

1. INTRODUCTION

1.1 Multiple Linking

- In some constructions, a single lexical element appears to play multiple grammatical roles that are usually associated with distinct positions.

(1) e.g. Coordination

- a. *Joe bakes \_\_\_<sub>i</sub> and Sam decorates cookies<sub>i</sub>.*
- b. *Joe eats cookies and \_\_\_<sub>i</sub> drinks tea.*

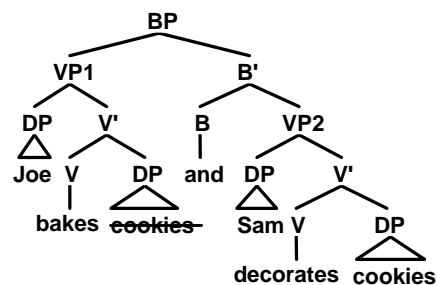
(2) e.g. Wh-questions

- a. *Who<sub>i</sub> did Emmy make \_\_\_<sub>i</sub> eat spinach?*
- b. *What<sub>i</sub> did Emmy eat \_\_\_<sub>i</sub>?*

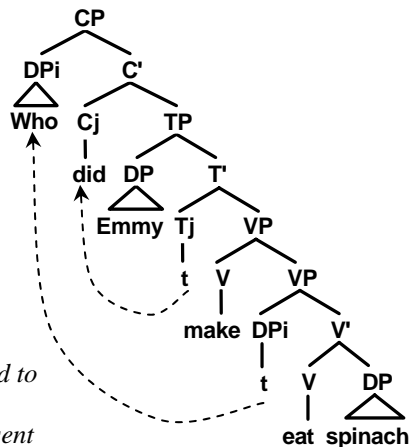
1.2 Traditional Tree-Based Approaches

- Ellipsis
- Movement

(3) Possible analysis for (1a)



(4) Possible analysis for (2b)

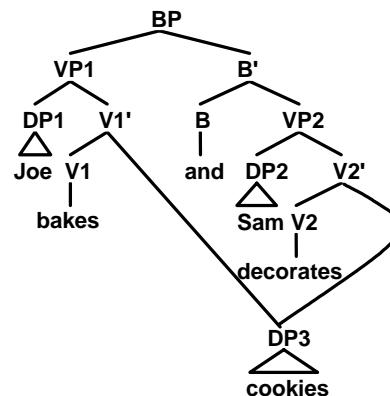


... but why delete the first copy as opposed to the second?  
 ... and isn't co-indexing a means to represent that a node has multiple parents?

1.3 Alternative Multidominance Approach

- A multi-dominance approach: allow nodes to be immediately dominated by multiple parent nodes.
- The set of syntactic structures is expanded to include non-tree graphs.

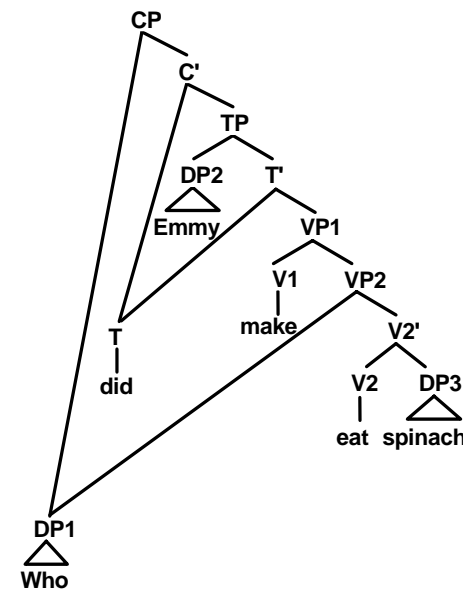
(5) A multidominance analysis for (1a)



Node DP3 has two parents:  
 V1' and V2'

Node DP3 has two sisters:  
 V1 and V2

(6) A multidominance analysis for (2b)



Node DP1 has two parents:  
 CP and VP2

Node DP1 has two sisters:  
 C' and V2'

Node T has two parents:  
 C' and T'

Node T has two sisters:  
 TP and VP1

See also Gärtner (1997), Wilder (2001), Abels (2004), Goodall (1987), Moltmann (1992).

• **Research Questions**

... addressed in last talk (handouts available!):

How are such graphs generated?

