

## #9 – Complexity & Economy in Parsing and Grammar

### Structural ambiguity resolution

*Evidence for mechanisms particular to sentence comprehension supports the independence of a sentence comprehension system.*

- Existence of garden-path phenomena initially taken to provide evidence for *heuristic rules* in sentence comprehension (e.g. Bever 1970).
  - (1) a. NP V subject main-verb  
The horse raced ... past the barn fell.
  - b. V NP verb direct-object  
I know the answer to the question ... is wrong.  
While Gromit was awakening Wallace ... fell through the ceiling.
  - c. V NP NP verb indirect-object direct-object  
Wallace sent the woman his love ... was reserved for a bunch of daisies.
- Mis-parsing phenomena later taken to reflect operation of *structural economy conditions* when sentence-analyzer is faced with a choice point (e.g. Kimball 1973; Frazier & Fodor 1978; Fodor & Frazier 1980; Ford et al. 1982 etc. etc.)
  - (2) a. Minimal Attachment: use as few new nodes as possible
  - b. Local Attachment: attach incoming material as close as possible to recent material.
  - c. Active Filler Strategy: complete movement chains as quickly as possible.

### Some structural ambiguities in declaratives

- (3) Main verb vs. reduced relative clause
  - a. The horse raced past the barn fell.
  - b. The package dropped from the plane contained important news.
  - c. The boat floated down the river sank.
- (4) Ambiguous PP attachment: attachment to VP or to NP
  - a. The lifeguard saw the swimmer with inadequate experience.
  - b. The cop saw the spy with the binoculars.
- (5) Double complement vs. relative clause
  - a. Wallace gave the dog the cheese tempted milk.
  - b. Bill told the reporter that Hillary liked to go jump in the Potomac.

(6) Adjective-noun vs. relative clause

The cotton clothing is made of grows in Mississippi.

(7) Object vs. embedded subject ambiguity.

- a. Wallace knows Gromit likes cheese.
- b. Newt admitted the error was entirely his.

(8) Embedded object vs. matrix subject

- a. While Mary was mending the sock fell off her lap.
- b. Since Jay jogs a mile seems easy nowadays.

(9) Adverbial ambiguous between higher and lower clause attachment.

- a. John said Bill left yesterday.
- b. John said Bill will leave yesterday.

(10) Relative clause ambiguous between higher and lower NP attachment.

I met the daughters of the colonel who were visiting Washington.

(11) Subject of embedded relative clause vs. matrix subject.

- a. Since the conference organizers liked the caterers they hired (them) for the banquet...
- b. Although Erica hated the house she had owned (it) for ten years...

**Active Filler Strategy**

- Evidence for gap-filling as soon as possible (Fodor 1978, Stowe 1986)

(12) a. My brother wanted to know if Ruth will bring us home to Mom at Christmas.

- b. My brother wanted to know who Ruth will bring us home to at Christmas.

(13) a. Which book did Ian read to the children last night?

- b. Which book did Ian read to the children from last night?

(14) a. Which child did Ian walk to the office last night?

- b. Which child did Ian walk to the office with last night?

- Preference for subject > object gap in Dutch ambiguous relative clauses (Frazier 1987)

- (15) Karl hielp de mijnwerker die de boswachter vond.  
 'Karl helped the mineworker who \_\_ found the forester.'  
 'Karl helped the mineworker who the forester found \_\_.'
- (16) a. Karl hielp de mijnwerkers die de boswachter vonden  
*Karl helped the mineworkers who the forester found-pl*  
 'Karl helped the mineworkers who found the forester.'
- b. Karl hielp de mijnwerkers die de boswachter vond  
*Karl helped the mineworkers who the forester found-sg*  
 'Karl helped the mineworkers who the forester found.'

### Theories (in brief)

#### A. "Garden Path" theory (Frazier, Fodor, Clifton and others)

##### i. Minimal attachment:

Make the attachment that requires the least number of new syntactic nodes

##### ii. Late closure/Right association:

Attach incoming items to the most recently built nodes.

##### iii. Active filler strategy/Minimal chain condition

Build movement chains which are (i) as short, (ii) as few as possible.

#### B. Argument-first theory (Ford, Bresnan, Pritchett, Gibson and others)

Give priority to predicate-argument relations over modifier relations.

#### C. Referential theory (Crain, Steedman and others)

Choose the attachment which best fits the existing discourse model.

##### Null context:

The package dropped from the plane contained important news.

##### Context with one alternative:

The intrepid airman was determined to safely deliver the supply package to the explorers waiting high on the Himalayan slopes. He positioned himself for the critical maneuver...

The package dropped from the plane...

Context with two alternatives:

After two months in the mountains the explorers received two packages from the outside, one by air and one from a pair of sherpa messengers.

The package dropped from the plane...

D. Fully interactive theories (Tanenhaus, MacDonald and many others)

Semantics, discourse, frequency all take effect immediately in resolving structural ambiguities.

**Uses of Economy Constraints in Syntax**

- Substitute for minimality conditions on movement (e.g. wh-islands, head movement constraint, superraising?): movement X is impossible, because there's a position which *could* have been targeted which would have created a shorter dependency.
- (17) a. \* How did John wonder what Mary fixed.  
b. \* John seems it is certain to be here.  
c. \* Fix John can the car?
- Constraint on movement which fails to provide (sufficiently) distinct interpretation (*Ellipsis Dependency Generalization*, Fox 1995)
- (18) a. Wallace likes Gromit, and Wendolene does too.  
b. Every sheep likes Gromit, and every cat does too.
- (19) a. Some sheep likes every dog, and Shawn does too. (unambiguous)  
b. Some sheep likes every dog, and some cat does too. (ambiguous)
- Constraint on generation of vacuous structure (e.g. Chomsky 1991 treatment of *do*-support; Grimshaw 1997 treatment of similar phenomena).
  - *Procrastinate*: essentially a ban on (overt) movement, unless forced.
  - Means of blocking devious derivations that violate the Proper Binding Condition (Collins 1994)
- (20) a. Who did you say that John stole pictures of t?  
b. \* Who did you say that pictures of t were stolen t?
- (21) a. Who did you say that John killed t?  
b. \* Who did you say that t was killed t?





