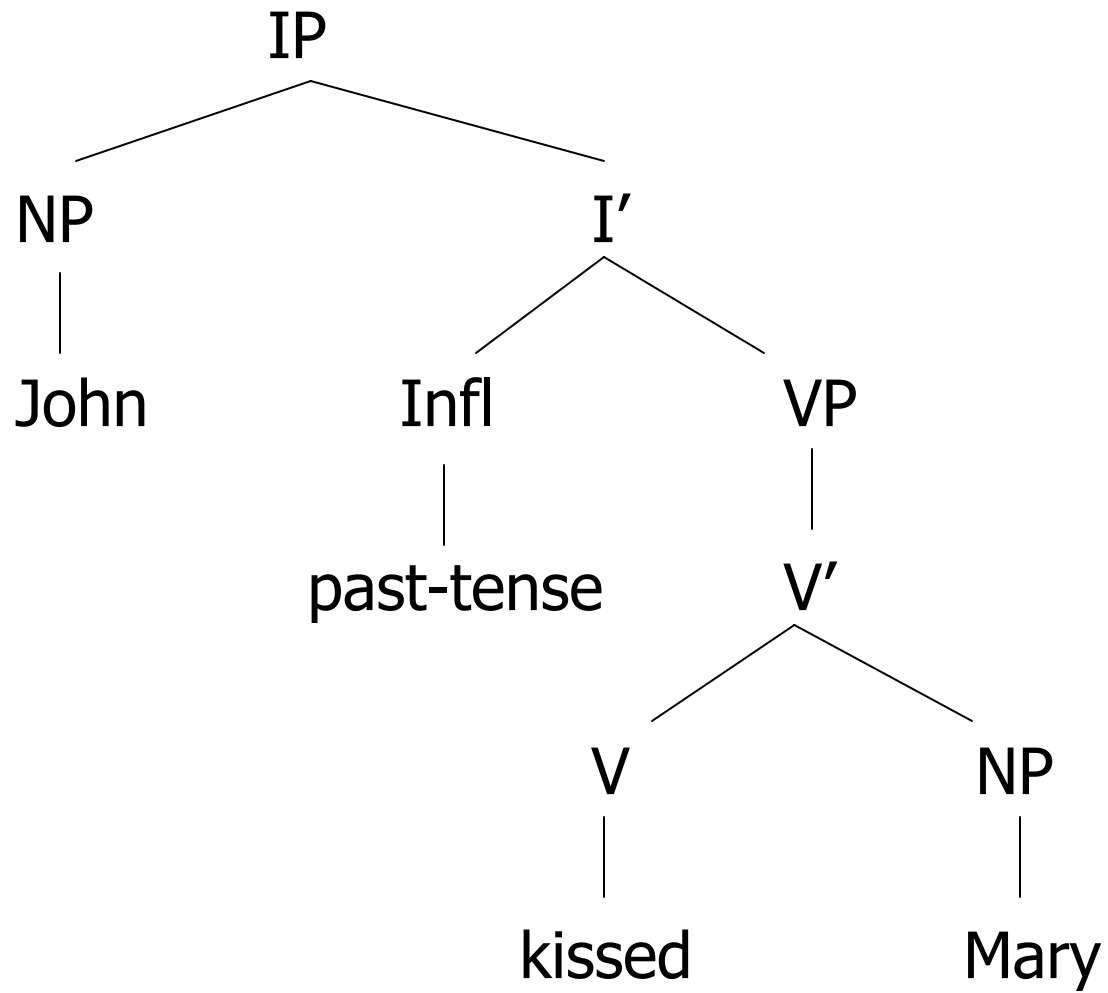
An active sentence:

Mary kicked the ball.

