Flat Binding

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The Goal

Index Binding: Reference by position

it$_1$, she$_2$, it$_3$

Flat Binding: Reference by property

the ear, the woman, the apple

Can flat binding replace index binding? (Sauerland, 2007)

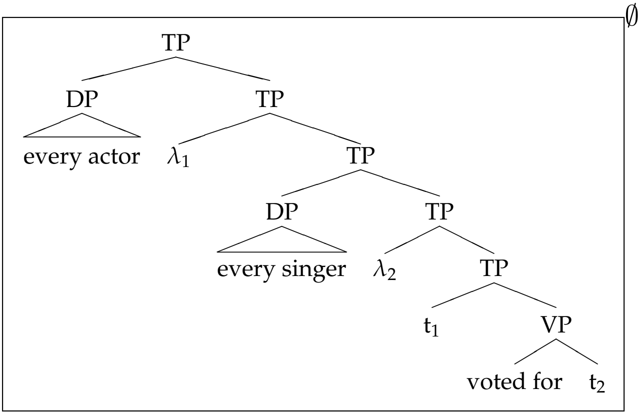
Index-Binding (Frege, Tarski)

Basic assumptions of one popular version:

- bound elements bear abstract indices
- the semantic model contains a *assignment sequence*
- indexed λ-operators can modify the assignment sequence

Index-Binding: Example, Step 1

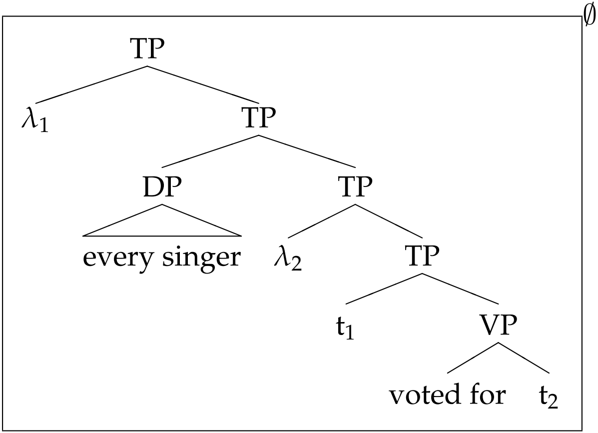
(1) Every actor voted for every singer.



Index-Binding: Example, Step 2

(1) Every actor voted for every singer.

For every actor A, evaluate:

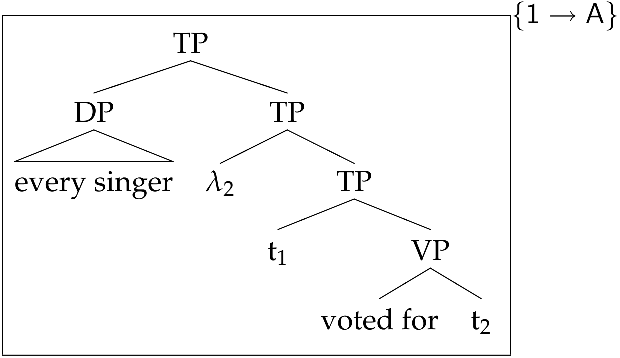


(A)

Index-Binding: Example, Step 3

(1) Every actor voted for every singer.

For every actor A, evaluate:

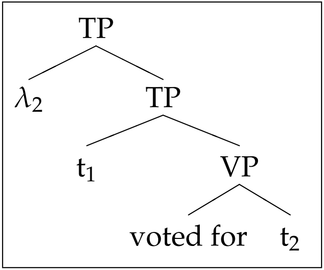


Index-Binding: Example, Step 4

(1) Every actor voted for every singer.

For every actor A and every singer S, evaluate:

$\{1 \rightarrow \mathsf{A}\}$

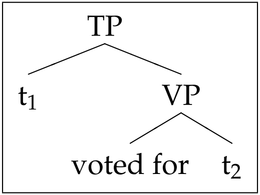


(S)

Index-Binding: Example, Step 5

(1) Every actor voted for every singer.

For every actor A and every singer S, evaluate:



$$\left\{ \begin{array}{l} 1 \rightarrow \mathsf{A} \\ 2 \rightarrow \mathsf{S} \end{array} \right\}$$

Index-Binding: Example, Step 6

(1) Every actor voted for every singer.

For every actor A and every singer S, evaluate:

$$\boxed{\text{voted for}}^{\left\{\begin{array}{c}1 \rightarrow \mathsf{A} \\ 2 \rightarrow \mathsf{S}\end{array}\right\}}\left(\boxed{\mathsf{t}_2}^{\left\{\begin{array}{c}1 \rightarrow \mathsf{A} \\ 2 \rightarrow \mathsf{S}\end{array}\right\}}\right)\left(\boxed{\mathsf{t}_1}^{\left\{\begin{array}{c}1 \rightarrow \mathsf{A} \\ 2 \rightarrow \mathsf{S}\end{array}\right\}}\right)$$

Index-Binding: Example, Step 7

(1) Every actor voted for every singer.