## II. COREFERENCE AND BOUND VARIABLE ANAPHORA

- (30) a. Every Englishman<sub>i</sub> thinks he<sub>i</sub> is a great cook.  
b. Wallace<sub>i</sub> thinks he<sub>i</sub> is a great cook.
- (31) a. Wallace thinks he is a great cook, and Gromit does too.  
... & Gromit<sub>j</sub> ( x (x thinks he<sub>i</sub> is a great cook))  
... & Gromit ( x (x thinks x is a great cook))  
b. Only Wallace thinks he is a great cook.  
(only Wallace<sub>i</sub>)( x (x thinks he<sub>i</sub> is a great cook))  
(only Wallace) ( x (x thinks x is a great cook))  
c. Even Wallace thinks he is a great cook.  
(even Wallace<sub>i</sub>)( x (x thinks he<sub>i</sub> is a great cook))  
(even Wallace) ( x (x thinks x is a great cook))
- (32) a. Only the British think they are great cooks.  
b. Nowadays, even New Yorkers think they are safe.
- Coreference readings can sometimes escape binding conditions (examples from Grodzinsky & Reinhart 1993)
- (33) a. (Who is this man over there?) He<sub>i</sub> is Colonel Weisskopf<sub>i</sub>.  
b. Only Churchill<sub>i</sub> remembers Churchill<sub>i</sub> giving the speech about blood, sweat, toil, and tears. (J.A. Fodor 1975: 134)  
c. Everyone has finally realized that Oscar is incompetent. Even he<sub>i</sub> has finally realized that Oscar<sub>i</sub> is incompetent. (Evans 1980: (52))  
d. I know what Ann and Bill have in common. She thinks that Bill is terrific and he<sub>i</sub> thinks that Bill<sub>i</sub> is terrific. (Evans 1980:(49))  
e. I dreamt I was Brigitte Bardot, and I kissed me. (due to George Lakoff, discussed in Heim 1991)  
f. Oscar is sad. He<sub>i</sub> thinks that Oscar<sub>i</sub> is incompetent.
- Bound-variable readings can *never* escape binding conditions
- (34) a. I know what Ann and every linguist here have in common.  
\* She thinks that every linguist is terrific, and he<sub>i</sub> thinks that every linguist<sub>i</sub> is terrific. (Demirdache 1998)  
b. \* Only he<sub>i</sub> thinks that every linguist<sub>i</sub> is a genius.  
c. \* Everybody is sad. He<sub>i</sub> thinks that everybody<sub>i</sub> is incompetent.  
d. I dreamt I was Brigitte Bardot, and Wallace dreamt that he was Wendolene, and I kissed me, and Wallace did too. [strict reading only]

- How to rule out Condition B violations which need not be interpreted as variable-binding?

- (35) a. \* Lucie adores her.  
b. \* Mama bear touched her.

- Grodzinsky & Reinhart 1993: if a coreference relation *can* be treated as a variable-binding relation (because c-command is satisfied), then it *must* be treated as a variable-binding relation.

- (36) *Rule I: Intrasentential Coreference* (Grodzinsky & Reinhart 1993, 79)  
NP A cannot corefer with NP B if replacing A with C, C a variable A-bound by B, yields an indistinguishable interpretation.

PREDICTION: G&R's Rule I should also lead to interpretive preference in genuinely ambiguous sentences.

- (37) a. Clinton hopes that he is found innocent, and Jordan does too.  
b. Clinton hopes that he is found innocent, and Starr does too.

- (38) a. Only New Yorkers think they are truly cosmopolitan.  
b. Only Delawareans think they are truly cosmopolitan.

Prediction is supported by intuitive judgments, but has not been experimentally confirmed.

[Off-line preference for bound-variable over coreference reading of *reflexives* claimed by Fiengo & May 1994, Shapiro & Hestvik 1995, Hestvik 1996]

### III. MINIMAL ATTACHMENT AND STRUCTURAL ECONOMY

e.g., Gorrell 1995: attempt to assimilate Minimal Attachment effects to Structural Economy effects in syntax as argued for by Chomsky (1991), Grimshaw (1997).

### IV. SHORTEST MOVE CONSTRAINTS?

Although tempting to assimilate them, *Active Filler Strategy/Minimal Chain Condition* effects discussed in the sentence processing literature do not seem to parallel the *Shortest Move/Minimal Link Condition* effects discussed at length in recent syntactic literature.

- (39) a. Active Filler effects: complete movement chain as soon as possible. (Frazier 1987; Frazier & Flores d'Arcais 1989; de Vincenzi 1992)  
b. Minimal Link effects: movement chain cannot span a position which could participate in a chain of the same type (relativized minimality effects); competing derivations do not have identical semantic or phonological representations. (Epstein 1992, Chomsky 1995, Manzini 1994, Kitahara 1997)

- (40) Shortest Move Constraint (Kitahara 1997: 27; Chomsky 1995, 15)  
Given two convergent derivations  $D_1$  and  $D_2$ , both minimal and containing the same number of steps,  $D_1$  blocks  $D_2$  if its links are shorter

“the SMC prohibits any derivation in which a category has skipped a position it could have reached by a shorter move, *had that position not been filled.*”

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