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## BINDING, EXTRACTION AND ARG-S: CONNECTIVITY EFFECTS IN HPSG

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### OUTLINE

- I. The Phenomenon
- II. Head-Driven Phrase Structure Grammar
- III. HPSG3: ARG-S and Traceless Extraction
- IV. Towards a Solution

### I. THE PHENOMENON

#### CONNECTIVITY EFFECTS

- *Wh*- phrase behaves as if it is *in situ* with respect to (non-)coreference possibilities.

#### Reflexives:

1. a. [How many pictures of himself<sub>i</sub>] did Roberta think that Greg<sub>i</sub> would choose?  
b. Roberta thought that Greg<sub>i</sub> would choose [five pictures of himself<sub>i</sub>].
2. a. [How proud of herself<sub>i</sub>] does David think that Julie<sub>i</sub> was?  
b. David thinks that Julie<sub>i</sub> was not very [proud of herself<sub>i</sub>].

#### Pronouns:

3. a. \*[How many movies about him<sub>i</sub>] did Joy say that Michael<sub>i</sub> wrote?  
b. \*Joy said that Michael<sub>i</sub> wrote [two movies about him<sub>i</sub>].
4. a. \*[How proud of her<sub>i</sub>] did Phil expect Hana<sub>i</sub> to be?  
b. \*Phil expected Hana<sub>i</sub> to be [very proud of her<sub>i</sub>].

#### Nonpronouns:

5. a. \*[How far from Sarah<sub>i</sub>] did Jay think she<sub>i</sub> threw the ball?  
b. \*Jay thought she<sub>i</sub> threw the ball [five meters from Sarah<sub>i</sub>].
6. a. \*[How happy to see Kim<sub>i</sub>] did Ron think she<sub>i</sub> would be.  
b. \*Ron thought she<sub>i</sub> would be [quite happy to see Kim<sub>i</sub>].

#### ANTICONNECTIVITY EFFECTS

- *Wh*- phrase does not behave as if it is *in situ* with respect to (non-)coreference possibilities (a.k.a. antireconstruction effects, cf. Van Riemsdijk & Williams 1981, Cinque 1984, Barss 1986, Huang 1993, Heycock 1995).

Reflexives:

7. a. [Which pictures of herself<sub>i</sub>] did Roberta<sub>i</sub> think that Greg would choose?  
b. [Which books about himself<sub>i</sub>] does David<sub>i</sub> think that Julie actually wrote?

Pronouns:

8. a. [Which movies about him<sub>i</sub>] did Joy say that Michael<sub>i</sub> wrote?  
b. [Which pictures of her<sub>i</sub>] does Greg think that Roberta<sub>i</sub> chose?

Nonpronouns:

9. a. [Which allegations about John<sub>i</sub>] do you think he<sub>i</sub> will deny?  
b. [Which question Gore<sub>i</sub> hadn't prepared for] do you think he<sub>i</sub> messed up on the worst?  
[from Heycock 1995]

### CONNECTIVITY VS. ANTICONNECTIVITY

- Obligatory connectivity found with fronted predicates, but not with fronted arguments (Cinque 1984, Barss 1986, Huang 1993; examples from Heycock 1995):

10. a. [Which pictures of himself<sub>i/j</sub>] did John<sub>i</sub> think Bill<sub>j</sub> admired?  
b. [How proud of herself<sub>j/\*i</sub>] did Alice<sub>i</sub> think that Barbara<sub>j</sub> should be?
11. a. [Which allegations about John<sub>i</sub>] do you think he<sub>i</sub> will deny? [=9.a]  
b. \*[How proud of John<sub>i</sub>] do you think he<sub>i</sub> is?

- Not the whole story:

First, there are arguments which induce connectivity effects (Heycock 1995):

12. a. \*[How many stories about Diana<sub>i</sub>] is she<sub>i</sub> most likely to invent?  
b. \*[How many lies aimed at exonerating Clifford<sub>i</sub>] is he<sub>i</sub> planning to come up with?

Second, there are other nonpredicates that induce connectivity effects:

13. \*[How far from Sarah<sub>i</sub>] did Jay think she<sub>i</sub> threw the ball? [=5.a]

HEYCOCK'S (1995) GENERALIZATION (in my words): fronted phrases that quantify semantically over individuals/entities need not show connectivity effects; other fronted phrases do show such effects.