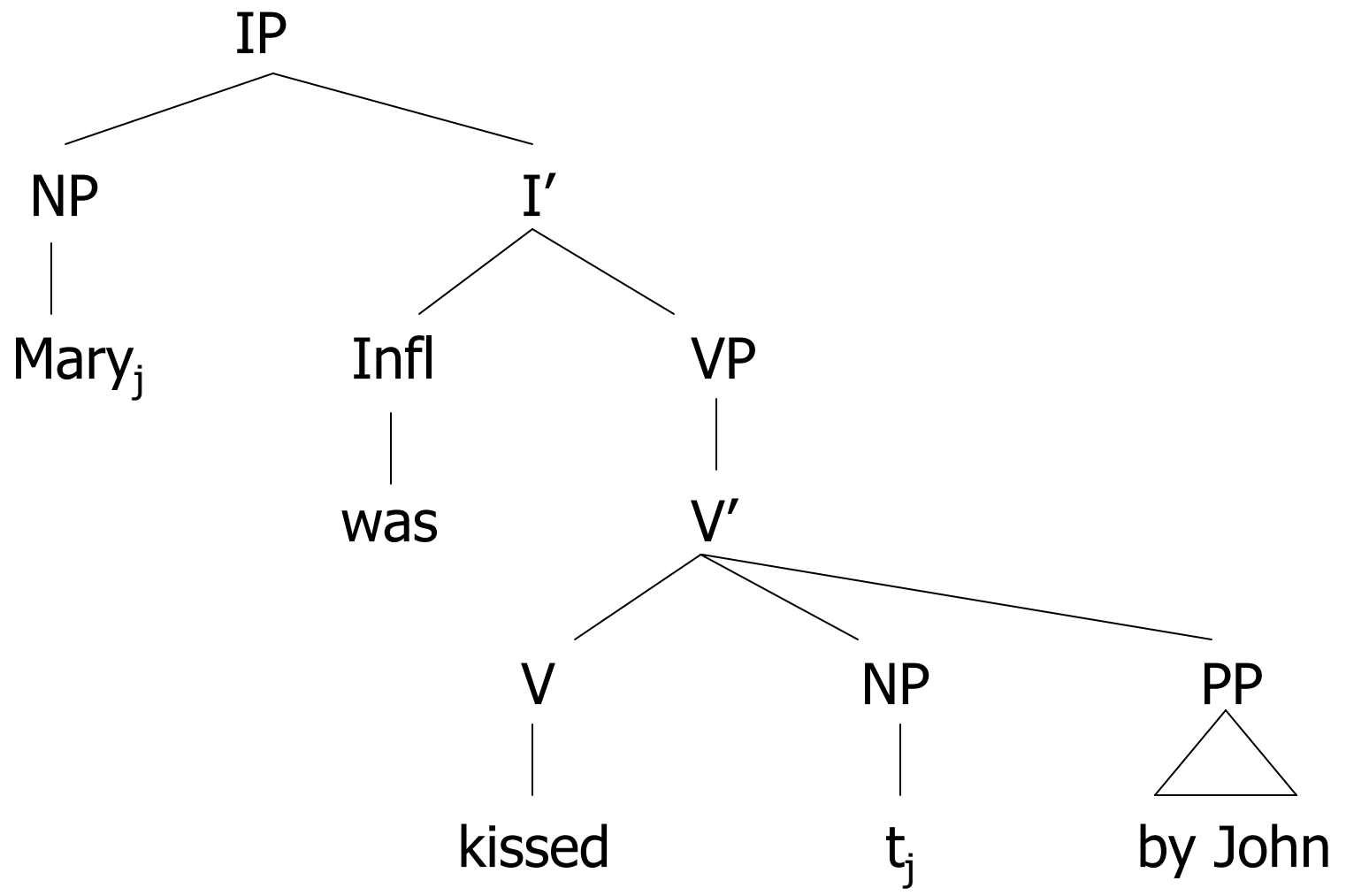A passive form of the same sentence:

The ball was kicked (by Mary).

In order to keep thematic-role assignments constant for a lexical entry, passivization is proposed to be another movement transformation.

After the passive transformation, the subject position receives the role that is assigned to the object position in the active form.

```
                        IP
            ┌───────────┴───────────┐
           NP                       I′
            │              ┌────────┴────────┐
          John           Infl               VP
                           │                 │
                       past-tense            V′
                                    ┌────────┴────────┐
                                    V                 NP
                                    │                 │
                                 kissed             Mary
```

```
                    IP
            ┌────────┴────────┐
           NP                 I′
            │            ┌─────┴─────┐
          Mary_j        Infl         VP
                         │            │
                        was          V′
                               ┌──────┼──────────┐
                               V      NP          PP
                               │      │          ╱△╲
                             kissed  t_j        by John
```

Practice sentences

1. Fred borrowed some money from Maria on Tuesday.
2. The apple which Mary found on the ground contained a worm.
3. The book was given to Mary by the teacher.
4. The woman who the book was given to was happy.
5. English-Japanese:

   Mary told John that Bill found some money at the game.