What introduces multidominance into the system?

TAG answer: node contraction

Minimalist answer: internal merge

... addressed in this talk:

**How are the terminals in such graphs linearized?**

How are multidominance structures pronounced?

e.g. Why is the object *cookies* in (5) always pronounced after the second verb, never immediately after the first?

**1.4 Proposal**

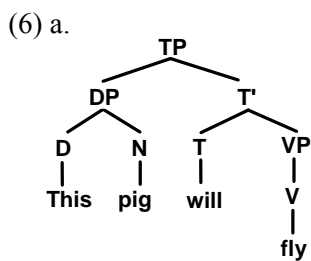
- A procedure for deriving a linearization for the terminals of a graph, general enough to linearize:
  - coordinate constructions
  - cases traditionally involving movement
- Linearizability as a well-formedness requirement (following Kayne 1994). i.e. Exclude:
  - totality violations
  - antisymmetry violations

**2. DERIVING A LINEARIZATION**

**2.1 Primitive Relations**

- Immediate Dominance:  $xIDy = x$  immediately dominates  $y$
- Sister Precedence:  $xSPy = x$  sister precedes  $y$

e.g. The graph in (6a) represents the two relations given in (6b).



- b.  $ID = \{ (TP, DP), (TP, T'), (DP, D), (DP, N), (T', T), (T', VP), (D, This), (N, pig), (T, will), (VP, V), (V, fly) \}$

Note that  $(VP, fly)$  is not in this relation.

- $SP = \{ (DP, T'), (D, N), (T, VP) \}$

Note that  $(This, pig)$  is not in this relation.

**2.2 Derived Relations**

- Dominance **D**: the transitive closure of immediate dominance (i.e. What we usually mean by “dominance.”)

e.g. For the graph in (6a)

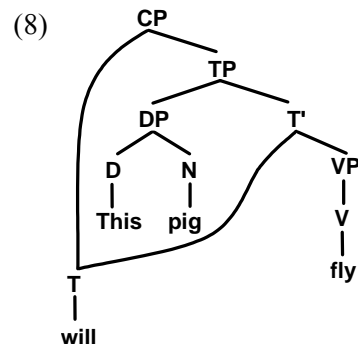
- $D = ID \cup \{ (TP, D), (TP, N), (TP, T), (TP, VP), (TP, This), (TP, pig), (TP, will), (TP, V), (TP, fly), (DP, This), (DP, pig), (T', will), (T', V), (T', fly), (VP, fly) \}$

Note that  $(VP, fly)$  is in this relation.

- Precedence **P**:
  - defined over terminals
  - uses a modification of the Non-Tangling Condition on trees (Partee *et al.*, 1990)
  - uses notion of *full-dominance* (Wilder 2001)

(7) Full-Dominance(Wilder 2001):

$\alpha$  fully dominates  $\gamma$  iff every path from  $\gamma$  to the root of the sentence includes  $\alpha$ .



DP fully dominates: *This* and *pig*

TP fully dominates: *This*, *pig*, and *fly*  
(does not fully dominate *will*)

**(9) Derived Precedence of Terminals**

- a. If  $\alpha$  and  $\beta$  are terminals and  $\alpha$  sister-precedes  $\beta$ , then  $\alpha$  precedes  $\beta$
- b. **Full-dominance Cousin-precedence condition:**  
If  $\alpha$  sister-precedes  $\beta$ , then all terminals *fully* dominated by  $\alpha$  precede all terminals *fully* dominated by  $\beta$ .
- c. If  $x$  precedes  $y$  and  $y$  precedes  $z$ , then  $x$  precedes  $z$ .

e.g. The graph in (6a) has three pairs in **SP** : (DP, T'), (D, N), and (T, VP)  
 - all terminals fully dominated by DP precede all terminals fully dominated by T'

DP **SP** T': *This, pig* precede *will, fly*

- all terminals fully dominated by D precede all terminals fully dominated by N

D **SP** N: *This* precedes *pig*

- all terminals fully dominated by T precede all terminals fully dominated by VP

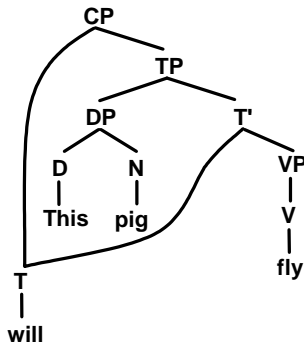
T **SP** VP: *will* precedes *fly*

- The ordering of the terminals is *This* >> *pig* >> *will* >> *fly*.