- Anticonnectivity: *which* phrases (examples 7, 8, 9)
- Connectivity: *how many* phrases, *how* predicate phrases (examples 1, 2, 3, 4, 5, 6)



18. *loves* [SUBCAT <NP<sub>1</sub>, NP<sub>3</sub>>] (ordered list: NP<sub>1</sub> less oblique than NP<sub>3</sub>)

- NP<sub>1</sub> locally o-commands NP<sub>3</sub>
- NP<sub>1</sub> o-commands NP<sub>4</sub> (it locally o-commands NP<sub>3</sub> dominating NP<sub>4</sub>)
- Neither NP<sub>2</sub>, NP<sub>3</sub>, nor NP<sub>4</sub> (locally) o-command NP<sub>1</sub> or each other

IN OTHER WORDS: The subject locally o-commands the object, and o-commands anything embedded within the object. No other o-command (local or not) obtains.

Reflexives:

19. a. The linguist<sub>i</sub> saw himself<sub>i</sub> in the mirror  
 b. \*The linguist<sub>i</sub> said [that Mary saw himself<sub>i</sub> in the mirror]

Pronouns:

20. a. He<sub>i</sub> left  
 b. The linguist<sub>i</sub> said [that he<sub>i</sub> would be late]  
 c. \*The linguist<sub>i</sub> saw him<sub>i</sub> in the mirror

Nonpronouns:

21. a. The linguist left  
 b. \*The linguist<sub>i</sub> said [that John<sub>i</sub> would be late]

### EXTRACTION IN HPSG2

22. Who does John love?

23.           S'

NP<sub>j</sub>            S

who NP<sub>i</sub>            VP

          John V            NP<sub>j</sub>

                  love            —

- "Trace" ('\_') is a lexical noun phrase with no phonology.
- Trace is sort of a place-holder to satisfy verb's SUBCAT requirements:

24. a. *love* [SUBCAT <NP<sub>1</sub>, NP<sub>2</sub>>]  
 b. NP<sub>1</sub> = John, NP<sub>2</sub> = trace

- A coindexed "slash" feature appears in tree and is "cached out" at S' level when *who* is encountered.
- This ensures a one-to-one correspondence between the number of traces introduced and the number of "displaced" phrases in the tree.
- The coindexation also forces the displaced phrase and the trace to refer to the same NP.





## SOME MOTIVATION FOR THE DISSOCIATION

- Canonically, SUBCAT list is just the **append** of the SUBJ, SPR and COMPS lists, in that order.
- Dissociating the two lists allows noncanonical "mapping" between SUBCAT list and valence features.

TOBA BATAK (Manning & Sag 1995, citing Schachter 1984):

Active voice (*mang-*) and objective voice (*di-*)

33. a. Mang-ida si Ria si Torus  
AV-see PM Ria PM Torus  
'Torus sees/saw Ria.'
- b. Di-ida si Torus si Ria  
OV-see PM Torus PM Ria  
'Torus sees/saw Ria'

Manning & Sag (1995): final NP is syntactic subject in both sentences.

- In (a) the syntactic subject is the "logical" subject.
- In (b) the syntactic subject is the undergoer (Foley and Van Valin 1984), the proto-patient (Dowty 1991), or the logical object (Mohanana 1990).

HPSG3 Analysis:

- TB active voice employs canonical mapping between valence features and SUBCAT list (via **append**)
- TB objective voice employs a noncanonical mapping: undergoer/proto-patient/object argument indexed with SUBJ feature and logical subject is indexed with COMPS feature.

Noncanonical mapping accounts can be given to syntactically ergative languages (Manning 1995).

## BINDING THEORY IN HPSG3

HPSG3 BINDING CONDITIONS: the same as in HPSG2 except defined on ARG-S instead of SUBCAT (see p. 3)

34. \*He<sub>i</sub> loves John<sub>i</sub>

35. loves [ARG-S <NP<sub>1</sub>, NP<sub>2</sub>>]

- NP<sub>1</sub> = he<sub>i</sub>
- NP<sub>2</sub> = John<sub>i</sub>
- NP<sub>1</sub> o-commands NP<sub>2</sub>, violating the condition on nonpronouns.

### EXTRACTION IN HPSG3

- Lexical rule removes argument from valence list and introduces "slash" feature.
- No trace is needed since valence list is restructured.
- ARG-S is unaffected.

