

## SLOPPY IDENTITY, BINDING, AND CENTERING

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### 1 Introduction

#### Sloppy Identity: Variable Binding vs. Centering

- (1) John<sub>1</sub> loves his<sub>1</sub> cat. Bill<sub>2</sub> does too (loves his<sub>2</sub> cat)
- (2) John<sub>1</sub>  $\lambda x$ . x loves x's cat. Bill<sub>2</sub>,  $\lambda x$ . x loves x's cat

(Keenan, 1971; Sag, 1976; Williams, 1977)

- **Problem:** binding of sloppy pronouns violates locality conditions on binding – the controller need not c-command the sloppy pronoun.
- **Proposal:** sloppy identity does not involve binding at all; instead, it reflects a *center shift*.
- **Consequences:**
  - In one way, sloppy identity is more flexible than predicted by variable binding – it is possible without c-command.
  - In another way, sloppy identity is less flexible than predicted by variable binding – with two pronouns, “mixed” readings are ruled out.

#### The Plot

- **Background**
  - 2: The Locality Problem for Sloppy Identity
  - 3: Sloppy Identity as Center Shift
- **New Evidence for Centering View**
  - 4: Two-pronoun Ellipsis Puzzle
  - 5: Two-pronoun Dream Puzzle
- **Final Points**
  - 6: E-type Account of Sloppy Identity: Critique
  - 7: Conclusions

Unlike other accounts, Centering provides a uniform explanation of the two-pronoun ellipsis puzzle and the two-pronoun dream puzzle.

## 2 The Locality Problem for Sloppy Identity

Sloppy pronoun need not be c-commanded by controller.

[VP [NP]]:

- (3) The police officer who arrested *John* [insulted [him]], and the one who arrested *Bill* did too. (insulted him)  
(Wescoat, 1989)
- (4) If *Tom* was having trouble in school, I would [help [him]]. If *Harry* was having trouble, I wouldn't. (help him)  
(Hardt, 1992)

In (3), *John* does not c-command sloppy pronoun *him*. Similarly, in (4), *Tom* doesn't c-command *him*.

Similar observations have been made with other anaphoric forms.

- (5) [VP [VP]] I'll *help you* if you [want me to [VPE]]. I'll *kiss you* even if you don't (want me to kiss you).  
(Hardt, 1994)
- (6) [VP [VP]] When John had to *cook*, he didn't [want to [VPE]]. When he had to *clean*, he didn't, either. (want to clean) (Schwarz, 2000)
- (7) [VP [Tense]] You *Past* [thought I [Past] was crazy]. You probably still *Pres* do VPE. (Stone and Hardt, 1997)
- (8) [Modal [NP]] *John* would use slides if [[he] had to give the presentation]. *Bill* would just use the chalkboard. (Stone and Hardt, 1997)
- (9) [VP [N]]: Every police officer who arrested some *murderers* [insulted one [ ] ], and every police office who arrested some *burglars* did too. (insulted one burglar)  
(Elbourne, 2001)

- Sloppy identity can involve a variety of anaphoric forms
- Does not require c-commanding controller

## 3 Sloppy Identity as Center Shift

### Centering and Dynamic Semantics

- Discourse has a distinguished individual, termed the *center*; roughly the current topic. (Grosz *et al.*, 1995)
- The center is notated with \*, which signifies position 0 in assignment function.
- Unlike other positions, center can be reassigned during a discourse
- The centered individual is always the value of an ordinary position in assignment function as well.
- Centers of other semantic types (properties, propositions) are also permitted. (Stone and Hardt, 1997; Bittner, 2001).

- **Ellipsis Resolution:** assume that indices do not change in ellipsis resolution.
- **Sloppy Identity:** only possible for a pronoun with index  $*$ , with an intervening *center shift*. (Hardt, 1996; Hardt, 1999)

## Example

(10) The police officer<sub>3</sub> who arrested John<sup>1\*</sup> [insulted him<sub>\*</sub>]<sup>4</sup>, and the one<sub>5</sub> who arrested Bill<sup>2\*</sup> did<sub>4</sub> too. (insulted him<sub>\*</sub>) (Wescoat, 1989)

- Center shifts from *John* to *Bill* between antecedent and VPE
- The centered pronoun *him<sub>\*</sub>* switches from *John* to *Bill*.