For every actor A and every singer S, evaluate:

$$\boxed{\text{voted for}}(\mathsf{S})(\mathsf{A})$$

Index-Binding: Cons

- indices in syntactic structures
- sequences in semantic models

Combinatorial Logic

Basic assumptions:

- argument positions may remain open
- new semantic rules ('combinators') percolate open argument positions up

Cons:

- sequence of open argument position: a constituent with n bound pronouns may be an n-place predicate
- empirical problems with some agreement cases

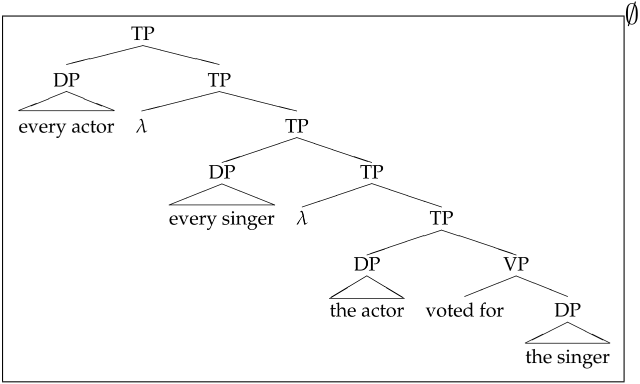
My Proposal: Flat Binding

Basic assumptions of my approach:

- bound elements are definite descriptions
- the semantic model contains a *assignment set*
- unindexed λ-operators extend the assignment set

Flat Binding: Example, Step 1

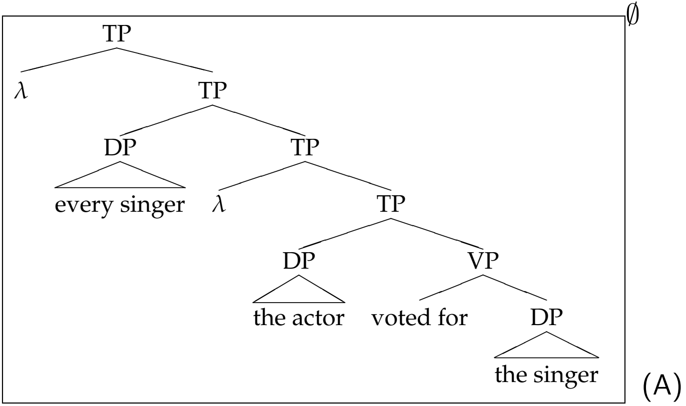
(1) Every actor voted for every singer.



Flat Binding: Example, Step 2

(1) Every actor voted for every singer.

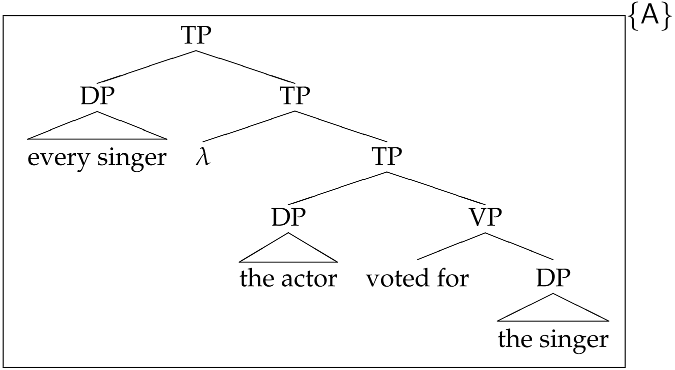
For every actor A, evaluate:



Flat Binding: Example, Step 3

(1) Every actor voted for every singer.

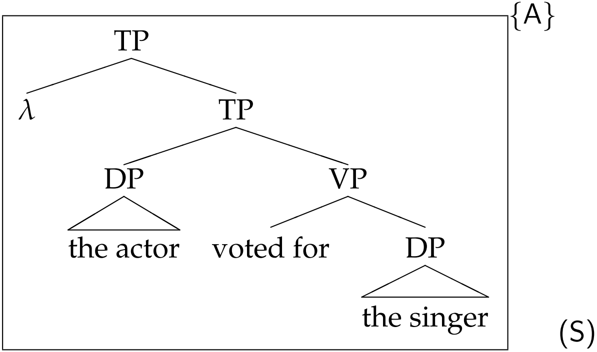
For every actor A, evaluate:



Flat Binding: Example, Step 4

(1) Every actor voted for every singer.