### 2.3 Example 1: Subj-Aux Inversion in Yes-No Questions

e.g. The graph in (10) represents the two relations given in (11).

(10)



- (11) a. **ID** = { (CP, T), (CP, TP),  
 (T, *will*),  
 (TP, DP), (TP, T'),  
 (DP, D), (DP, N),  
 (T', T), (T', VP)  
 (D, *This*),  
 (N, *pig*),  
 (VP, V),  
 (V, *fly*), }

- b. **SP** = { (T, TP)  
 (DP, T'),  
 (D, N),  
 (T, VP) }

- Consider the sister precedence pairs that affect the multi-dominated node:

T **SP** TP: *will* precedes *This, pig, fly*  
 (Note that TP does not fully dominate will.)

T **SP** VP: *will* precedes *fly*

- The other sister precedence pairs will provide the remaining ordering information needed:

DP **SP** T': *This, pig* precede *fly*  
 (Note that T' does not fully dominate will.)

D **SP** N: *This* precedes *pig*

- The pronunciation of the structure in (X) is:

*Will this pig \_\_\_\_ fly?*

NOT *\_\_\_\_ This pig will fly*

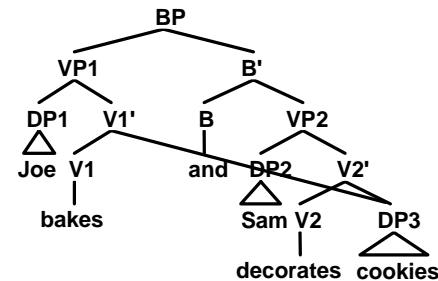
(12)

	<i>will</i> >> <i>This, pig, fly</i>	<i>will</i> >> <i>fly</i>	<i>This, pig</i> >> <i>fly</i>	<i>This</i> >> <i>pig</i>
<i>Will this pig ____ fly?</i>	✓	✓	✓	✓
<i>____ This pig will fly</i>	✗	✓	✓	✓

### 2.4 Example 2: Right Node Raising

e.g. The graph in (13) represents the two relations given in (14).

(13)



- (14) a. **ID** = { (BP, VP1), (BP, B'),  
 (VP1, DP1), (VP1, V1'),  
 (B', B), (B', VP2),  
 (DP1, *Joe*),  
 (V1', V1), (V1', DP3),  
 (B, *and*),  
 (VP2, DP2), (VP2, V2'),  
 (V1, *bakes*),  
 (DP3, *cookies*),  
 (DP2, *Sam*),  
 (V2', V2), (V2', DP3),  
 (V2, *decorates*) }

- b. **SP** = { (VP1, B'),  
 (DP1, V1'),  
 (B, VP2),  
 (V1, DP3),  
 (DP2, V2'),  
 (V2, DP3) }

- Consider the sister precedence pairs that affect the multi-dominated node:

V1 **SP** DP3: *bakes* precedes *cookies*  
 V2 **SP** DP3: *decorates* precedes *cookies*

- The other sister precedence pairs will provide the remaining ordering information needed:

VP1 **SP** B': *Joe, bakes* precede *and, Sam, decorates*  
 (Note that VP1 does not fully dominate cookies.)  
 DP1 **SP** V1': *Joe* precedes *bakes*  
 B **SP** VP2: *and* precedes *Sam, decorates*  
 DP2 **SP** V2': *Sam* precedes *decorates*

- This correctly predicts:

*Joe bakes \_\_\_\_\_ and Sam decorates cookies.*  
 \* *Joe bakes cookies and Sam decorates \_\_\_\_\_.*

(15)