(CDRT as in (Hardt, 1999), based on (Muskens, 1996). See a more general version in (Stone and Hardt, 1997), and a related approach in (Bittner, 2001).)

$[u_0, u_1, u_3, P_4 \mid John(u_1), u_0 = u_1, officer(u_3), arrested(u_3, u_0), P_4 = \lambda x. [insulted(x, u_0)]]; P_4(u_3);$   
 $[u_0, u_2, u_5 \mid Bill(u_2), u_0 = u_2, officer(u_5), arrested(u_5, u_0)]; P_4(u_5);$

Equivalently:

$[u_0, u_1, u_3, P_4 \mid John(u_1), u_0 = u_1, officer(u_3), arrested(u_3, u_0), insulted(u_3, u_0)];$   
 $[u_0, u_2, u_5 \mid Bill(u_2), u_0 = u_2, officer(u_5), arrested(u_5, u_0), insulted(u_5, u_0)];$

## Two Constraints about Centering

1. **Centering Requirement:** If the value of the center is the value of index  $i$ , pronouns may not be indexed with  $i$ .
2. **Centering Preference:** A pronoun  $p_*$  is *preferred* over  $p_i$  for any non-zero  $i$ .
  - The Centering Preference is overridden by contra-indexing constraints and agreement constraints, and may be overridden by other factors such as plausibility.

## 4 The Two-Pronoun Ellipsis Puzzle

(11) John<sub>1</sub> said he saw his mother. Bill<sub>2</sub> did too (said he saw his mother).

- All four readings are permitted by the variable binding account.
1. Bill<sub>2</sub>  $\lambda x$  x said he<sub>1</sub> saw he<sub>1</sub>'s mother. (**John** saw **John's** mother)
  2. Bill<sub>2</sub>  $\lambda x$  x said x saw x's mother. (**Bill** saw **Bill's** mother)
  3. Bill<sub>2</sub>  $\lambda x$  x said x saw he<sub>1</sub>'s mother. (**Bill** saw **John's** mother)
  4. \* Bill<sub>2</sub>  $\lambda x$  x said he<sub>1</sub> saw x's mother. (**John** saw **Bill's** mother)

Reading 4 should be ruled out (Dahl, 1973; Fiengo and May, 1994).

## The Centering Account

- *No Mixed Readings*: since sloppy identity is a result of an intervening center shift, either there is no center shift, in which case all pronouns must remain strict, or there *is* a center shift, and all pronouns are sloppy.
- Reading 3 can be represented as an unmixed reading.
- Reading 4 cannot be represented as an unmixed reading.

### Reading 1

John<sup>1\*</sup> [said he<sub>\*</sub> saw [his<sub>\*</sub> mother]], Bill<sup>2</sup> did too [said he<sub>\*</sub> saw [his<sub>\*</sub> mother]]  
(no center shift)

### Reading 2

John<sup>1\*</sup> [said he<sub>\*</sub> saw [his<sub>\*</sub> mother]], Bill<sup>2\*</sup> did too [said he<sub>\*</sub> saw [his<sub>\*</sub> mother]]  
(center shift)

### Reading 3 as Unmixed

(12) John<sup>1\*</sup> [[his<sub>\*</sub> mother]<sub>3</sub> [said he<sub>\*</sub> saw e<sub>3</sub>]<sup>4</sup>], Bill<sup>2\*</sup> did<sub>4</sub> too (said he<sub>\*</sub> saw e<sub>3</sub>).

- The center shift causes *he* to be interpreted as *Bill*
- The offending pronoun *his* is embedded in a larger NP *his mother*, and this larger NP can be interpreted outside the scope of a propositional verb like *said*. We use QR to adjoin *his mother* to the matrix VP, leaving a coindexed trace, e<sub>3</sub>
- e<sub>3</sub> is interpreted as John's mother
  - definite description *his mother*<sub>3</sub> sets up John's mother as the value of 3 in the assignment function, which is made available for the variable e<sub>3</sub> in the following sentence.

