HPSG Binding Theory

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January 17, 2008
Introduction

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Structure

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   - Tasks Of a Binding Theory
2. GB and HPSG: Initial Comparison
   - Common Properties
   - Differences
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   - Command and Binding
   - The Binding Theory
   - Explanatory Force
   - Problems
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Tasks of a Binding Theory

- Account for the distribution of anaphors, personal pronouns and R-expressions
Tasks of a Binding Theory

- Account for the distribution of anaphors, personal pronouns and R-expressions
- Account for what coindexings are necessary, possible or impossible
Necessary Coindexings

(1) John\textsubscript{i} hates himself\textsubscript{i}
(2) John\textsubscript{i} showed Bill\textsubscript{j} himself\textsubscript{i}/\textsubscript{j} on the picture
(3) John\textsubscript{i} thinks Bill\textsubscript{j} hates himself\textsubscript{j}
(4) Mom and Dad\textsubscript{i} think they\textsubscript{j} hate each other\textsubscript{j}
Impossible Coindexings

(5) * John$_i$ beheaded him$_i$
(6) * He$_i$ thinks John$_i$ beheaded her
(7) * John$_i$ thinks Bill$_j$ beheaded himself$_i$
It makes sense to compare the HPSG binding theory to that of GB because
GB and HPSG Binding Theories

It makes sense to compare the HPSG binding theory to that of GB because

- HPSG binding theory is (structurally) modelled on GB binding theory
GB and HPSG Binding Theories

It makes sense to compare the HPSG binding theory to that of GB because

- HPSG binding theory is (structurally) modelled on GB binding theory
- Still, there are very significant differences
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Common Properties

Both theories
Both theories

- use a command relation to define the notion of binding; 
  \textit{c(onstituent)-command} in GB, \textit{o(bliqueness)-command} in HPSG. (Both will be introduced soon)
Common Properties

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- use a command relation to define the notion of binding; \textit{c(onstituent)-command} in GB, \textit{o(bliqueness)-command} in HPSG. (Both will be introduced soon)
- use similar definitions of \textit{binding}:
Both theories

- use a command relation to define the notion of binding; \(c(\text{onstituent})\)-command in GB, \(o(\text{bliqueness})\)-command in HPSG. (Both will be introduced soon)
- use similar definitions of \textit{binding}:

\[ X \text{ binds } Y \text{ iff } X \text{ commands } Y \text{ and } X \text{ and } Y \text{ are coindexed.} \]

This relation normally holds between NPs. (An exception are PPs in HPSG; more on that soon.)
Common Properties

Both theories

- use a command relation to define the notion of binding; 
  \textit{c(onstituent)}-\textit{command} in GB, \textit{o(bliqueness)}-\textit{command} in HPSG. (Both will be introduced soon)

- use similar definitions of \textit{binding}:

  \begin{itemize}
  \item \textbf{Binding}
  \item X binds Y iff X \textbf{commands} Y and X and Y are coindexed.
  \end{itemize}

  This relation normally holds between NPs. (An exception are PPs in HPSG; more on that soon.)

- consist of three clauses A, B and C, where A is concerned with anaphors, B with personal pronouns and C with R-expressions.
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Differences

- The command relations the theories employ
Differences

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  - C-command is defined with respect to phrase structure.
The command relations the theories employ

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- O-command is defined with respect to the relative obliqueness of complements, (i.e., their order on some SUBCAT list. This includes the subject.)
Differences

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- The data the theories aim to account for
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  HPSG binding theory is in some respects less ambitious than that of GB; it does not try to cover everything.
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- The data the theories aim to account for
  HPSG binding theory is in some respects less ambitious than that of GB; it does not try to cover everything.

  To explain the design of HPSG binding theory, a short review of the GB binding theory is in order.
C-Command: A Configurational Notion

C-command is defined with respect to phrase structure:

**C-Command**

Y c-commands Z iff Z is contained in the smallest maximal projection containing Y and Z is not contained in Y.
Y c-commands Z:

Y
  |
  X?
  |
  ...
  ...
  Z
  ...

XP
(A-)Binding

Binding (more precisely $A$-binding, i.e. argument-binding), is now defined as:

(A-)Binding in GB

$X$ binds $Y$ iff $X$ c-commands $Y$ and $X$ and $Y$ are coindexed.
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Now the GB Binding Theory can be formulated. This is a simplified version, only covering the aspects of direct relevance.

**GB Binding Theory**

A  An anaphor must be bound, and bound ‘as soon as possible’, i.e. to something in the smallest clause or NP that contains it and that it can be bound in.

