# Grammar Implementation with TAG

## XTAG-Analyses of Syntactic Phenomena

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## Outline



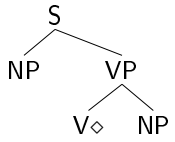
Main reference:
Carl Pollard, Ivan A. Sag (1994): Head-Driven Phrase Structure Grammar
The XTAG Research Group (2001): A Lexicalized Tree Adjoining Grammar for English



## The architecture of the XTAG-grammar

| | |
|---|---|
| Morph Database | inflected form → root form, POS, inflectional information |
| Syntactic Database | root form, POS → list of tree templates or tree families, list of feature equations |
| Tree Database | list of tree templates and tree families |

Example: **Tree template** for the declarative transitive verb ($\alpha$nx0Vnx1), where $\diamond$ marks the lexical insertion site:



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**A tree family**

- is a set of tree templates,
- represents a subcategorization frame, and
- unifies all syntactic configurations the subcategorization frame can be realized in.

Example: $\alpha$nx0Vnx1 $\in$ Tnx0Vnx1

## The architecture of the XTAG-grammar - Counts

| subcategorization frame | # tree fam. | # tree temp. |
|---|---|---|
| intransitive | 1 | 12 |
| transitive | 1 | 39 |
| adjectival complement | 1 | 11 |
| ditransitive | 1 | 46 |
| prepositional complement | 4 | 182 |
| verb particle constructions | 3 | 100 |
| light verb constructions | 2 | 53 |
| sentential complement (full verb) | 3 | 75 |
| sentential subject (full verb) | 4 | 14 |
| idioms (full verb) | 8 | 156 |
| small clauses/predicative | 20 | 187 |
| equational 'be' | 1 | 2 |
| ergative | 1 | 12 |
| resultatives | 4 | 101 |
| it clefts | 3 | 18 |
| total | 57 | 1008 |

(from Prolo (2002))

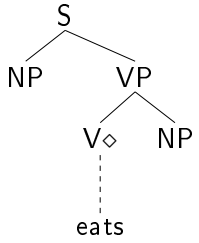


## Lexical insertion

**Lexical insertion**

Drawing an edge between the lexical anchor and the lexical insertion site

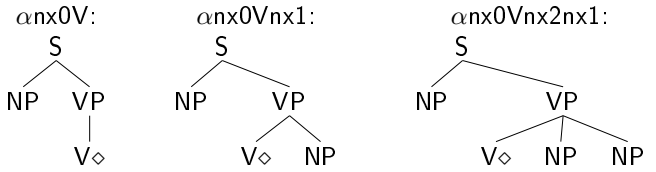
- prior to substitution and adjunction
- The feature structures of the **lexical anchor** and the **insertion site** unify.



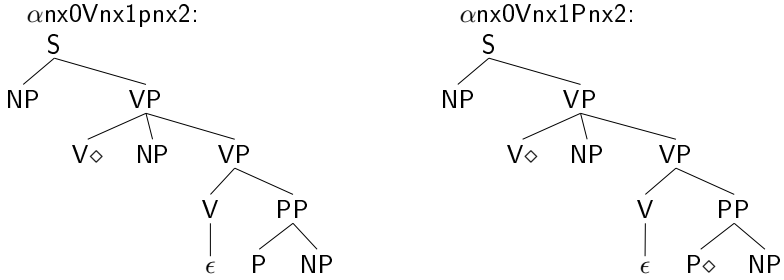



## Complementation with NPs and PPs: The base cases

**Complementation with NPs:**




**Complementation with PPs:** substitution or co-anchor



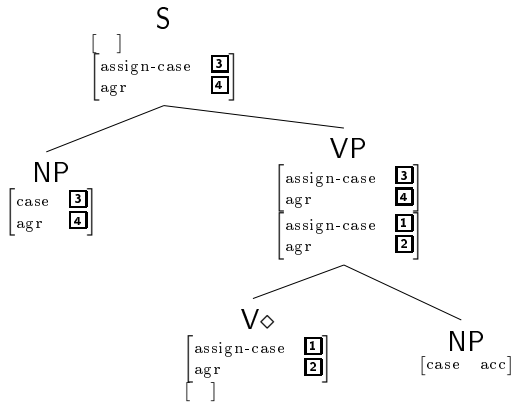



## Case assignment and subject-verb agreement

Two modes of case assignment in tree templates:

- Direct case assignment with case
- Indirect case assignment with assign-case
  ⇒ by the lexical anchor (during lexical insertion) or by adjoing trees

αnx0Vnx1:



## Sentential complement structures

Within the framework of GB, it is often assumed that the following verbs subcategorize for **a single sentential complement**:

(1) a. Kim said [that Sandy left]. (finitive)
b. Dana preferred [for Pat to get the job]. (to-infinitive)
c. Leslie wanted [Chris to go].
d. Lee believed [Dominique to have made a mistake].
e. René tried [PRO to win].
f. Terry preferred [PRO to go to Florida].
g. Tracy proved [the theorem false]. (small clauses)
h. Bo considered [Lou a friend].
i. Gerry expects [those children off the ship]

In XTAG, a distinction is drawn between sentential complements with **(1) finite verbs**, sentential complements with **(2) to-infinitives**, and **(3) small clauses**.



## To-infinitives: Controlling and Raising its subject

Verbs that subcategorize for to-infinitives show differing properties with respect to their **semantic and syntactic influence on the subject** of the to-infinitives.

- Control verbs / Equi verbs (*try*, *persuade*)
- Raising verbs (*seem*, *expect*)



## Control verbs

Control verbs establish the coreference between their subject/object and the unexpressed subject (PRO) of their sentential complement. (PRO control)

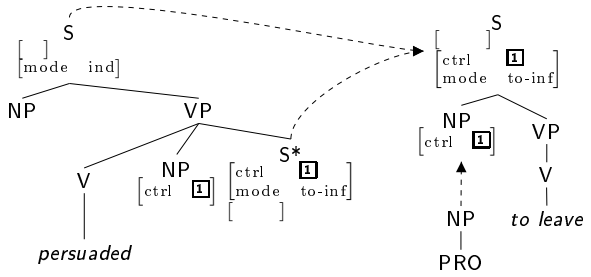
(2) a. John tried [PRO to leave]. (subject control)
b. John persuaded him [PRO to leave]. (object control)
c. *There tries [PRO to be disorder after a revolution].

⇒ Control verbs assign semantic role to the controller!



## Control verbs - XTAG-Analysis

- control feature for coindexation
- PRO tree
- Object control does not involve ECM



## Raising verbs

Raising verbs determine case and agreement properties of the subject of the (non-finite) sentential complement. Semantically, however, the "raised" constituent is no immediate part of the argument structure of the raising verb.

(3) a. [John] seems [to leave]. (subject raising)
b. John expects [her to leave]. (object raising)
c. [There] seems [to be disorder after a revolution].
d. John expected [it to rain].

⇒ assign no semantic role to the raised constituent (raising of expletive *it/there*)

(4) John seems unhappy.
*John tries unhappy.

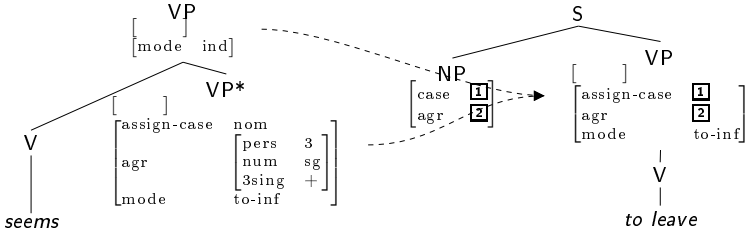
⇒ allow for **small clauses**



## Raising verbs - XTAG-Analysis (1)

- no PRO
- The "raised" constituent is still part of the to-infinitive!
- ECM via assign-case feature

Example for subject raising:

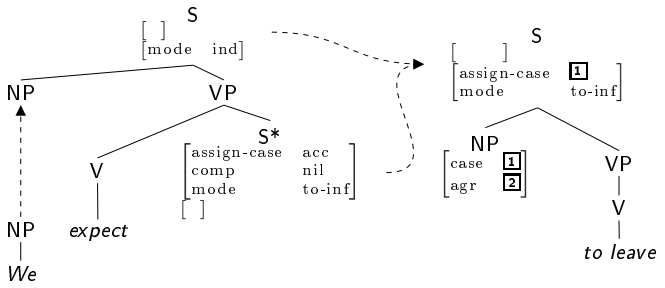





## Raising verbs - XTAG-Analysis (2)

Example for object raising:

(5) We expect him to leave.