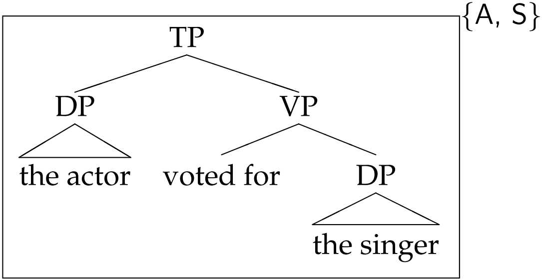
For every actor A and every singer S, evaluate:



Flat Binding: Example, Step 5

(1) Every actor voted for every singer.

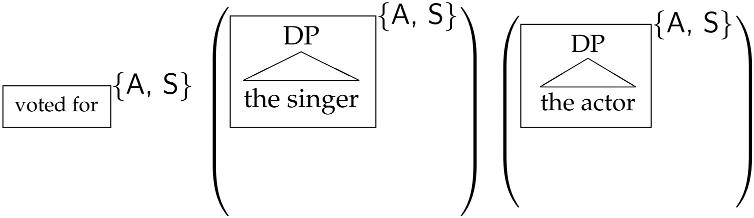
For every actor A and every singer S, evaluate:



Flat Binding: Example, Step 6

(1) Every actor voted for every singer.

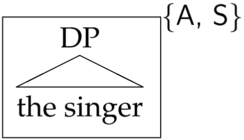
For every actor A and every singer S, evaluate:



The Overlap Problem

(1) Every actor voted for every singer.

The definite description only uniquely denotes an element of the set {A, S} if A is not also a singer.



But the sentence can be used when there is overlap:

(2) Every actor voted for every singer.
can entail: Every singing actor voted for himself.

Concepts in Semantic Models

Our knowledge of object properties is always incomplete.
Therefore: Represent objects as concepts (*guises*); functions from possible worlds to individuals:

(3) Sean, actor:

$$\begin{aligned} f: \{w\text{: Sean is an actor in } w\} &\longrightarrow D_e \\ w &\longrightarrow \text{Sean} \end{aligned}$$

(4) Sean, actor and singer:

$$\begin{aligned} f: \{w\text{: Sean is an actor and singer in } w\} &\longrightarrow D_e \\ w &\longrightarrow \text{Sean} \end{aligned}$$

A concept x has property P, if x selects an individuals with property P whereever x is defined.

Maximal Concepts

The smaller its domain, the more properties or a concept are known. On the other hand, a maximal P-concept has only property P and properties.

(5) Definition: A concept x is maximal for property P, if it has property P and:

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

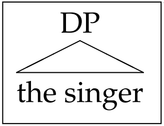
Example: A maximal girl-concept P can never have the property 'under 20 years old': We can imagine a possible world where humans first live as genderless caterpillars underground before they hatch. A maximal girl-concept must select a 20-year old individual in this world.

Overlap Resolved

Proposal: Quantifiers range of maximal concepts only.

(1) Every actor voted for every singer.

Since A is a maximal actor concept and S a maximal singer concept, the definite denotes uniquely:



$^{\{A, S\}} = S$

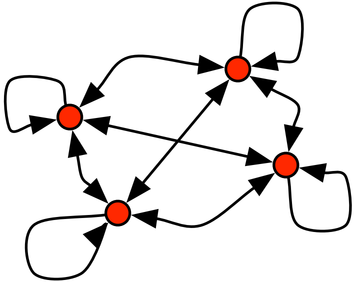
Now, the concepts are first applied to the actual world, and then the verb.

[voted for] $(S(w_0))(A(w_0))$

Identical Quantifiers I

Identical quantifiers should range over the same maximal concepts:

(6) Every dot is connected to every dot.



Identical Quantifiers II

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

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

The silent restrictors can be extensionally equivalent:

(8) Every (red) dot is connected to every (round) dot.

(9) Every dod is connnected to every dot (connectable to the dot)

Pronominalization

When can/must DPs be reduced to pronouns?

- Deletion up to recoverability of reference
- Maximal concepts are of higher salience
- (Schlenker, 2005) *Minimize Restrictors*

  (10) A linguist working on Binding theory was so devoid of any moral sense that he forced a physicist working on particles to hire a friend of the linguist in his lab.

Relevant Empirical Evidence

Further sources of evidence:

- lexical content of ‘variables’ (see below)
- type of ‘variables’ (Landman, 2005)
- available quantifiers (Hackl 2000, below)
- surprising sloppy readings (Hardt (2006), see below)

Further areas of investigation:

- psycholinguistic evidence
- strict/sloppy readings (see below)
- pronoun agreement (see below)
- A-movement structures (no lexical content?)

