Handling Coordination in Tree Adjoining Grammars

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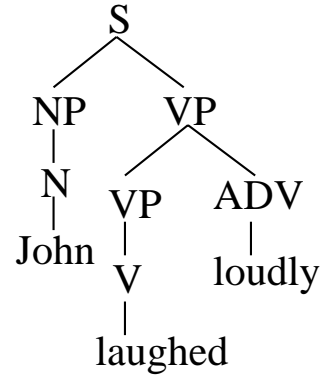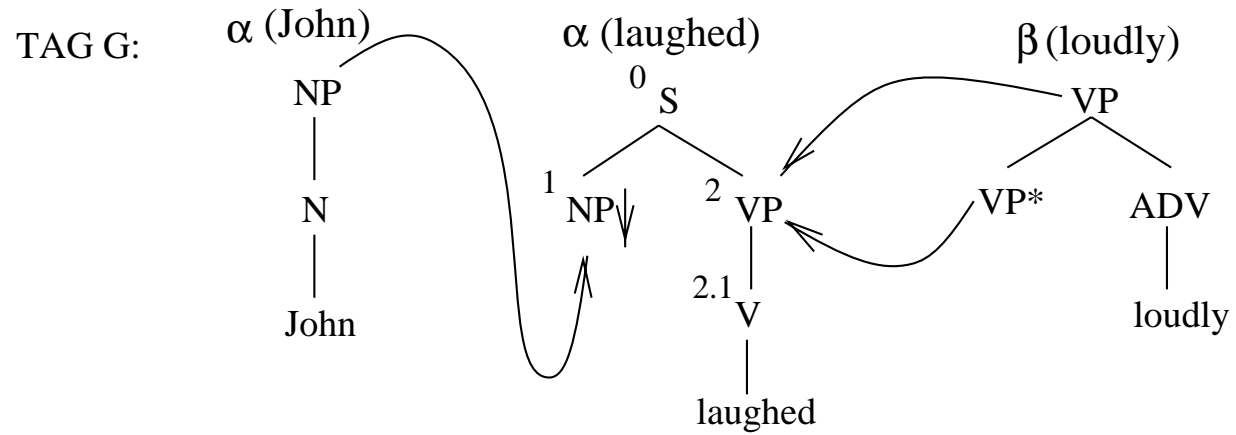**anoop@linc.cis.upenn.edu**

Dept. of Computer and Information Science
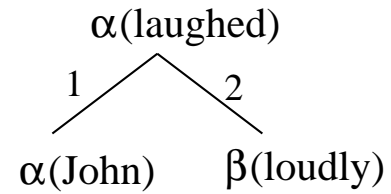University of Pennsylvania

TAG+ Tutorial

Motivation

- TAG: reconcile locality and endemic treatment of long distance dependency with coordination

- most successful accounts exploit string adjacency

- CCG: function application interspersed with composition and type raising (Steedman 1996)

- despite being weakly equivalent the CCG analysis of coordination cannot be imported into TAG

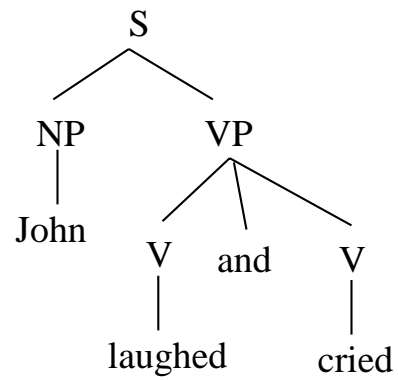- TAGs need a treatment which is structural and not string based.
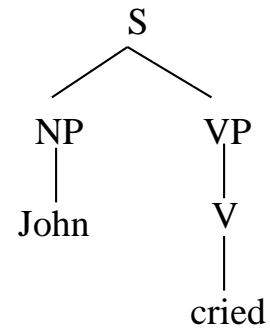
TAGs

TAG G:

α (John)

NP

N

John

α (laughed)

0 S

1 NP↓   2 VP

2.1 V

laughed

β (loudly)

