

Binding in HPSG

Introduction to HPSG
June 25, 2009

Kordula De Kuthy

1

Some binding facts

Binding theory has to do with constraining referentially dependent elements in terms of what is a possible antecedent, or binder.

- (1) John_{*i*} likes himself_{*i*}. (anaphor/reflexive)
- (2) *John_{*i*} likes him_{*i*}. (pronominal/personal pronoun)
- (3) *John_{*i*} likes John_{*i*}. (referring expression)

2

The three basic principles

As a rough characterization, we can say:

- A. Anaphors must be bound within a particular domain.
- B. Pronominals must be free within a particular domain.
- C. Referring expressions (R-expressions) must be free.

The trick is in how we define *bound*, *free*, *domain*, ...

3

Binding theory of Chomsky Definitions of bind and c-command

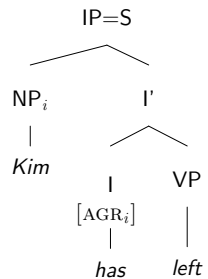
- (4) Y *binds* Z just in case:
 - a. Y and Z are coindexed; and
 - b. Y c-commands Z.
- (5) Y *c-commands* Z just in case:
 - a. Z is contained in the least maximal projection containing Y; and
 - b. Z is not contained in Y.
- (6) *A-binding*: the binder is in an *A* (argument) position, that is, subject, object, or object of a preposition.
 - a. Z is called *A-bound* if it is bound by a Y in an argument position.
 - b. Otherwise, Z is called *A-free*.

4

Binding theory of Chomsky

Defining *indexing*

(7) An *indexing* of a phrase is an assignment of indices to all the NPs in the phrase.



5

Binding theory of Chomsky

Defining *government*

- (8) *G governs Z* just in case one of the following three conditions obtains:
- G* and *Z* c-command each other, *Z* is a maximal projection, and *G* is either a lexical category (N, A, V, or P) or a projection of one.
 - Z* is the head of an element governed by *G*.
 - Z* is the specifier (including subject) of an element governed by *G*.

6

Binding theory of Chomsky

The three binding principles

Conditions on permissible indexings, where *I* is an indexing in an expression, and *Z* is an NP

- If *Z* is an anaphor and governed by *G*, *Z* needs to be A-bound (under *I*) in the least maximal projection *M* containing a subject and *G* for which there is an indexing *J* s.t. *Z* is A-bound (under *J*) in *M*
- If *Z* is a pronominal and governed by *G*, *Z* needs to be A-free (under *I*) in the least maximal projection *M* containing a subject and *G*.
- If *Z* is an R-expression, it must be A-free (under *I*) in *E*.

7

Condition B

If *Z* is a governed pronominal, then it has to be A-free in its *governing category*.

- (9) a. *John_i likes him_i.
b. [The children]_i like their_i friends.
- (9a) is bad, since the governing category for *him* is the sentence itself.
 - (9b) is grammatical, since the governing category for *their* is the NP *their friends*, here the noun *friends* is the governor.

8

Condition A

A governed anaphor must be A-bound in its governing category.

- (10) a. John_i likes himself_i.
b. * John_i knows Bill_j likes himself_i.
c. [_S The children_i like [_{NP} [each other's]_i friends]].
- (10a) is good, since the governing category of *himself* is the sentence.
 - (10b) is bad, since the governing category of *himself* is the embedded sentence, but *himself* is not bound within it.
 - For (10c), with the extra condition, the governing category will not be the NP but rather the whole sentence, because there is no way to index the phrases in this NP that binds the anaphor.

9

Condition C

- (11) a. * He_i likes John_i.
b. * He_i knows that Mary likes John_i.
c. John_i, [I like e_i].
- (11a) and (9b) are both ungrammatical, since in both cases *John* fails to be A-free.
 - In (11c), the variable *e* is A-free in its domain (indicated by square brackets).

10

Problems for Chomsky's theory

There are some theoretical problems with this binding theory, which we'll mostly pass over:

- Has to use possible alternative indexings (in addition to real indexings)
- The *i*-WITHIN-*i* CONDITION seems to be an ad hoc stipulation to get the following to work out right:

(12) [The children]_i thought that [pictures of [each other/themselves]_i were on sale].