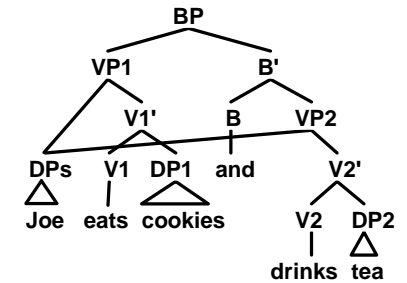
		<i>bakes &gt;&gt; cookies</i>	<i>decorates &gt;&gt;&gt; cookies</i>	<i>Joe, bakes &gt;&gt; and, Sam, decorates</i>	<i>Joe &gt;&gt; bakes</i>	<i>and &gt;&gt;&gt; Sam, decorates</i>	<i>Sam &gt;&gt; decorates</i>
<i>Joe bakes _____ and Sam decorates cookies.</i>	✓	✓	✓	✓	✓	✓	✓
<i>Joe bakes cookies and Sam decorates _____.</i>	✓	✗	✓	✓	✓	✓	✓

## 2.4 Successful Linearizations

- Shared Object (i.e. Right Node Raising)  
*Joe bakes and Sam decorates cookies.*
- Shared Subject (i.e. Coordinated VPs), as in (16)  
*Joe bakes and decorates cookies.*

- (16) sister precedence pairs that affect the multi-dominated node:

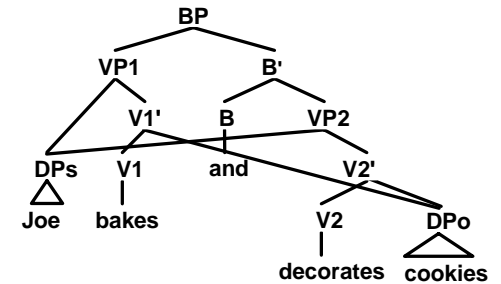
DPs **SP** V1':  
*Joe >> eats, cookies*  
 DPs **SP** V2':  
*Joe >> drinks, tea*



- Shared Subject and Object (i.e. Coordinated Vs), as in (17)  
*Joe eats cookies and drinks tea.*

- (17) sister precedence pairs that affect the multi-dominated nodes:

DPs **SP** V1':  
*Joe >> bakes*  
 DPs **SP** V2':  
*Joe >> decorates*  
 V1 **SP** DPo:  
*bakes >> cookies*  
 V2 **SP** DPo:  
*decorates >> cookies*

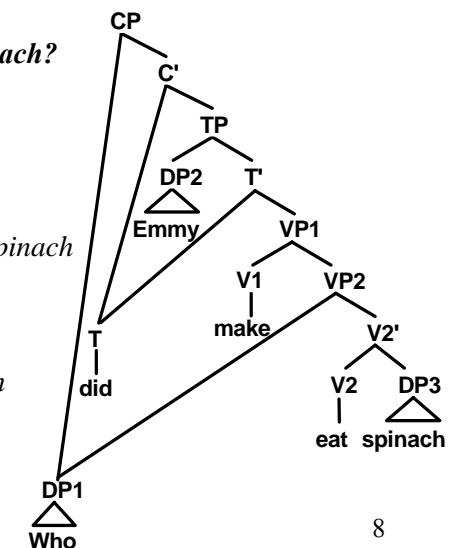


- Yes-No Questions  
*Will this pig fly?*

- Wh-Subject Questions, as in (18)  
*Who did Emmy make eat spinach?*

- (18) sister precedence pairs that affect the multi-dominated nodes:

DP1 **SP** C':  
*Who >> did, Emmy, make, eat, spinach*  
 DP1 **SP** V2':  
*Who >> decorates*  
 T **SP** TP:  
*did >> Emmy, make, eat, spinach*  
 T **SP** VP1:  
*did >> make, eat, spinach*



### 3. VIOLATIONS OF THE LINEARIZATION REQUIREMENT

- Following Kayne's (1994) LCA:  
If a syntactic structure cannot provide the information needed to linearize its terminals, the structure is ill-formed.
- A linearization is a total, transitive, antisymmetric, relation on the terminals.
- The procedure in section 2 does not guarantee a linearization for every graph.

#### 3.1 Avoiding Totality Violations

What happens when we don't have enough information?

- System does not tolerate underspecification
- Chooses between alternate analyses
- Example 1: Consider Coordinated Subjects.