Evidence for Lexical Content

Representation of traces and pronouns on the two theories:

Index-binding	Flat binding
i	DP (the *P*)

Traces: Lexical content (= obligatory reconstruction): (Chomsky, 1993; Fox, 1999; Sauerland, 1998, 2004a)
Pronouns: Lexical content, specifically bound ones: Sauerland (2000, 2001, 2004b).

Pronouns and Focus

Contrastive focus marks meaning differences (see Schwarzschild 1999):

(11) On Monday, Mary praised Bill, and ...

a. ...on $[\text{Tuesday}]_F$, Mary praised $[\text{JOHN}]_F$.

b. #on $[\text{Tuesday}]_F$, $[\text{MARY}]_F$ praised $[\text{JOHN}]_F$.

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

(12) On Monday, every boy called his mother, and ...

a. ...on $[\text{Tuesday}]_F$, every $[\text{TEAcher}]_F$ called $[\text{HIS}]_F$ mother.

b. #... on $[\text{Tuesday}]_F$, every boy called $[\text{HIS}]_F$ mother (again).

Explanation

Flat binding explains this contrast:

(13) every boy λ the boy called the boy's mother, and ...

a. every t. λ the t. called [the teacher]$_F$'s mother

b. #every boy λ the boy called [the boy]$_F$'s mother

Index-binding has no explanation for the contrast:

(14) every boy λ_1 1 called 1's mother, and ...

a. ... every teacher λ_1 1 called [1]$_F$'s mother

b. #... every boy λ_1 1 called [1]$_F$'s mother

Sloppy Interpretation 1

(15) The waitress washed her hands and the cook did ~~wash her hands~~, too.

Representation for the strict reading:

(16) The waitress washed [the waitress]'s hands and the cook ~~washed [the waitress]'s hands~~

Representation for the sloppy reading?

(17) The waitress washed [the waitress]'s hands and the cook ~~washed [the cook]'s hands~~

How could ellipsis be licensed in (17)?

Sloppy Interpretation 2

Recall: Sloppy readings not constrained by c-command Tomioka (1999):

(18) The policeman who arrested John read him his rights and the policeman who arrested Bill did too.

A structure sharing account (Sauerland 2007, *SuB 11*):

(19) The [—]$_F$ washed the —'s hands

cook

Surprising Sloppy Interpretation 1

Prediction: Structure sharing not needed in :

(20) Every woman washed he hands. Even the waitress did ~~wash the woman's hands~~.

The Argument: Part 1) Sloppy interpretation blocked by MaxElide effect (Takahashi and Fox, 2005)

(21) *?Bill believes that Sally will marry him, but nobody else believes that she will.

Surprising Sloppy Interpretation 2

Part 2) The exception to this generalization:

(22) a. Almost every boy hopes that Sally will marry him. Even this boy hopes that she will. (cf. Hardt (2006))
b. #Almost every boy hopes that Sally will marry him, and even the teacher hopes that she will.

Explanation: Structure sharing analyses for (22):

boy

(23) every — prays Sally will marry him[the boy] . . .

a. . . . even the boy hopes that she will ~~marry him[the boy]~~
b. #. . . and even the teacher hopes that she will marry him[~~the boy~~]

Missing Quantifiers

Maximal boy concepts cannot be counted: (24a) and (24b) are for practical purposes equivalent.

(24) a. $[\![$one boy$]\!]$ = there is a maximal boy concept
b. $[\![$two boys$]\!]$ = there are two maximal boy concepts

There always is a world outside of the context set with two boys (or more boys).
Still possible:

(25) $[\![$no boy$]\!]$ = there is no maximal boy concept

Agreement 1

Agreement between binder and bound variable (Ross, Sag, Partee, Heim, . . .)

(26) I did my homework, but you didn't.

(27) Only I did [my] homework.

(28) The kids each thing [they] are the only person in the room.

Heim 2006, Kratzer 2006: Bound variable pronouns must agree with their binders.

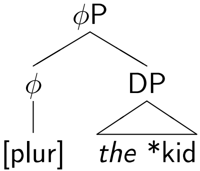
Agreement 2

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

(29) 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:

(30) their =



Proposal: contextual concept licenses plural, maximal concept determines reference

Agreement 3

Pronominal reference prefers maximal concepts:

(31) $[\![\text{pro}]\!]^{\ell}(P)$ denotes

a. the unique $c \in \ell$ with domain$(c) \supset C$ and $P(c)$, if any such c exist, and otherwise

b. the unique $c \in \ell$ with $P(c)$

Agreement is relative to contextual concepts only:

(32) $[\![[\text{sing}]\ \text{DP}]\!]^{w,\ell}$ is defined if $[\![\text{DP}]\!]^{w,\ell'}$ is atomic, where $\ell' = \{c \in \ell \mid \text{domain}(c) = C\}$

Conclusions

- no indices in syntax
- no sequences in semantic models
- all pronouns and traces are underlyingly definite descriptions

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