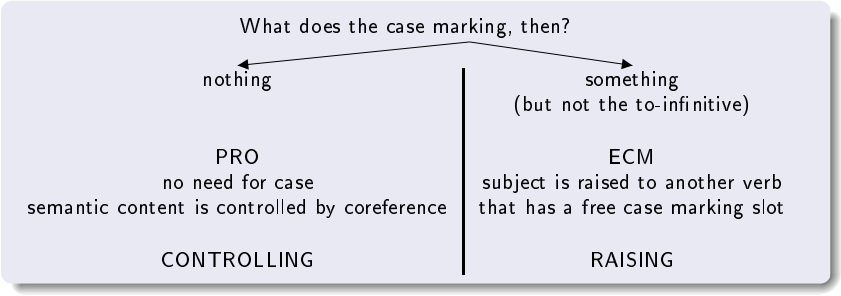





## Raise or control - The big GB-picture

**Forschungsobjekt:** to-infinitives
**Background assumption:** argument → complement (Projection Principle)

**Findings:** the subject of to-infinitives (1) can have several cases or (2) is not realized phonologically.
**Hypothesis:** (1) to-infinitives cannot assign case to its subject; (2) incomplete to-infinitives have a phonologically empty PRO in subject position.



## "Ist's eins? Sind's zwei?" (Goethe, 1819)

**Question:**
What complements does the verb *consider* take?

(6) a. We consider [Kim to be an acceptable candidate].
b. We consider [Kim an acceptable candidate].
c. We consider [Kim quite acceptable].
d. We consider [Kim among the most acceptable candidates].
e. *We consider [Kim as an acceptable candidate].

Similar verbs: *prove, expect, rate, count, want*

1. **One sentential complement (small clause)**, where *to be* can be omitted
2. **A noun and a predicative phrase**



## Small clauses - Pro and contra (1)

**Pro:**

- Homomorphism between argument structure and complement structure (in GB: Projection Principle, UTAH; in TAG: $\theta$-Criterion)
- Uniformity of the subcategorized constituents:

  Instead of NP, AP, PP, IP/S, ... as possible categories of the complements, there is only one complement category.



## Small clauses - Pro and contra (2)

**Contra:**

- Passivization (object-to-subject shift)

  (7) We considered [Kim quite acceptable].
  Kim was considered [__ quite acceptable].

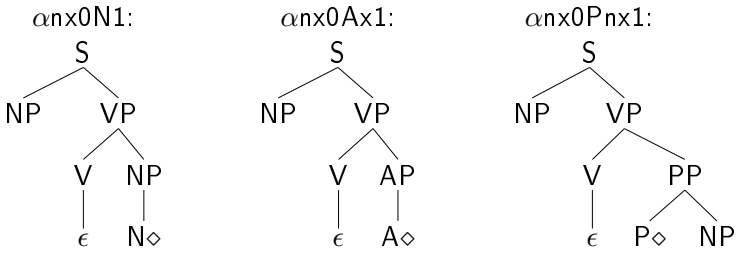
- Idiosyncratic restrictions on the predicative phrase

  (8) a. I consider/*expect [this Island a good vacation spot].
  b. I consider/*expect [this man stupid].
  I expect [that man to be stupid].
  c. We rate/*consider [Kim as quite acceptable]

⇒ The verb should be indifferent to the categorial status of the small clause predicate!