VP

VP*   ADV

loudly

S

NP   VP

N   VP   ADV

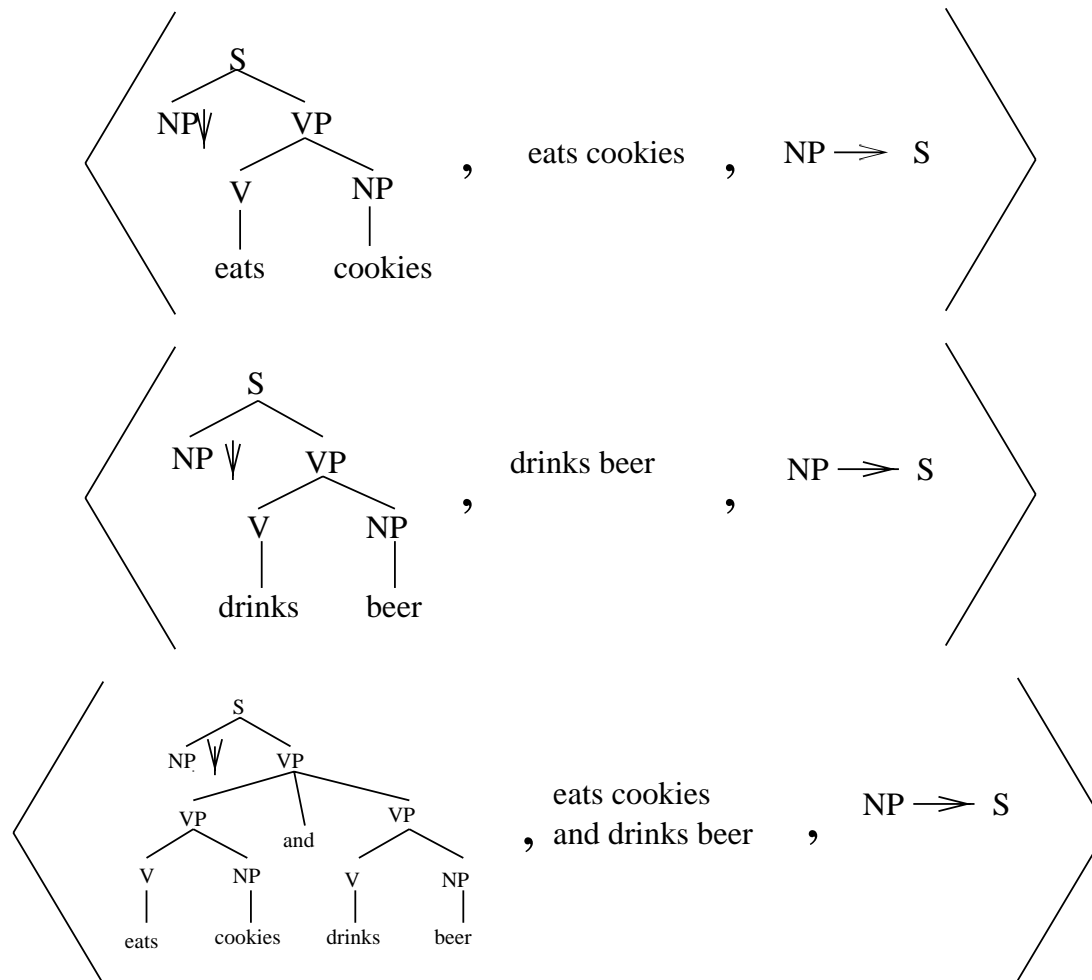John   V   loudly

laughed

Derived Tree

α(laughed)

1   2

α(John)   β(loudly)

Derivation Tree

Coordination in a TAG: Problems
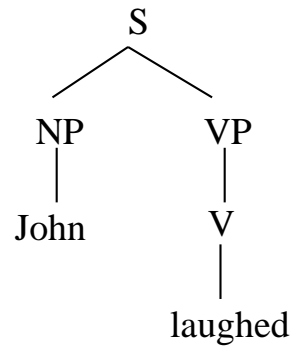
John laughed and cried

Structure Merging (Joshi and Schabes 91)

