The Semantics of Plurals

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August 2, 2009

(Rough) plan

- This course will cover some basic issues that plurals raise to the study of semantics.
- We will discuss the following topics:
  - How to fit in plurality into our theories of semantics.
  - Distributive, collective, and cumulative readings.
  - Bare plural nouns and their readings (focusing on English).

First order predicate logic

- It is common practice in model-theoretic semantics to use predicate logic as a representation of sentence meaning.
- However, standard first-order predicate logic cannot properly account for plural meaning.
- The normal interpretation of first order logic predicates, for example, is to take them to be sets of individuals:

(1) a. Andrea is a student.
    b. $\textsc{student}(a)$.

First order predicate logic

- If the predicate is distributive, we can also accommodate plural/conjoined subjects:

(2) a. Andrea and Beth are students.
  b. Andrea is a student and Beth is a student.
  c. $\textsc{student}(a) \wedge \textsc{student}(b)$

(3) a. The girls are students.
  b. $\forall x[\textsc{girl}(x) \rightarrow \textsc{student}(x)]$

First order predicate logic

- Similarly, if there is a quantifier that induces a distributive reading, there is no problem, regardless of whether the predicate is always distributive, or whether it is ambiguous:

(4) a. Every girl is a student.
    b. $\forall x[\textsc{girl}(x) \rightarrow \textsc{student}(x)]$

(5) a. Every girl lifted a piano.
    b. $\forall x[\textsc{girl}(x) \rightarrow \textsc{lift-a-piano}(x)]$

But...

- But, what do we do if we have no distributive predicate or quantifier?

(6) a. John and Mary are a happy couple.
b. $*\text{HAPPY COUPLE}(j) \wedge \text{HAPPY COUPLE}(m)$

(7) a. All the students gathered.
b. $*\forall x[\text{STUDENT}(x) \rightarrow \text{GATHER}(x)]$

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- As a general rule, predicate logic cannot handle non-distributive predication/quantification.

What to do?

- There are two (families of) solutions in the literature:
  1. Reduce all non-distributive predication to distributive predication.
  2. Use a more robust logic.
- Following the majority of the (linguistic) semantic literature, we will be focusing on the first strategy.

Reductive (singularist) approaches

- The most common approach is the view that treats non-distributive sentences as distributive sentences over some other type of entity.

(8) a. John and Mary are a happy couple.
 b. $\exists\alpha[\alpha\Re j \wedge \alpha\Re m \wedge \textsc{happy couple}(\alpha)]$

- Where these approaches differ is in the nature of α and the relation $\Re$.

Set based theories

- One approach says there is no need to look beyond the set of tools already available from standard set theory.
- A set, after all, is a single thing, but it may have many elements.
- Thus, accounting for plural predication can be as simple as taking plurals to denote sets, and non-distributive predicates are taken to be predicates of sets of individuals.
- This has been the approach taken by a wide range of plurality literature, including Scha (1981), Hoeksema (1983), Gillon (1987, 1990), Lasersohn (1995) and Schwarzschild (1996).

Set based theories

- In this view, we have the following:

(9) a. John and Mary are a happy couple.
b. $\text{HAPPY COUPLE}(\{j, m\})$

Plural quantifiers can be taken to be quantifiers over sets, so that (10a) can be interpreted as (10b):

(10) a. Three students met.
b. $\exists X[X \subseteq \text{STUDENT} \wedge |X| = 3 \wedge \text{MET}(X)]$

Mereological theories

- Set-based theories, however, have been criticized on a variety of grounds, the main one being metaphysical.

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(12) $\Rightarrow$ The set of Godehard's daughters made a mess in the living room.

(13) $\Rightarrow$ A set made a mess in the living room.

Argument from Link (1998)

Another problem

- Both sets and sums work by positing the existence of an entity (set or sum) that represents the plurality.
- But it has been argued (Boolos 1984, Schein 1995, Higginbotham 1998) that this is a highly problematic point.

(14) The sets that do not contain themselves are numerous.

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(15) There is a set, such that it is the set of sets that does not contain themselves, and it is numerous.

(16) $\Rightarrow$ There is a set of sets that do not contain themselves

Mereological theories

- An alternative to the set-based view is based on the notion of part/whole relations, or mereology.

John

arms *legs* *torso*

Mary

arms *legs* *torso*

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John $\oplus$ *Mary*

John *Mary*

Mereological theories

- So, we have the following:

(17) a. John and Mary are a happy couple.
b. $\text{HAPPY COUPLE}(j \oplus m)$

- Plural quantifiers can be taken to be quantifiers over sums:

(18) a. Three students met.
b. $\exists X[\forall x[\text{ATOM}(x) \wedge x \leq X \rightarrow \text{STUDENT}(x)] \wedge |X| = 3 \wedge \text{MET}(X)]$

- This approach is also common in the semantic literature, including Hoeksema (1988), Moltmann (1997), Winter (2002) and Landman (2000).

Non-reductionist theories

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(19) The non-atoms are the atoms. (False)

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- Unfortunately, just like the set-based system, it has been argued that the sum-based system leads to inevitable paradox (Schein 1995)
- To see this, let us take the following sentence:

(19) The non-atoms are the atoms. (False)

(20) The sum of all non-atoms is the sum of the atoms. (True)

Non-reductionist theories

- As a response, there have been several advocates (esp. in the philosophical literature) of plural semantics that do not involve a mediating level in which predication is distributive.
- These include monadic second-order logics (Boolos 1984, Schein 1993, Pietroski 2005, McKay 2006):

(21) a. Adam fought with Yuri and Zero.

b. $\textsc{fight}(a)\begin{pmatrix} y \\ z \end{pmatrix}$

- And logics based on polyadic relations (Oliver and Smiley 2004):

(22) a. Adam fought with Yuri and Zero.

b. $\textsc{fight}a;\, yz$

Consequences

- So, there are a variety of approaches for handling non-distributive predication.
- However, they all have an unavoidable consequence.

(23) a. John and Mary are a happy couple.
b. $\text{HAPPY COUPLE}(j \oplus m)$

(24) a. John and Mary are tall.
b. $\text{TALL}(j) \wedge \text{TALL}(m)$

- We need a method of distinguishing distributive from non-distributive predication.

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- To be continued...

Choice of theory

- For the rest of this course, we will use the sum-based notation for plurals, for convenience.
- However, this should not be taken to be an endorsement of this theory over the alternatives.
- Rather, unless explicitly stated otherwise, the issues we will deal with apply to all the views above.

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