## Small clauses - XTAG-Analysis (1)

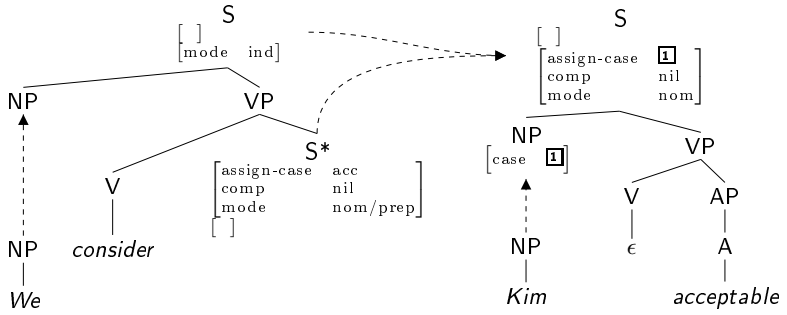



Small clauses have the structure of regular sentences , except that the verb is missing.

⇒ The superordinate verb is represented as auxiliary tree that adjoins at VP or S.

## Small clauses - XTAG-Analysis (2)

(9) We consider Kim acceptable.




**Exceptional Case Marking (ECM):**

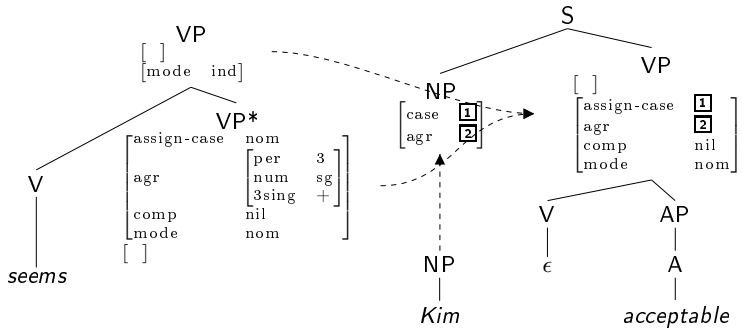
The case of the subject of the sentential complement is assigned from the superordinate subcategorizing verb.
For ECM, XTAG uses the feature assign-case.



## Small clauses - XTAG-Analysis (3)

- *seems* adjoins to VP
- ECM for nominative case

(10) Kim seems acceptable.



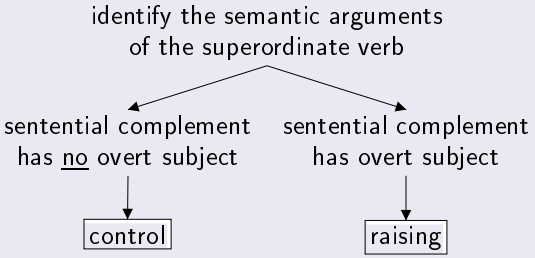



## Raise and control - Summary

| control verbs | raising verbs |
|---|---|
| assign semantic role (to the controlled subject) | assign no semantic role (to the raised subject) |
| PRO (incomplete sent. complement) | no PRO (complete sent. complement) |
| assign no case (to the controlled subject) | assign case via ECM (to the raised subject) |
| no small clauses | small clauses |
| XTAG: adjoin to S | XTAG: adjoin to S or VP |



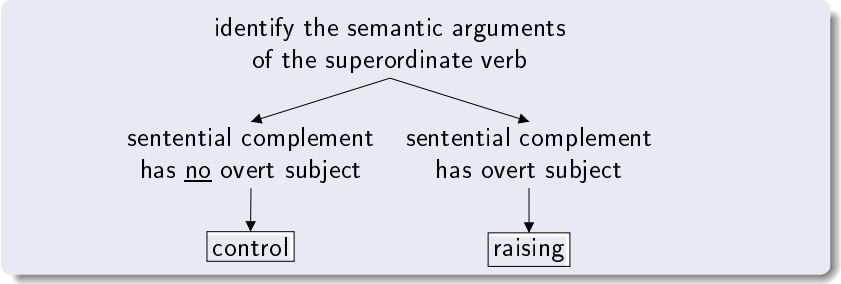
## Raise or control?




- Classfication game:

(11) a. They asked Jan to leave. (object control)
b. Bo turns out to be obnoxious. (subject raising)
c. Sandy is willing to go to the movies. (subject control)
d. Terry was expected to win the prize. (subject raising)
e. Kim believed a unicorn to be approaching. (object control)

# Raise or control?




- Classfication game:

(12) a. It is important for Bill to dance.
b. Christy left the party early to go to the airport.
c. Peter kept standing in the doorway.