36. Who does John love?

37. S'

NP <sub>2</sub>	S	
who	NP <sub>1</sub>	VP
	John	V
		love

Simplified version of complement extraction lexical rule (slash info left out):

38. *love* [SUBJ <NP<sub>1</sub>>, COMPS <NP<sub>2</sub>>, ARG-S <NP<sub>1</sub>, NP<sub>2</sub>>]

↓

*love* [SUBJ <NP<sub>1</sub>>, COMPS <...>, ARG-S <NP<sub>1</sub>, NP<sub>2</sub>>]

### BINDING THEORY AND EXTRACTION IN HPSG3

#### CONNECTIVITY

39. \*[How many movies about John<sub>i</sub>] do you think he<sub>i</sub> will write?

40. *write* [SUBJ <NP<sub>1</sub>>, COMPS <...>, ARG-S <NP<sub>1</sub>, NP<sub>2</sub>>]

- NP<sub>1</sub> (*he*) locally o-commands NP<sub>2</sub> (*how many movies about John*)
- NP<sub>1</sub> o-commands *John* dominated by NP<sub>2</sub>

No Problem:

- NP<sub>1</sub> (*he*) and *John* are coindexed so the condition on nonpronominals rules the sentence out.
- Connectivity effect obtains, as desired.

## ANTICONNECTIVITY

41. [Which allegations about John<sub>i</sub>] do you think he<sub>i</sub> will deny?

42. *deny* [SUBJ <NP<sub>1</sub>>, COMPS <...>, ARG-S <NP<sub>1</sub>, NP<sub>2</sub>>]

- NP<sub>1</sub> (*he*) locally o-commands NP<sub>2</sub> (*which allegations about John*)
- NP<sub>1</sub> o-commands *John* dominated by NP<sub>2</sub>

Problem:

- NP<sub>1</sub> (*he*) and *John* are coindexed so the condition on nonpronominals rules the sentence out.
- Connectivity effect should obtain, but does not.

MINI-CONCLUSION 2: HPSG3 account of extraction and binding wrongly predicts that connectivity effects should always obtain.

THE PROBLEM: Neither version of HPSG provides a way to capture both connectivity and anticonnectivity effects: HPSG2 predicts only anticonnectivity effects; HPSG3 predicts only connectivity effects.

THE SOLUTION: Both versions are correct?

## IV. TOWARDS A SOLUTION

Differences between HPSG2 and HPSG3:

- Dissociation of valence features and ARG-S list.  
Motivated by cross-linguistic differences in the correspondence between the representation on which generalizations like binding theory hold and the one that determines the grammatical relations of a clause.
- Extraction accomplished via lexical rule.  
Pollard & Sag (1994, Ch. 9) provide little motivation for abandoning the trace solution, except for a conceptual desire to place more emphasis on lexical processes and less on syntactic ones.

### PROPOSAL

- Maintain dissociation of valence features and ARG-S list à la HPSG3.
- Extraction is accomplished by lexical rule affecting valence features à la HPSG3, but an additional "trace strategy" is available to extractions of a certain type.

### EXTRACTION STRATEGIES

LEXICAL RULE: lexical rule removes valence features and inserts slash into representation, leaving ARG-S list alone (as outlined above).

TRACE STRATEGY: trace appears in ARG-S list, coindexed with slash and ultimately with extracted phrase, along the lines of HPSG2 approach.

43. *love* [SUBJ <NP<sub>1</sub>>, COMPS <...>, ARG-S <NP<sub>1</sub>, NP<sub>2</sub>>]

- NP<sub>1</sub> = you, NP<sub>2</sub> = \_\_ (trace)

#### CONNECTIVITY

44. \*[How many movies about John<sub>i</sub>] do you think he<sub>i</sub> will write?

Lexical Rule (no trace strategy):

45. *write* [SUBJ <NP<sub>1</sub>>, COMPS <...>, ARG-S <NP<sub>1</sub>, NP<sub>2</sub>>]

- NP<sub>1</sub> (*he*) locally o-commands NP<sub>2</sub> (*how many movies about John*)
- NP<sub>1</sub> o-commands *John* dominated by NP<sub>2</sub>

No Problem:

- NP<sub>1</sub> (*he*) and *John* are coindexed so the condition on nonpronominals rules the sentence out.
- Connectivity effect obtains, as desired.

