Flat Binding and Presuppositions on Bound Elements

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Overview

(1) Every boy called his (own) mother.
Pronoun does not stand for the binder.

(2) Every boy called every boy’s mother.

**Index-Binding**: Pronouns are indexed variables (Quine, 1960).

(3) \([\text{Every boy}]_x \text{ called } x\text{’s mother.}\)

**Flat Binding**: Pronouns are definite descriptions.

(4) Every boy talked to the boy’s mother.
Index-Binding (Frege, Tarski)

A recursive interpretive procedure assigns semantic values to constituents relative to a model and an assignment.

- Assignments are sequences (functions from indices to values).
- Bound elements are indices (*Variables*).
- Binder are indexed operators (specifically: $\lambda_i$).

Interpretation rules for pronouns, traces, and binders (Heim and Kratzer, 1998).

\[(5)\]
\[
\begin{align*}
& a. \quad [\text{pro}_i]^g = [t_i]^g = [i]^g = g(i) \\
& b. \quad [\lambda_i \alpha]^g = \lambda x: [\alpha]^g[i \mapsto x]
\end{align*}
\]
Every boy called friends of his.

\[
\text{TP} \\
\text{DP} \quad \text{TP} \\
\text{every boy} \quad \lambda_1 \text{VP} \\
\text{1} \quad \text{VP} \\
\text{called} \quad \text{NP} \\
\text{friends} \quad \text{his}_1
\]
(6) Every boy called friends of his.

For every boy a:

```
(6) Every boy called friends of his.

For every boy a:
```

```
\[ \lambda_1 \text{VP} \]

\[ 1 \text{VP} \]

\[ \text{called} \]

\[ \text{friends} \]

\[ \text{his}_1 \]
```
Index-Binding: Example, Step 3

(6) Every boy called friends of his.

For every boy $a$:

```
   VP
   /
  /
 1  VP
    /
   called

   /
  /
  /
   friends  his
```

\{⟨1→a⟩\}
(6) Every boy called friends of his.

For every boy $a$:

\[
\text{called}
\begin{array}{c}
\text{NP} \\
\text{friends} & \text{his}_1
\end{array}
\{\langle 1 \mapsto a \rangle \} (1 \{\langle 1 \mapsto a \rangle \})
\]

= For every boy $a$: called(friends(a))(a)
Flat Binding

Assumption kept: A recursive interpretation procedure assigns semantic values relative to model and assignment.

The following three assumption, however, are different:

- Assignments are sets.
- Bound elements are definite descriptions.
- Binders are unindexed operators $\lambda$.

New interpretation rules for bound elements and binders:

\begin{align*}
\text{(7)} & \quad 
\begin{align*}
\text{a. } & \left[\text{the}\right]^{\ell}(P) = \nu x \in \ell : P(x) = 1 \\
\text{b. } & \left[\lambda \alpha\right]^{\ell} = \lambda x : \left[\alpha\right]^{\ell \cup \{x\}}
\end{align*}
\end{align*}
Flat binding: example 1, step 1

(8) Every boy called friends of his.

\[
\begin{align*}
\text{TP} & \\
\text{DP} & & \text{TP} & \\
\text{every boy} & & \lambda & \text{VP} \\
\text{the boy} & & \text{called} & \text{NP} \\
& & \text{friends} & \text{DP} \\
& & & \text{the boy}
\end{align*}
\]
(8) Every boy called friends of his.

For every boy $a$:
(8) Every boy called friends of his.

For every boy a:
Flat Binding: Example 1, Step 4

(8) Every boy called friends of his.

For every boy $a$:

```
called (friends (the boy))
```

```
(a)
```

```
DP (the boy)
```

```
(a)
```
Flat Binding: Example 1, Step 5/6

(8) Every boy called friends of his.

For every boy $a$:

\[
\text{called}(\text{friends}(\text{DP}_{\{a\}}))(a)
\]

\[
= \text{For every boy } a: \text{called}(\text{friends}(a))(a)
\]
Flat Binding: Example 2, Step 1

(9) Every girl called every boy.
Flat Binding: Example 2, Step 2

(9) Every girl called every boy.

For every girl \( a \):
Flat Binding: Example 2, Step 3

(9) Every girl called every boy.