B  A pronoun must be free in the smallest clause or NP that contains it.

C  1. An overt R-expression must be free.
   2. A *wh*-trace must be free in the smallest projection that does not contain the moved element.

The notion of *government* has been omitted (or rather, used implicitly, perhaps audaciously, but we can make do without it)
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GB BINDING THEORY

The Explanatory Effects of Clause A

Clause A

An anaphor must be bound, and bound 'as soon as possible', i.e. to something in the smallest clause or NP that contains it and that it can be bound in.

(8) John; beheaded himself;
(9) John; thinks Bill; beheaded himself;
(10) * John; thinks Bill; beheaded himself;
GB Binding Theory
The Explanatory Effects of Clause A

Clause A
An anaphor must be bound, and bound 'as soon as possible', i.e. to something in the smallest clause or NP that contains it and that it can be bound in.

(11) John\textsubscript{i} showed Bill\textsubscript{j} himself\textsubscript{i/j} on the picture.
(12) The men\textsubscript{i} wanted each other\textsubscript{i}'s heads
(13) Mary\textsubscript{j} wanted for herself\textsubscript{i} to get his head

All these anaphor bindings are explained by the theory.
GB Binding Theory
The Explanatory Effects of Clause B

Clause B
A pronoun must be free in the smallest clause or NP that contains it.

(14) * John; beheaded him;
(15) John; thinks Bill; beheaded him;
(16) John; beheaded his; friend.

The ungrammaticality of the first follows from clause B. Nothing excludes the second and third.
GB Binding Theory
The Explanatory Effects of Clause C

Clause C

1. An overt R-expression must be free.
2. A wh-trace must be free in the smallest projection that does not contain the moved element.

(17) * He_{i} beheaded John_{i}
(18) * He_{i} knows I beheaded John_{i}
(19) John_{i}, I like_{i}
(20) * John_{i}, he_{i} said you beheaded t_{i}

The ungrammaticality of the first two sentences follows from clause C1, that of the third from clause C2 (C2 is necessary because in sentences like this, the topicalized NP binds the trace).
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Clause A

An anaphor must be bound, and bound 'as soon as possible', i.e. to something in the smallest clause or NP that contains it and that it can be bound in.

The following data are problematic for clause A of the GB binding theory:

(21) John and Mary; knew that the journal had rejected each other;'s papers

The theory would require binding the anaphor in the embedded clause.
Clause A

An anaphor must be bound, and bound ’as soon as possible’, i.e. to something in the smallest clause or NP that contains it and that it can be bound in.

The following data are problematic for clause A of the GB binding theory:

(22) John suggested that [tiny gilt-framed portraits of [each other]; would amuse [the twins];]

(23) Iran; agreed with Iraq; that [each other’s] shipping rights must be respected. (k = Iran and Iraq)
GB Binding Theory
Problems For Clause A

- *The twins* does not c-command the anaphor. So it cannot be bound as the theory demands.
- Iran&Iraq does not even come as a grammatical unit but has to be inferred. It cannot be bound.
Problems

- C-command does not seem to work quite as intended. It does not hold here.
- The requirement that any anaphor be bound seems to be too strong.
GB Binding Theory
Problems For Clause A

Clause A
An anaphor must be bound, and bound 'as soon as possible', i.e. to something in the smallest clause or NP that contains it and that it can be bound in.

(24) Mary talked [to John] [about himself]

*John* fails to c-command the anaphor
Problems: once more, c-command seems to be problematic.
GB Binding Theory

Problems For Clause B

Clause B

A pronoun must be free in the smallest clause or NP that contains it.

(25)  * Mary talked [to John] [about him]

*John does not c-command him, hence him is free as required by clause B. So the sentence should be grammatical. Problem: c-command again...
GB Binding Theory
Problems For Clause C1

Clause C1

An overt R-expression must be free.

The problem with PPs carries over to clause C1:

(26) * Mary talked [to him,] [about John,]

*John* is free, just as required by clause C1. So the sentence is wrongly predicted to be grammatical.

Problem: And again.
Clause C2

A *wh*-trace must be free in the smallest projection that does not contain the moved element.

(27) The Senator doubted that the delegates would endorse his wife. But HIM, he was sure they would support t;  

Though grammatical, the sentence is ruled out by Clause C2. Problem: the trace is not allowed to be bound by *he*. 
'Reconstruction' analyses have been proposed to solve the latter problem.
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(30) He was sure they would support **him**

**Him** is back in the place it came from. The sentence is predicted to be grammatical.
(31) I wonder [which of Claire\textsubscript{i}'s friends]\textsubscript{j} we should let her\textsubscript{i} invite t\textsubscript{j} to the party?