11

Problems for Chomsky's theory

Condition A violations

- Non c-command, but still acceptable:

(13) a. John suggested that [tiny gilt-framed portraits of [each other]_i would make ideal gifts for [the twins]_i].
b. The agreement that [Iran and Iraq]_i reached guaranteed [each other's]_i trading rights in the disputed waters until the year 2010.
c. Mary talked [to John_i] [about himself_i].
- Anaphors in separate sentences and other contexts:

(14) a. Mary still hadn't decided about birthday presents for the twins_i. Tiny gilt-framed portraits of [each other]_i would be nice, but there was also that life-sized stuffed giraffes.
b. John_i told Mary_j that there were some pictures of themselves_k inside. (*k* = John and Mary)

12

Problems for Chomsky's theory Condition B & C violations

Examples where the pronominal is A-free but should be disallowed:

- (15) a. *Mary_i talked about John_j to him_j.
 b. *Mary_i talked to him_j about John_j.

The same examples show that *John* is A-free (because *him* does not c-command it), but they're unacceptable.

13

A Nonconfigurational binding theory

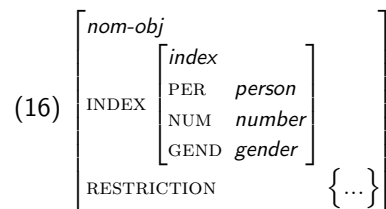
To better account for the facts, instead of stating the binding theory in terms of configurations, we can use the notion of *obliqueness*

- *obliqueness command* (*o-command*) is defined in terms of the relative obliqueness of grammatical functions
- Binding will be defined in terms of o-command

14

Preliminaries Indices of nominal-objects

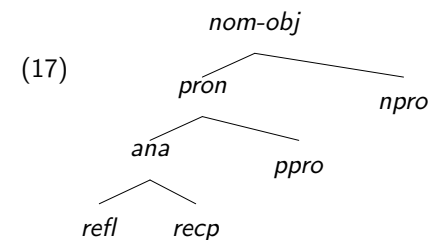
Nominal-objects bear indices:



15

Preliminaries Sortal hierarchy of nominal-objects

Define anaphors (*ana*), pronominals (*ppro*), and nonpronominals/R-expressions (*npro*) via this type hierarchy:



(independent of classification of *referential*, *it*, and *there*)

16

The Content of pronouns and anaphors

<p><i>herself</i></p> $\left[\begin{array}{l} \text{refl} \\ \text{INDEX} \left[\begin{array}{l} \text{ref} \\ \text{PER } 3rd \\ \text{NUM } sing \\ \text{GEND } fem \end{array} \right] \\ \text{RESTR } \{ \} \end{array} \right]$	<p><i>they</i></p> $\left[\begin{array}{l} \text{ppro} \\ \text{INDEX} \left[\begin{array}{l} \text{ref} \\ \text{PER } 3rd \\ \text{NUM } plur \end{array} \right] \\ \text{RESTR } \{ \} \end{array} \right]$
<p><i>there</i></p> $\left[\begin{array}{l} \text{ppro} \\ \text{INDEX} \left[\begin{array}{l} \text{there} \\ \text{PER } 3rd \end{array} \right] \\ \text{RESTR } \{ \} \end{array} \right]$	<p><i>it</i></p> $\left[\begin{array}{l} \text{ppro} \\ \text{INDEX} \left[\begin{array}{l} \text{it} \\ \text{PER } 3rd \\ \text{NUM } sing \end{array} \right] \\ \text{RESTR } \{ \} \end{array} \right]$

17

Formulating the binding theory

We can state the binding theory (*o-command*) in terms of the SUBCAT list:

(18) a. Fido chased himself

b.

$$\left[\begin{array}{l} \text{RELATION } chase \\ \text{CHASER} \left[\begin{array}{l} \text{ref} \\ \text{PER } 3rd \\ \text{NUM } sing \end{array} \right] \\ \text{CHASED} \left[\begin{array}{l} \text{ref} \\ \text{PER } 3rd \\ \text{NUM } sing \\ \text{GEND } masc \end{array} \right] \end{array} \right]$$

c. < NP:*npro*, NP:*ana* >

⇒ We need to make sure these two NPs are coindexed.