[ $u_0, u_1, u_3, P_4 \mid John(u_1), u_0 = u_1, mother(u_3), of(u_3, u_0), P_4 = \lambda x. [said(x, saw(u_0, u_3))]$ ];  $P_4(u_1)$ ;  
[ $u_0, u_2 \mid Bill(u_2), u_0 = u_2$ ];  $P_4(u_2)$ ;

Equivalently:

[ $u_0, u_1, u_3, P_4 \mid John(u_1), u_0 = u_1, mother(u_3), of(u_3, u_0), said(u_1, saw(u_0, u_3))$ ];  
[ $u_0, u_2 \mid Bill(u_2), u_0 = u_2, said(u_2, saw(u_0, u_3))$ ];

### Reading 4

- Reading 4 has no unmixed representation:
  - Center shift is again required, to allow *his* to get a sloppy reading
  - The offending pronoun *he* is not embedded. Thus even if one raised he<sub>\*</sub>, this would have no effect, since the trace e<sub>\*</sub> would remain.

(13) John<sup>1\*</sup> [he<sub>\*</sub> [said e<sub>\*</sub> saw [his<sub>\*</sub> mother]], Bill<sup>2\*</sup> did too (said e<sub>\*</sub> saw [his<sub>\*</sub> mother]).

## 5 The Two-Pronoun Dream Puzzle

(14) John dreamed that he was marrying his grand-daughter. (Percus and Sauerland, 2003a; Percus and Sauerland, 2003b)

- In his dream, John believed he was Bill. The two pronouns in the dream description could refer to John, or Bill (the “dream-self”).
- Four readings:
  1. John dreamed that John was marrying John’s grand-daughter.
  2. John dreamed that Bill was marrying Bill’s grand-daughter.
  3. John dreamed that Bill was marrying John’s grand-daughter.
  4. \*John dreamed that John was marrying Bill’s grand-daughter.

Again, reading 4 should be ruled out. (Percus and Sauerland, 2003b)

### The Centering Account

- *dream* can optionally cause a center shift, so that the center under the scope of *dream* can shift to Bill.

#### Readings 1 and 2

1. John<sup>1\*</sup> dreamed he<sub>\*</sub> was marrying [his<sub>\*</sub> granddaughter]<sub>3</sub> (no center shift)
2. John<sup>1\*</sup> dreamed<sup>Bill<sup>2\*</sup></sup> he<sub>\*</sub> was marrying [his<sub>\*</sub> granddaughter]<sub>3</sub> (center shift)

#### Reading 3 as Unmixed

- Just as in the ellipsis puzzle, the offending pronoun *his* can be removed by QR, which results in *his granddaughter* being VP-adjoined

John<sup>1\*</sup> [his<sub>\*</sub> granddaughter]<sub>3</sub> dreamed<sup>Bill<sup>2\*</sup></sup> he<sub>\*</sub> was marrying e<sub>3</sub>

#### Reading 4

The only way to derive Reading 4 is the following, which violates the Centering Preference, since it has he<sub>1</sub>, instead of he<sub>\*</sub>.

(15) John<sup>1\*</sup> dreamed<sup>Bill<sup>2\*</sup></sup> he<sub>1</sub> was marrying [his<sub>\*</sub> granddaughter]

## 6 E-Type Account of Sloppy Identity: Critique

(Tomioka, 1999): unbound sloppy pronouns are E-Type pronouns. Example (3) receives the following analysis:

- (16) The police officer<sub>1</sub> who arrested John<sub>2</sub> insulted *the x that he<sub>1</sub> arrested*, and the one<sub>3</sub> who arrested Bill<sub>4</sub> did too. [insulted (the x that he<sub>3</sub> arrested)]

Now, the sloppy pronoun he<sub>1</sub> is c-commanded by its antecedent.

(Heim and Kratzer, 1998):

“E-Type pronouns can always be paraphrased by certain definite descriptions.” [page 288]

This conflicts with Evans’ original view (Evans, 1977) – he argues that a description should not appear in place of an E-type pronoun.

...the sentence which results when the description takes the place of the E-type pronoun (the ‘prolix sentence’) is often ambiguous in a way in which the original sentence is not. The trouble arises because definite descriptions give rise to scope ambiguities when interacting with almost all operators [page 132].

Here are Evans’ examples, involving interaction with modality, time and psychological attitudes.