(32) We should let her\textsubscript{i} invite [which of Claire\textsubscript{i}'s friends] to the party

Reconstruction leads to a C1 violation. This problem will have an elegant solution in HPSG (Anas).
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Not designed to account for all of the data as far as anaphors are concerned
General Approach Of the HPSG Binding Theory

- Not designed to account for all of the data as far as anaphors are concerned
- Solves problems with c-command by employing o-command instead
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Recall: The CONTENT values of NPs are objects of sort nominal object.

\[
\begin{bmatrix}
\text{nom-obj} \\
\text{INDEX}
\end{bmatrix}
\begin{bmatrix}
\text{PER} & \text{per} \\
\text{NUM} & \text{num} \\
\text{GEND} & \text{gend} \\
\text{RESTRICTION} & \{\ldots\}
\end{bmatrix}
\]

Anaphors, pronouns and R-expressions can be discerned by partitioning this sort (not index) appropriately.
Preliminaries
The Sort Hierarchy Below $nom$-$obj$

```
     nom-obj
   /\       /\ 
  pron   npro
 /\   /\  /\   /\  
ana ppro refl recp
```
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A New Command Relation: O-Command

Obliqueness

O-Command is based on the notion of *relative obliqueness*:

Relative Obliqueness

A *syne* object X is less oblique than some other *syne* object Y iff X precedes Y on the SUBCAT list of some lexical head.
A New Command Relation: O-Command

Definition Of O-Command

A 'weak' and a 'strong version': local and 'non-local'. The difference will be of importance.
A New Command Relation: O-Command

Definition Of O-Command

A 'weak' and a 'strong version': local and 'non-local'. The difference will be of importance.

Local O-Command

For synsem objects X, Y, where X is referential (i.e. LOCAL | CONT | INDEX ~ ref): X locally o-commands Y iff X is less oblique than Y.
A New Command Relation: O-Command

**Definition Of O-Command**

A 'weak' and a 'strong version': local and 'non-local'. The difference will be of importance.

### Local O-Command

For *synsem* objects $X$, $Y$, where $X$ is referential (i.e. $\text{LOCAL} \mid \text{CONT} \mid \text{INDEX} \sim \text{ref}$): $X$ locally o-commands $Y$ iff $X$ is less oblique than $Y$.

### O-Command

For *synsem* objects $X$, $Y$, where $X$ is referential, $X$ o-commands $Y$ iff $X$ locally o-commands some *synsem* object $Z$ whose embedding sign dominates the sign embedding $Y$. 
A ‘weak’ and a ‘strong version’: local and ‘non-local’. The difference will be of importance.

**Local O-Command**

For *synsem* objects X, Y, where X is referential (i.e. LOCAL | CONT | INDEX ~ ref): X locally o-commands Y iff X is less oblique than Y.

**O-Command**

For *synsem* objects X, Y, where X is referential, X o-commands Y iff X locally o-commands some *synsem* object Z whose embedding sign dominates the sign embedding Y.
A New Command Relation: O-Command

Remarks

- Only the definition of non-local o-command makes reference to phrase structure. This reference will also be eliminated in a second version of the binding theory.
- The requirement that X be referential will play a role in the treatment of expletives. (Anas)
A New Binding Relation

Definition

O-Binding

X (locally) o-binds Y iff X (locally) o-commands Y and X and Y are coindexed
A New Binding Relation

Definition

O-Binding

X (locally) o-binds Y iff X (locally) o-commands Y and X and Y are coindexed

The distinction between local and non-local carries over to the notion of binding
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## The Binding Theory

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GB and HPSG: Initial Comparison

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The Binding Theory

**BINDING THEORY**

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

- Clause A no more requires all anaphors to be bound
The Binding Theory

**Binding Theory**

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

- Clause A no more requires all anaphors to be bound
- Only clause C makes reference to phrase structure via o-free
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'Case marking' prepositions heading PP complements are analysed as 'figure heads'
Accounting For The Data
Preliminaries: the Treatment of PP Complements

'Case marking' prepositions heading PP complements are analysed as 'figure heads'

- They contribute no semantics of their own.
'Case marking' prepositions heading PP complements are analysed as 'figure heads'