18

O-command

(19) Let *Y* and *Z* be *synsem* objects with distinct LOCAL values, *Y* referential. Then *Y* *locally o-commands* *Z* just in case *Y* is less oblique than *Z*.

- *Y* is less oblique than *Z* if *Y* precedes *Z* on the SUBCAT list

(20) Let *Y* and *Z* be *synsem* objects with distinct LOCAL values, *Y* referential. Then *Y* *o-commands* *Z* just in case *Y* locally *o-commands* *X* dominating *Z*.

- So, there is some configurational notion in this (“domination”), conveying the idea that an object which locally *o-commands* another object also *o-commands* its daughters

19

O-binding

Now, we can define what it means to bind an object, in terms of *o-command*:

(21) *Y* (*locally*) *o-binds* *Z* just in case *Y* and *Z* are coindexed and *Y* (*locally*) *o-commands* *Z*. If *Z* is not (*locally*) *o-bound*, then it is said to be (*locally*) *o-free*

20

HPSG Binding Theory

- **Principle A.** A locally o-commanded anaphor must be locally o-bound.
- **Principle B.** A personal pronoun must be locally o-free.
- **Principle C.** A nonpronoun must be o-free.

⇒ Principle C refers to potentially configurational notions, as o-freeness does not have to be local.

21

Principle B

The pronoun *him* is not locally o-free:

- (22) a. *John_i likes him_i.
b. *likes*: * $[\text{SUBCAT} \langle \text{NP}_i, \text{NP:ppro}_i \rangle]$

The possessive *their* is locally o-free:

- (23) a. [The children]_i like their_i friends.
b. *friends*: $[\text{SUBCAT} \langle \text{DETP:ppro}_i \rangle]$

22

Principle A Locally o-commanded anaphors

A locally o-commanded anaphor is locally o-bound:

- (24) a. John_i likes himself_i.
b. *likes*: $[\text{SUBCAT} \langle \text{NP:npro}_i, \text{NP:ana}_i \rangle]$

A locally o-commanded anaphor is not locally o-bound:

- (25) a. *John_i knows Bill_j likes himself_i.
b. *likes*: * $[\text{SUBCAT} \langle \text{NP:npro}_j, \text{NP:ana}_i \rangle]$

23

Principle A Anaphors not locally o-commanded

If an anaphor is not locally o-commanded, then it is *exempt* from Principle A

- (26) a. [_S The children_i like [_{NP} [each other's]_i friends]].
b. *friends*: $[\text{SUBCAT} \langle \text{DETP:ppro}_i \rangle]$

Recall that *their* (which needs to be locally o-free) is also acceptable in this context, so a Principle A which has exemptions (or overlaps with Principle B) is desirable.

24

Principle C

A nonpronominal is not o-free:

- (27) a. *He_i likes John_i.
b. *likes*: * $[\text{SUBCAT} \langle \text{NP:}ppro_i, \text{NP:npro}_i \rangle]$

Note that the binding properties of a filler are the same as that of the gap; in this case the gap is o-free:

- (28) a. John_i [I like e_i].
b. *like*: $[\text{SUBCAT} \langle \text{NP:}ppro_j, \text{NP:npro}_i \rangle]$

25

More facts

- (29) a. Mary_i talked to John_j about himself_j.
b. $[\text{SUBCAT} \langle \text{NP}_i, \text{PP}[to]_j, \text{PP}[about]:ana_j \rangle]$
(30) a. Mary_i talked to John_j about herself_i.
b. $[\text{SUBCAT} \langle \text{NP}_i, \text{PP}[to]_j, \text{PP}[about]:ana_i \rangle]$
(31) a. *Mary_i talked about John_j to himself_i.
b. * $[\text{SUBCAT} \langle \text{NP}_i, \text{PP}[to]:ana_j, \text{PP}[about]_j \rangle]$
(32) a. Mary_i talked to herself_i about John_j.
b. $[\text{SUBCAT} \langle \text{NP}_i, \text{PP}[to]:ana_i, \text{PP}[about]_j \rangle]$

One inadequacy: *Mary talked about himself_j to John_j is predicted to be good (footnote 17, p. 264)