- (17) John owns a donkey and it likes carrots, though it might not have been the case that *it* likes carrots.
- (18) John owns a donkey and it likes carrots, though it might not have been the case that *the donkey John owns* likes carrots.
- (19) Boston has a Mayor and *he* used to be a Democrat.
- (20) Boston has a Mayor and *the Mayor of Boston* used to be a Democrat.
- (21) A man murdered Smith, but John does not believe that *he* murdered Smith.
- (22) A man murdered Smith, but John does not believe that *the man who murdered Smith* murdered Smith.

Evans claims, for example, that (19) is unambiguous – *he* must refer to the current mayor of Boston. But he finds (20) to be ambiguous; *the Mayor of Boston* might refer to the current mayor, who was a Democrat in the past, or it might refer to a previous mayor.

### Interaction with Ellipsis

A similar effect can be observed in the interaction between hidden descriptions and ellipsis resolution:

- (23) The patrolman<sub>1</sub> who arrested a burglar<sub>2</sub> interrogated him<sub>2</sub>. Detective Wilson<sub>3</sub> did too. (interrogated him<sub>2</sub>)
- (24) The patrolman<sub>1</sub> who arrested a burglar<sub>2</sub> interrogated *the burglar he arrested*. Detective Wilson<sub>3</sub> did too. (interrogated the burglar he arrested)

E-type account introduces a sloppy reading that doesn't exist.

The paraphrase version (24) has a sloppy reading, where Wilson interrogated the burglar *Wilson* arrested, while the original version (23) has only the strict reading, where Wilson interrogated the burglar *the patrolman* arrested.

Problem for the E-type approach is that the pronoun *he* becomes part of the LF representation of the E-type pronoun *him<sub>2</sub>* in (23), which means *he* is within the VP antecedent, and is therefore copied to the VPE location. Here it can receive a sloppy interpretation, switching to *Wilson*

This suggests that the hidden description posited by the E-type approach is in fact not present.

## Shrinking the Definite Description

How big is the implicit definite description?

- (Heim, 1990) S containing antecedent NP
- (Elbourne, 2001) just antecedent NP
- (Chierchia, 1992) just N-head of antecedent NP

(Elbourne, 2001) and (Büring, 2001) suggest that spurious sloppy readings can be avoided by shrinking the implicit definite description.

“Just copy NP” still gives spurious sloppy reading:

- (25) When Officer Smith saw *the burglar he arrested*, he interrogated *him*. Detective Jones did too.
- (26) When Officer Smith saw *the burglar he arrested*, he interrogated *the burglar he arrested*. Detective Jones did too.

“Just copy N” also gives wrong reading:

- (27) The police officer who arrested a burglar insulted *him*, and the one who arrested a murderer did too.
- (28) The police officer who arrested a burglar insulted *the burglar*, and the one who arrested a murderer did too.  
(Tomioka, 1999)

Here, the E-type approach incorrectly rules out the sloppy reading, because *burglar* must be part of the descriptive content of the E-type pronoun *him*, which is in turn copied by VPE resolution

Evans argues that E-type pronouns must not be represented as hidden definite descriptions – rather, the antecedent fixes the referent for the subsequent unbound pronoun. Centering can be seen as giving an explicit mechanism for this.

## E-type and Two-pronoun Cases

Two-pronoun cases are possible with a controller that doesn't c-command the pronoun.

- (29) The police officer who arrested John knew he saw his mother, and the one who arrested Bill did too.
- (30) The police officer who arrested John knew [the x he arrested] saw [the x he arrested]'s mother, and the one who arrested Bill did too.

Centering account correctly rules out the 4th reading (“the one who arrested Bill knew John saw Bill's mother”), just as in original two-pronoun ellipsis example.

This creates a problem for accounts such as (Fox, 2000) – which doesn't permit sloppy pronoun to be c-commanded by non-sloppy pronoun. That doesn't apply here, since the two occurrences of *he* aren't in c-command relation.

## 7 Conclusions

- Centering is more flexible than variable binding in that it doesn't require c-command.
- Centering is more constrained than variable binding in two-pronoun cases, in that it doesn't permit mixed readings.
- Unlike other accounts, Centering applies uniformly to ellipsis two-pronoun puzzle and dream two-pronoun puzzle
- The E-type alternative involves complicating the LF level, allowing copying of material to build implicit definite descriptions
- Centering account relies on independently needed constraints on processing, allowing syntax-semantics interface to remain simple.

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