Is: **John and Mary ate cookies.**

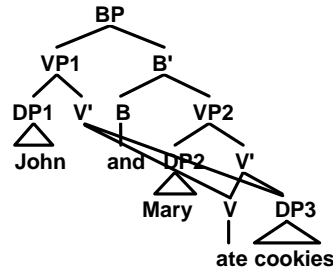
[**John** \_\_\_ \_\_\_] and [**Mary ate cookies**].

or

[**John and Mary**] ate cookies.

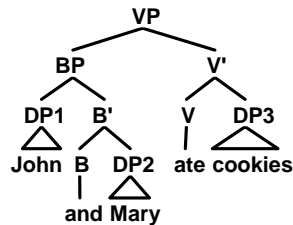
(19) Totality Violation:

Since *ate* and *cookies* are each only fully dominated by the root . . .  
*John*, *Mary*, and *and* are all unordered wrt *ate* and *cookies*.



(20) No Violation

Need such a structure anyway for sentences like:  
*John and Mary met in the park.*



### 3.2 Avoiding Symmetry Violations

What happens when we have conflicting information?

- System does not tolerate ordering conflicts either!
- Structure given in (21, (6) repeated) is not a possible analysis.

(21) Antisymmetry Violation:

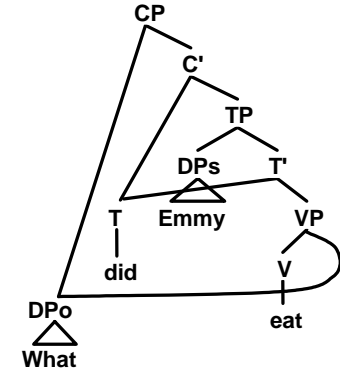
DPo SP C':

*what* >> *eat, did, Emmy*

V SP DPo:

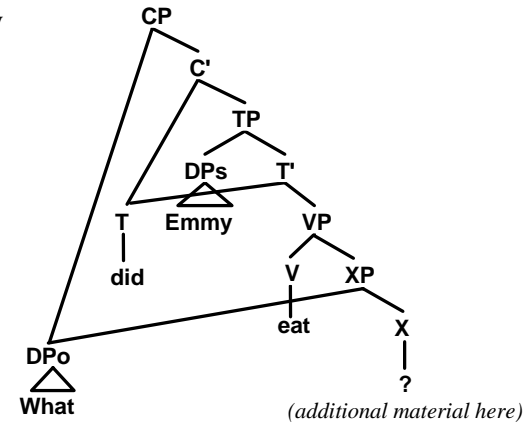
*eat* >> *what*

What can't both precede and follow *eat*.



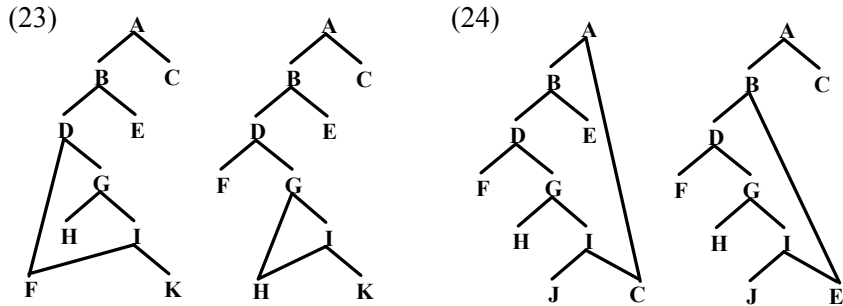
- The object must be analyzed as a left sister, as in (22). Possibilities:
  - Appeal to Fukui and Takano (1998)'s suggestion that all arguments are positioned to the left of the verb
  - Posit a sentence final question marker

(22) No Symmetry

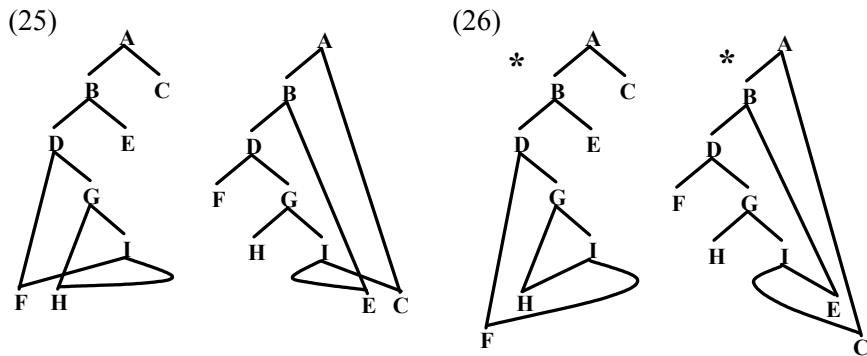


- More generally, the antisymmetry requirement constrains a multiply dominated node to maintain a consistent position with respect to all its sisters . . .  
except when a sister is also multiply dominated.