$\langle$ S [NP↓ VP [V (eats) NP (cookies)]] , eats cookies , NP $\Rightarrow$ S $\rangle$

$\langle$ S [NP↓ VP [V (drinks) NP (beer)]] , drinks beer , NP $\Rightarrow$ S $\rangle$

$\langle$ S [NP↓ VP [VP [V (eats) NP (cookies)] and VP [V (drinks) NP (beer)]]] , eats cookies and drinks beer , NP $\Rightarrow$ S $\rangle$
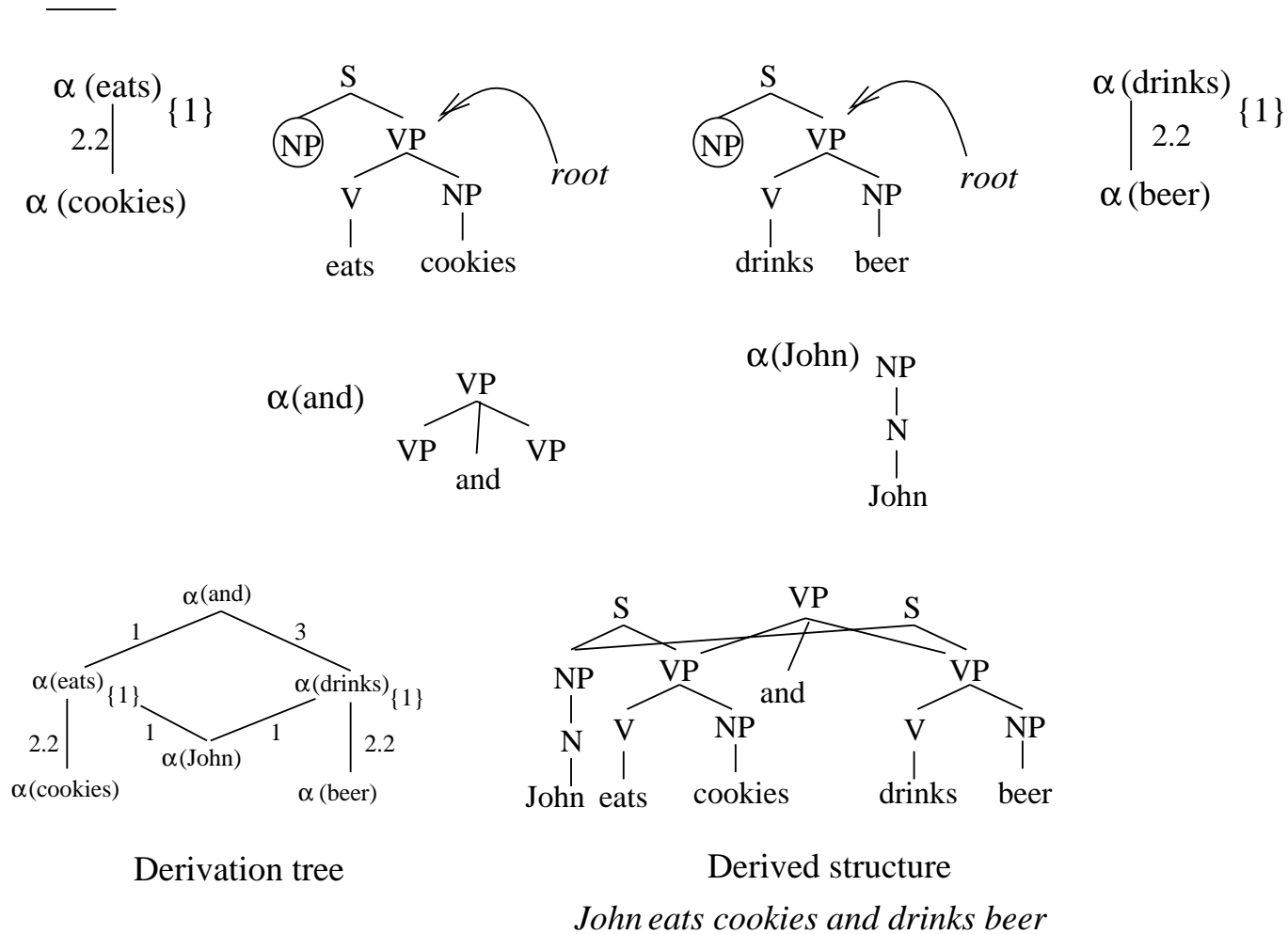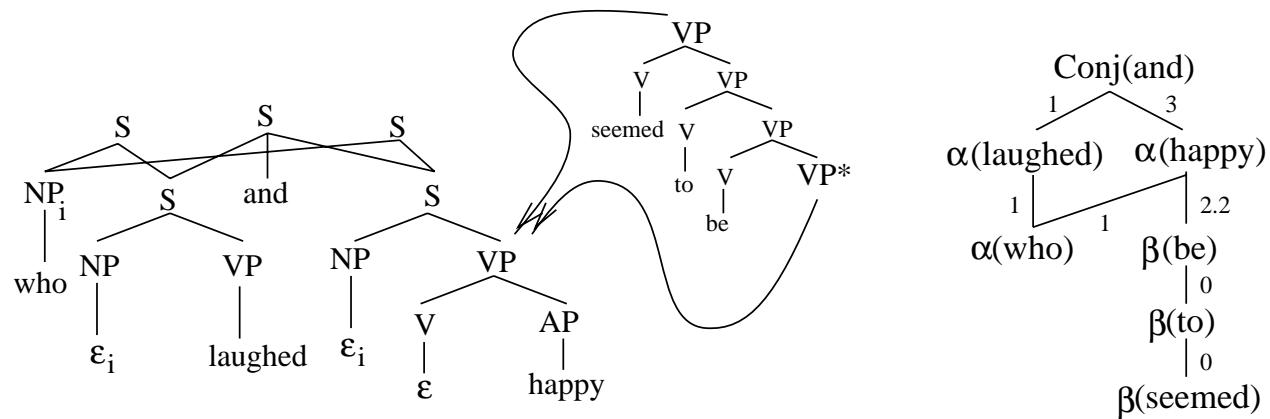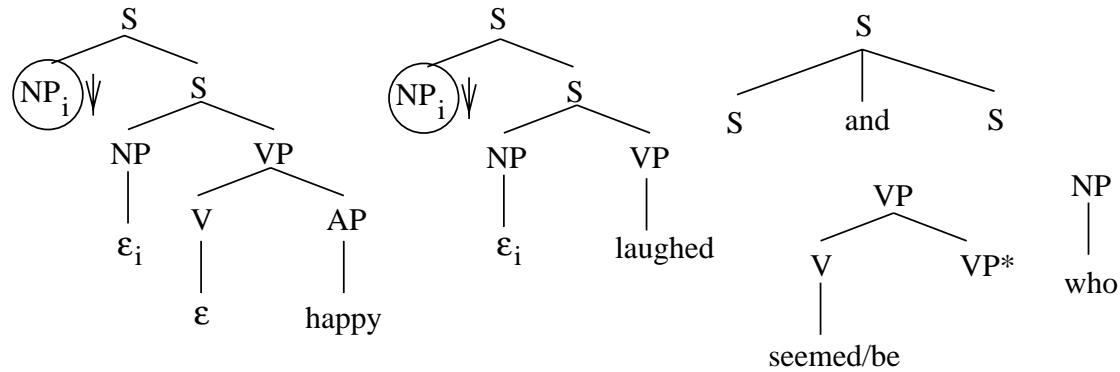
Coordination in a TAG