For every girl a:

```
(9) Every girl called every boy.

For every girl a:

\[
\begin{array}{c}
\text{TP} \\
\text{DP} \\
\quad \text{every boy} \\
\quad \lambda \\
\quad \text{VP} \\
\quad \text{DP} \\
\quad \text{the girl} \\
\quad \text{called} \\
\quad \text{DP} \\
\quad \text{the boy}
\end{array}
\]
Flat Binding: Example 2, Step 4

(9) Every girl called every boy.

For every girl \( a \) and for every boy \( b \):

\[
\text{TP} \\
\lambda \\
\text{DP} \quad \text{VP} \\
\text{the girl} \quad \text{called} \quad \text{DP} \\
\text{the boy}
\]
(9) Every girl called every boy.

For every girl \(a\) and for every boy \(b\):
(9) Every girl called every boy.

For every girl $a$ and for every boy $b$:

$$\text{called}(b)(a)$$
Evidence for Lexical Content

One important difference of the two theories:

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Elements</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>principle C</td>
<td>traces</td>
<td>(Chomsky, 1993; Fox, 1999)</td>
</tr>
<tr>
<td>ellipsis</td>
<td>traces</td>
<td>(Sauerland, 1998, 2004a)</td>
</tr>
<tr>
<td>ellipsis</td>
<td>traces &amp; pron.</td>
<td>(Merchant, 1998)</td>
</tr>
<tr>
<td>focus</td>
<td>pronouns</td>
<td>(Sauerland, 2000, 2004b)</td>
</tr>
<tr>
<td>focus</td>
<td>traces</td>
<td>(Sauerland, 2001)</td>
</tr>
<tr>
<td>gramm. gender</td>
<td>pronouns</td>
<td>—</td>
</tr>
</tbody>
</table>
Pronouns and Focus

Contrastive focus marks meaning differences (see Schwarzschild 1999):

(10) On Monday, Mary praised Bill, and . . .
    a. . . . on [Tuesday]ₚ, Mary praised [JOHN]ₚ.

Two bound pronouns can be contrasted, if and only if their lexical content is different (Sauerland, 1998, 2000, 2004b).

(11) On Monday, every boy called his mother, and . . .
    b. #. . . on [Tuesday]ₚ, every boy called [HIS]ₚ mother (again).
Flat binding explains this contrast:

\[(12) \quad \text{every boy } \lambda \text{ the boy called the boy’s mother, and . . .} \]

a. . . . every teacher \( \lambda \text{ the teacher called [the teacher}_F\)’s mother
b. . . . every boy \( \lambda \text{ the boy called [the boy}_F\)’s mother

Index-binding has no explanation for the contrast:

\[(13) \quad \text{every boy } \lambda_1 \ 1 \text{ called 1’s mother, and . . .} \]

a. . . . every teacher \( \lambda_1 \ 1 \text{ called [1}_F\)’s mother
b. . . . every boy \( \lambda_1 \ 1 \text{ called [1}_F\)’s mother
Traces and Ellipsis

VP-Deletion requires an antecedent with identical interpretation (Tancredi, 1992).

(14) Kai waved at him and Lina did, too.

VP-deletion in (15) is only possible, if both traces have the same lexical content (Sauerland, 2004a):

(15) a. *Polly visited every town that is near the lake Erik did.
    b. Polly visited every town that is near the one Erik did.
Flat binding predicts the contrast:

(16) a. *[every town that is near the lake λ Erik visited the [lake] λ Polly visited the [town] elided antecedent]
     b. [every town that is near the one λ Erik visited the [town] λ Polly visited the [town] elided antecedent]

Index-binding doesn’t predict the contrast:

(17) [every town that is near the lake/one λ₁ Erik visited 1] λ₁ Polly visited 1 elided antecedent
Overlap

(18) Every student called every boy.

dp: the student

vp: called

dp: the boy

tp: every boy

λ

tp: every student

λ

tp: the student

called

the boy
Overlap

(18) Every student called every boy.

= For every student $a$ and for every boy $b$:

$$\text{called} \left( \text{DP} \{a,b\} \text{the boy} \right) \left( \text{DP} \{a,b\} \text{the student} \right)$$

If $a$ is a student and a boy and $b$ is another boy, the boy doesn’t refer. Example (18) is only sensibly interpretable if there is no overlap between students and boys.
Principle B

Principle B rules out coreference in (19a):

(19)  
  a. Zelda is talking to her. (her \( \neq \) Zelda)
  b. Zelda is talking to herself.

Why doesn’t (20) violate Principle B (Evans, 1980; Heim, 1998)?

(20)  
  A: Is Zelda the author of this paper?
  B: How can you doubt it? She is praising her to the sky. No other author would do that.

*She* and *her* refer to two different concepts: the *author* and *Zelda*. 
(Individual-)Concepts are functions from possible worlds to individuals. We can understand definite descriptions as concepts:

(21) the author, the person named *Zelda*

(22) a. $x_{\text{author}} : w \mapsto \text{the author in } w$
    b. $x_{\text{Zelda}} : w \mapsto \text{the person with name } *Zelda \text{ in } w$

A concept $x$ has property $P$, if the following holds:

(23) $\forall w \in \text{domain}(x) : P(x(w))$
Maximal Concepts

(24) Definition: A concept $x$ is maximal for property $P$, if:

$$\text{domain}(x) = \{w | \exists y : P(y(w))\}$$

A maximal $P$-Concept possesses no author properties other than $P$ worth mentioning:

(25) If $x$ is a maximal concept for property $P$, the following holds for every property $Q$ other than $P$: $Q$ is a logical consequence of $P$, or $Q(x)$ is false.

For example: $P = \text{girl}$, $Q = \text{under 20 years old}$

We can imagine a possible world where humans first live as genderless caterpillars underground before they hatch. A maximal girl-concept must select a 20-year old individual in this world.
(18) Every student called every boy.

For every maximal student-concept $a$ and for every maximal boy-concept $b$:

A maximal student-concept $a$ never has the property $boy$ and a maximal boy-concept $b$ never has the property $student$. 
Identitical Restrictors

Sentence with identical restrictors can be reduced to overlap.

(26) Every coach voted for every coach.

Quantifier can always have additional, elided restrictors (Westerståhl, 1985; Stanley and Zsabo, 2000): (27) can mean that the sailors on board wave to the sailors on shore.

(27) Every sailor waved to every sailor. (Stanley and Williamson, 1995)

In (26), the elided restrictors can be extensionally equivalent. (28) is a possible representation:

(28) Every coach with permission to vote voted for every candidate coach.
Contextual Concepts

(29) Context set $C = \text{Set of all possible worlds, in which all propositions are true that all discourse participants agree are true (Stalnaker, 1978).}$

(30) Definition: A concept $x$ is contextual if:

$$\text{domain}(x) = C$$

Contextual concepts generally have many properties. For example, a contextual girl-concept also has the property $\text{younger than 20 years}$. 
Discourse Binding

Central Claim:

(31)  a. The assignment set at the beginning of interpreting a sentence contains the discourse-salient concepts. Discourse-salient concepts are always contextual.

  b. $\lambda$-operators add in the course of sentence interpretation new concepts to the assignment set. Quantifier binding (or the $\lambda$-operator) always add maximal concepts.
Discourse Binding

(32) A: Is Zelda the author of this paper?
B: How can you doubt it? She is praising her to the sky. No competing candidate would do that.
A: *? You’re right, I agree with you. Oh look, here she is praising her again.

Discourse before B’s utterance: no coreference:

(33) \( C, \{ x_{\text{author}}, x_{\text{Zelda}} \} \)

Discourse after B’s utterance: Coreference:

(34) \( C' = C \cap \{ w \mid x_{\text{author}} = x_{\text{Zelda}} \}, \{ x_{\text{author}}/\text{Zelda} \} \)

Namely: \( x_{\text{author}}|C' = x_{\text{Zelda}}|C' \).

General principle:

(35) Update of \( \langle C, d \rangle \) with \( \phi \): \( \langle C \cap \phi, \{ c \cap \phi \mid c \in d \} \rangle \)
Features of Bound Pronouns

Agreement features on bound pronouns cannot be interpreted as presuppositions about their reference:

(36) The teenagers all believe that they are the only person in the world.

The ascribed belief is not contradictory, though (37) is:

(37) They are the only person in the world.

I use (38) instead of (36):

(38) The kids each called their mother.

Standard analysis: Syntactic agreement (Pollard and Sag, 1994; Heim, 1994), but not restricted by locality at all.
Agreement is Discourse Licensed

When the bound pronoun their is evaluated, the assignment contains two related concepts:

(39)  a. from the discourse assignment: the contextual kids-concept \( c_{kids} \)

b. added by distributive quantification: a maximal kid-concept \( c_{kid} \)

I assume that NPs are numberless:

(40)  their =

Proposal: contextual concept licenses plural, maximal concept determines reference
Implementation

Pronominal reference prefers maximal concepts:

\[(41) \quad [pro]^{\ell}(P) \text{ denotes} \]
\[
a. \quad \text{the unique } c \in \ell \text{ with } \text{domain}(c) \supset C \text{ and } P(c), \text{ if any such } c \text{ exist, and otherwise} \]
\[
b. \quad \text{the unique } c \in \ell \text{ with } P(c) \]

Agreement is relative to contextual concepts only:

\[(42) \quad [[\text{SING}] \text{ DP}]^{w,\ell} \text{ is defined if } [[\text{DP}]]^{w,\ell'} \text{ is atomic, where } \ell' = \{c \in \ell \mid \text{domain}(c) = C\}\]
Conclusion

- Binding in Logic: Indexed storage positions, the indices are not related to properties of the stored elements, reference is by calling an index.
- Quantifier binding uses maximal concepts, discourse binding uses contextual concepts.
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