#### ANTICONNECTIVITY

46. [Which allegations about John<sub>2</sub>]<sub>1</sub> do you think he<sub>3</sub> will deny? [ =9.a]

Lexical Rule:

47. *deny* [SUBJ <NP<sub>3</sub>>, COMPS <...>, ARG-S <NP<sub>3</sub>, NP<sub>4</sub>>]

Trace Strategy:

48. *deny* [...ARG-S <NP<sub>3</sub>, NP<sub>4</sub>>]

- NP<sub>3</sub> = he; NP<sub>4</sub> = \_\_ (trace)
- NP<sub>3</sub> (*he*) o-commands object NP<sub>4</sub> (the trace ‘\_\_’),
- NP<sub>3</sub> does not o-command the fronted phrase (NP<sub>1</sub>) or the phrase (NP<sub>2</sub>) contained within it.

No Problem:

- No o-command between subject NP<sub>3</sub> (*he*) and NP<sub>2</sub> (*John*) embedded within fronted phrase.
- No o-command means no o-binding: no binding conditions relevant.
- Anticonnectivity effects obtain.

## WHY EMPLOY TRACE STRATEGY?

RECALLING HEYCOCK'S GENERALIZATION: fronted phrases that quantify semantically over individuals/entities need not show connectivity effects; other fronted phrases do show such effects.

- Anticonnectivity: *which* phrases (examples 7, 8, 9)
- Connectivity: *how many* phrases, *how* predicate phrases (examples 1, 2, 3, 4, 5, 6)

RESTATING THE GENERALIZATION: extraction of phrases that quantify over individuals/entities may use the trace strategy; all other extraction is via lexical rule only.

### THE TRACE

- Use of trace only sanctioned if extracted phrase quantifies over individuals/entities.
- Trace itself is individual/entity type; encoded as information in lexical entry, which must match type information on fronted phrase since they are coindexed.

### AN UNCONFIRMABLE PREDICTION

- Trace strategy is optional and only available in constructions where extracted phrase is of the right semantic type.
- Lexical rule alone (without trace strategy) is in principle available to this sort of construction.

PREDICTION: Extraction of phrases that quantify over individuals should show either anticonnectivity (lexical rule + trace strategy) or connectivity (lexical rule only).

49. [Which allegations about John<sub>2</sub>]<sub>1</sub> do you think he<sub>3</sub> will deny?

- Lexical rule + trace strategy results in the anticonnectivity effects observed.
- Lexical rule alone would result in connectivity, causing a violation of the condition on nonpronouns (*he* would o-command *John*).
- Since the sentence has an acceptable analysis (lexical rule + trace strategy) we cannot tell if it also has an unacceptable analysis.

What about these?

50. [Which pictures of himself<sub>i</sub>] did Roberta think that Greg<sub>i</sub> would choose?

51. [Which books about herself<sub>i</sub>] does David think that Julie<sub>i</sub> actually wrote?

- At first glance these appear to confirm the prediction: a *which* phrase is extracted and apparent connectivity effects obtain.

## HPSG BINDING CONDITION A:

A. A locally o-commanded reflexive must be locally o-bound

- HPSG binding theory treats reflexives which are not locally o-commanded as "exempt anaphors" constrained by pragmatic conditions.
- In e.g. (?), the head noun *pictures* has an ARG-S containing only the NP *himself*; since there are no other arguments on the ARG-S of the head noun, the reflexive itself is not locally o-commanded, and thus is exempt from the binding conditions.

## GRAB BAG OF OPEN QUESTIONS

### LONG EXTRACTION OVER ISLANDS

52. a. \*How many pictures were you wondering whether John painted?  
b. ?Which pictures were you wondering whether John painted?

- Island effects (somewhat) ameliorated with *which* phrase vs. *how many* phrase extraction.
- Is trace strategy implicated here? Is long extraction aided by presence of trace in ARG-S?

### "IDIOMATIC" PHRASES

53. Which pictures of  $him_{i/*j}$  did  $John_i$  say that  $Bill_j$  took

- Connectivity effect: why is trace strategy not available?

### PASSIVES

54. a. ?Pictures of  $John_i$  have been painted by  $him_i$   
b. ?Pictures of  $him_i$  have been painted by  $John_i$
55. a. Those pictures of  $John_i$  have been painted by  $him_i$  (himself)  
b. Those pictures of  $him_i$  have been painted by  $John_i$  (himself)

- Connectivity effects in passive appear to be sensitive to semantic type of "fronted" phrase.

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