Problems

- In a TAG, dependencies between predicate and arguments are made local within a tree (the extended domain of locality).

- Cases of coordination violate this notion of locality.

- Some notion of "sharing" these dependencies has to be introduced.

- Introduce a novel method of rewriting nodes as trees with following prerequisites:

  ○ Coordinate structures must be built from the elementary structures in a TAG.

  ○ Must have a precise notion of derivation.

  ○ Must respect TAG linguistic assumptions.

The *conjoin* Operation

α (eats) {1}
2.2
α (cookies)

S
NP   VP
      V   NP
      | |
    eats cookies
root

S
NP   VP
      V   NP
      | |
    drinks beer
root

α (drinks) {1}
2.2
α (beer)

α(and)   VP
        VP   VP
          and

α(John) NP
          |
          N
          |
        John

Derivation tree

α(and)
1   3
α(eats) {1}   α(drinks) {1}
2.2   1   1   2.2
      α(John)
α(cookies)   α (beer)

Derived structure

S   VP   S
NP   VP   and   VP
N   V   NP   V   NP
| | | | |
John eats cookies drinks beer

John eats cookies and drinks beer
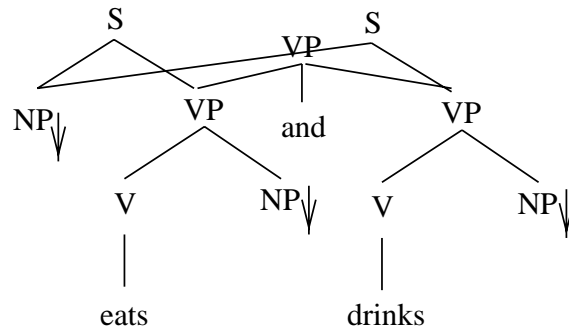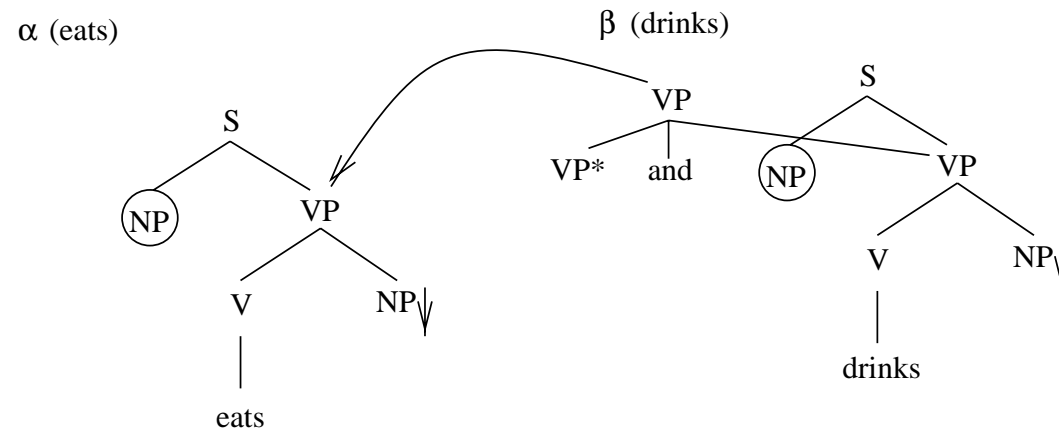
Across the board movement

Elementary trees

Who laughed and seemed to be happy?

Derived structure
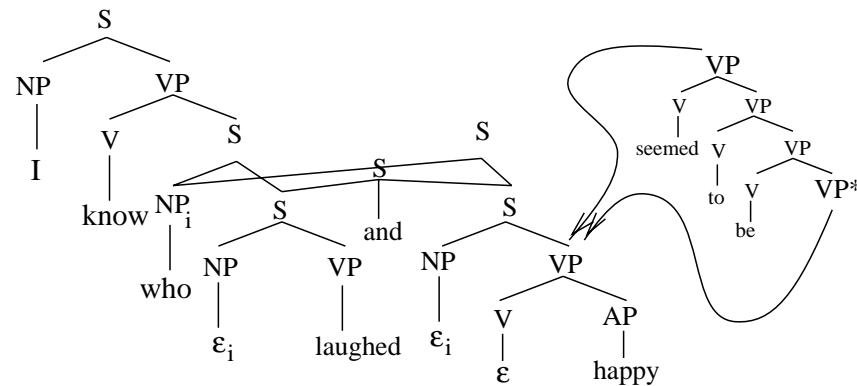
Derivation structure

Coordination as Adjunction

α (eats)