- e.g. In a binary branching structure, a multiply dominated node must be the left daughter of each of its mothers, as in (23), or the right daughter of each of its mothers, as in (24).



- The exception: When two sisters are both multiply dominated, a node may be both a right daughter and a left daughter so long as its position relative to its multiply dominated sister is maintained:
  - crossing dependencies, such as those in (25), avoid antisymmetry violations
  - nested dependencies, such as those in (26), result in antisymmetry violations



#### 4. SUMMARY

- We have presented a treatment of linearization for both coordination and cases typically taken to involve movement
  - Taken immediate dominance and sister precedence to be primitives
  - Derived precedence of terminals
  - Requiring syntactic graphs to be linearizable yields linguistically relevant consequences

#### Ongoing work:

##### How exactly can linearizable graphs be characterized?

##### What linearizations are possible?

- Contraction of right daughters yields rightward movement
- Contraction of left daughters yields leftward movement

##### What properties ensure antisymmetry?

##### What properties ensure totality?

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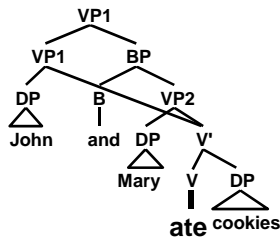
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## APPENDIX

### A. On the Possibility of Contracting X'-level nodes

In this paper, we have allowed contraction of nodes when at most one node dominates a terminal, as in the case of auxiliary inversion. This has limited nodes marked for contraction to XP-level nodes and some X-level nodes. We have not allowed contraction of X-level nodes that immediately dominate two lexical anchors, as this would result in a node that dominates two terminals which require additional machinery to keep one terminal from being pronounced. To maintain a linearizable sentential coordination analysis for *John and Mary ate cookies* would require supposing such machinery was indeed available, as well as allowing contraction of X'-level nodes. Under these assumptions, V', V, and the object DP could contract, yielding (1) as a third potential structure for *John and Mary ate cookies*.

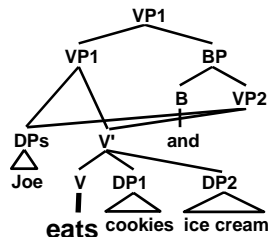
- (1) Third potential structure for *John and Mary ate cookies*.



Now that V' fully dominates *ate* and *cookies*, these terminals can be ordered with respect to the other terminals. (Let us put aside the additional difficulty of determining the agreement, which would become apparent in the present tense analogue of this sentence. Perhaps calculating is part of the process of collapsing two X-level nodes.)

Interestingly, expanding the set of nodes that may be contracted to include pairs of X'-level nodes and pairs of nodes that both dominate a terminal does not provide an analogous sentential coordination analysis for a construction with coordinated objects. This is the structure that contraction of the subject DP, V', and V yields.

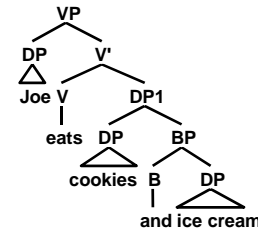
- (2) A potential structure for *Joe eats cookies and ice cream*.



In addition to appearing to incorrectly indicate that *eats* takes two complements, this structure is not linearizable. Neither VP1 nor VP2 fully dominate anything. This leaves *and* unordered and leaves *cookies* and *ice cream* unordered with respect to each other.

A structure with conjoined object DPs has no node contraction and no linearization problems.

- (3) A second potential structure for *Joe eats cookies and ice cream*.



The lack of a repair strategy for totality violations rules out (2) as a potential analysis for sentences with coordinated objects, leaving (3) as the analysis for such sentences. Unless machinery that allows two nodes both dominating terminals to contract is available, adopting this linearization requirement, means rejecting the notion that all cases of coordination can be reduced to cases of sentential coordination.