26

Binding theory and traces

The content of the trace (including the type of nominal object) is determined by the filler, so in this case it's *ppro*:

- (33) a. [Senator Dole]_i doubted that the party delegates would endorse his wife. But him_i, he_i was sure they would support t_i.
b. *support*: $[\text{SUBCAT} \langle \text{NP}_j, \text{NP:}ppro_i \rangle]$

And here it's *ana*:

- (34) a. [John and Mary]_i are stingy with their children. But themselves_i, they_i pamper t_i.
b. *pamper*: $[\text{SUBCAT} \langle \text{NP}_i, \text{NP:}ana_i \rangle]$

27

Expletive pronouns and Exemptions

- When an anaphor is not locally o-commanded, it is free to take nonlocal antecedents.
- An expletive pronoun (*it*, *there*) is nonreferential and thus does not locally o-command the anaphor

- (35) a. They_i made sure that it wouldn't bother each other_i to invite respective friends to dinner.
b. *bother*: $[\text{SUBCAT} \langle \text{NP}_{it}, \text{NP:}ana, \text{S} \rangle]$

28

Exemptions and Nonsyntactic Factors

More exempt anaphors:

- (36) a. John_i wanted more than anything else for himself_i to get the job.
b. [The children]_i thought that [pictures of themselves_i were on sale].

If the binding theory doesn't say why these examples are good, what does?

29

Intervenors

The Intervention Constraint, which also applies to equi constructions:

- A nonlocal binder is possible unless another possible binder intervenes (expletives are not possible binders):

- (37) a. John_i thought [that *it* would be illegal [to undress himself_i]].
b. John_i thought [that it would be illegal [for Harry_j to undress himself_{j/*i}]].

- Inanimate intervenors also do not inhibit long-distance binding:

- (38) John_i thought [that Proposition 91 made [undressing himself_i] illegal].

30

Point of view

- (39) a. John_i was going to get even with Mary. That picture of himself_i in the paper would really annoy her, as would the other stunts he had planned.
b. *Mary was quite taken aback by the publicity John_i was receiving. That picture of himself_i in the paper had really annoyed her, and there was not much she could do about it.
- (40) a. That picture of himself_i in *Newsweek* bothered John_i.
b. *That picture of himself_i in *Newsweek* bothered John_i's father.
c. That picture of himself_i in *Newsweek* dominated John_i's thoughts.

31

Making Binding Totally Non-configurational

Instead of making recourse to domination for Principle C, we first redefine local o-command

- (41) Let Y and Z be *synsem* objects with distinct LOCAL values, Y referential. Then Y *locally o-commands* Z just in case either:
a. Y is less oblique than Z [old part]; or
b. Y locally o-commands some X that subcategorizes for Z [new part].

That is, o-command is now defined in terms of SUBCAT lists instead of in terms of dominance (constituent daughters)

32

New Definition of o-command

- (42) Let Y and Z be *synsem* objects with distinct LOCAL values, Y referential. Then Y *o-commands* Z just in case either:
- Y is less oblique than Z ; or
 - Y o-commands some X that subcategorizes for Z ; or
 - Y o-commands some X that is a projection of Z (i.e. the HEAD values of X and Z are token-identical)

33

Example

- (43) Kim thinks John kissed Mary.

- *Kim* (locally) o-commands sentential complement *John kissed Mary* because both are on the SUBCAT list of *thinks*, and *Kim* is less oblique (clause a).
- *Kim* o-commands *kissed* because it o-commands *John kissed Mary*, a projection of *kissed* (clause c).
- *Kim* o-commands both *John* and *Mary* because *Kim* o-commands *kissed*, which subcategorizes for both *John* and *Mary* (clause b).

34

The advantages of non-configurational binding

With a binding theory which uses such a definition of o-command, we rule out sentences like this:

- (44) *John_i he_i claimed left.

The SUBCAT list of *claimed* is something like the following:

- (45)
$$\left[\text{SUBCAT} \left\langle \text{NP}[\textit{he}], \text{VP} \left[\begin{array}{l} \textit{left} \\ \text{SUBCAT} \langle [\textit{LOCAL John}] \rangle \end{array} \right] \right\rangle \right]$$

By the new definition of o-command, *John* is not free and thus is ungrammatical.

35