β (drinks)

```
                S                              VP              S
            /       \                        /    \        /      \
        (NP)        VP                    VP*     and   (NP)      VP
                  /    \                                        /    \
                 V     NP↓                                     V     NP↓
                 |                                             |
               eats                                         drinks
```
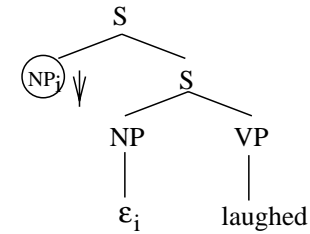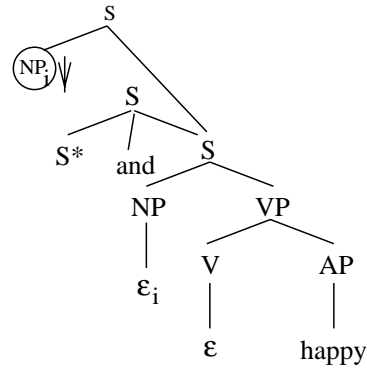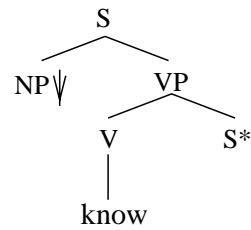
```
        S              S
      /   \    VP    /    \
    NP↓    \  /  \  /      \
           VP   and        VP
          /  \            /  \
         V   NP↓         V    NP↓
         |              |
       eats           drinks
```

α (eats)
|
β (drinks)

Derivation tree

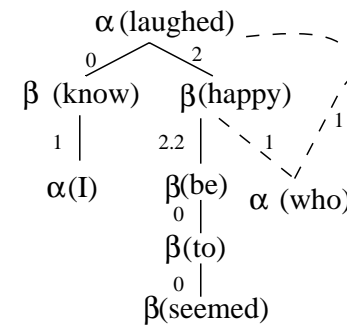*John eats cookies and drinks beer*
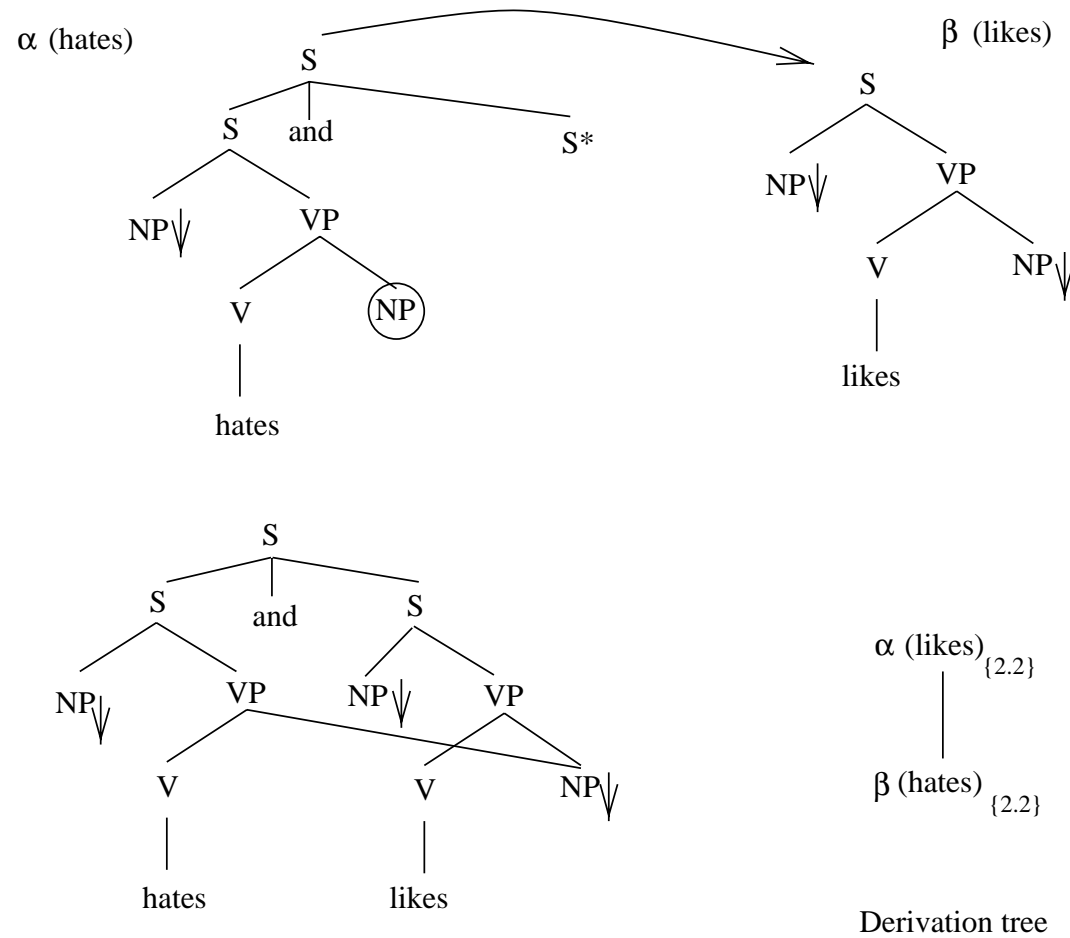
Coordination as Adjunction