- They contribute no semantics of their own.
- Their CONTENT value is identical to that of the prepositional complement.
Accounting For The Data
Preliminaries: the Treatment of PP Complements

'Case marking’ prepositions heading PP complements are analysed as 'figure heads’

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- Their CONTENT value is identical to that of the prepositional complement.
- As a result, PP complements do not differ from NP complements with respect to binding theory
Accounting For The Data
Preliminaries: the Treatment of PP Complements

'Case marking’ prepositions heading PP complements are analysed as 'figure heads’

- They contribute no semantics of their own.
- Their CONTENT value is identical to that of the prepositional complement.
- As a result, PP complements do not differ from NP complements with respect to binding theory

General description:

\[
\begin{bmatrix}
\text{SS|LOC} & \begin{bmatrix}
\text{CAT} & \begin{bmatrix}
\text{HEAD} & \text{prep} \\
\text{SC} & \langle \text{NP:1} \rangle
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
\]
Accounting For the Data
Clause A - Anaphors

Clause A

A locally o-commanded anaphor must be locally o-bound

(33)  a. John hates himself
    b. SUBCAT list of *hates*: \[
    \text{SUBCAT} \langle NP:npro_i, NP:ana_i \rangle
    \]

(34)  a. John depends on himself
    b. SUBCAT list of *depends*: \[
    \text{SUBCAT} \langle NP:npro_i, PP:ana_i \rangle
    \]

Due to the figurehead analysis, the same argument applies to both examples:

- The anaphor is locally o-commanded
- So it must be locally o-bound
- *John* is the only possible binder
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Accounting For the Data
Clause A - Anaphors

Clause A
A locally o-commanded anaphor must be locally o-bound

(35)  

a. John showed Bill himself on the picture

b. show SC: \[
\text{SUBCAT} \langle \text{NP:} npro_i, \text{NP:} nproj, \text{NP:} ana_{i/j} \rangle \]

- The anaphor has two o-commanders
- So it must be bound by one of them.
Clause A

A locally o-commanded anaphor must be locally o-bound

(36) a. John thinks Bill beheaded himself

b.  *thinks* SC: \[\text{SUBCAT} \langle \text{NP} : \text{npro}_i, S \rangle\]

c.  *behead*, the lexical head of the S, SC: \\
\[\text{SUBCAT} \langle \text{NP} : \text{nproj}, \text{NP} : \text{ana}_j \rangle\]

Since the anaphor is locally o-commanded, it must be locally o-bound. The only possible binder is the NP *Bill*. 
会计数据的解释
免于所指代

句子中的代词在GB中需要外显。但在HPSG中，不存在这样的约束。

(37) The children’s friends 与 each other’s friends

在GB中，这种外显性显示是必要的。但在HPSG中，不存在这样的约束：

(38) John and Mary knew that the journal had rejected each other’s papers
Accounting For the Data
Clause B - Personal Pronouns

Clause B

A personal pronoun must be locally o-free

(39)  a.  * John\textsubscript{i} hates him\textsubscript{i}
    b.  * [SUBCAT $\langle$NP:$npro_i$, NP:$ppro_i$\rangle]

(40)  a.  * John\textsubscript{i} depends on him\textsubscript{i}
    b.  * [SUBCAT $\langle$NP:$npro_i$, PP:$ppro_i$\rangle]

- Him is locally o-commanded
- Coindexing him with John would make him locally o-bound
- So, by clause B, him and John cannot be coindexed
Accounting For the Data
Clause C - Nonpronouns

Clause C

A nonpronoun must be o-free

(41) a. * He$_i$ hates John$_i$
b. * [SUBCAT ⟨NP:ppro$_i$, NP:npro$_i$⟩]

(42) a. * He$_i$ knows that she hates John$_i$
b. * knows SC: [SUBCAT ⟨NP:ppro$_i$, S⟩]
c. * hates, lexical head of S, SC:
   [SUBCAT ⟨NP:ppro$_j$, NP:npro$_i$⟩]

In both cases, the $John$ is o-commanded, locally in the first, non-locally in the second. Thus clause C rules the examples ungrammatical.
Accounting For the Data

Traces

(43) John\(_i\), I like t\(_i\)

(44) * John\(_i\), He\(_i\) does not like t\(_i\)

This follows directly from the theory:

- LOCAL values of trace and filler are structure-shared
- So, if the filler is a nonpronoun, the trace also is
- Since the trace is subcategorized for by the *like* in the second sentence, it is o-bound by he.
- The sentence is ungrammatical, since a nonpronoun may not be o-bound