Elementary trees

I know who laughed and seemed to be happy

Derived structure

Derivation structure

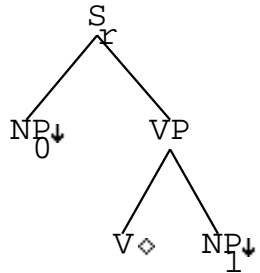# Parsing Issues: Ambiguity in non-coordinate sentences

α (hates)

β (likes)

John hates and Mary likes football

Derivation tree

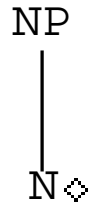α (likes) {2.2}

β (hates) {2.2}

Parsing Issues: Attachment ambiguity and coordination
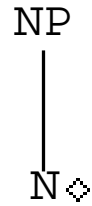
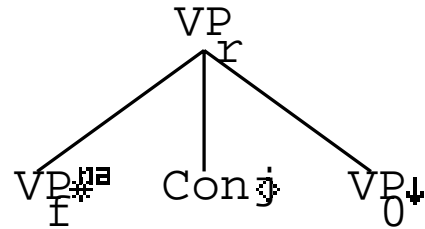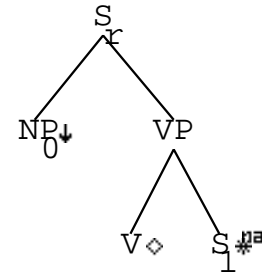[*Judge Curry*]　　*ordered*　　[*the refunds*]　　*which*
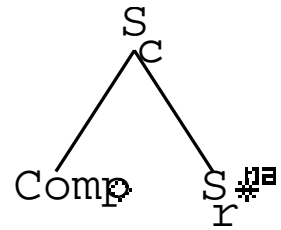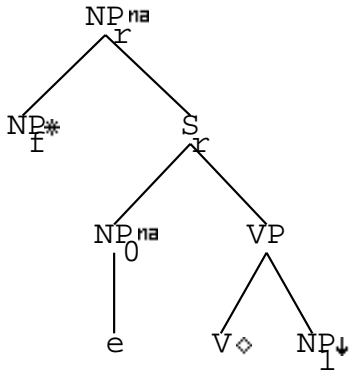
began　　[*Feb. 1*]　　*and*　　*said*　　...

Summary

- A structural approach towards coordination.

- Although motivated by the mechanisms of CCG, the treatment is distinct from CCG and 3D tree accounts.

- Extended domain of elementary trees allows elimination of ambiguities in non-coordinate sentences.

- Ambiguities while parsing sentences with coordination can be treated as attachment ambiguities.

Related Work

- Distinguishing dependencies between predicate-arguments from the notion of constituency. (Sarkar, 1997)

- Further linguistic examples are presented in (Joshi and Schabes, 1991; Sarkar and Joshi, 1996).

- Treatment of non-constituent coordination and gapping. (Sarkar and Joshi, 1996)