The Semantics and Pragmatics of Number
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Workshop on Romanian Syntax and Semantics
March 26, 2009
Université Paris 6 - CNRS

This talk reports on work done in collaboration with Henriëtte de Swart, Utrecht University.

1. Introduction

Why is the semantics of nominal number problematic?

Naïve view:

(1) singular *book* means ‘one’  plural *books* means ‘more than one’

(2) ‘singular’: *atomic reference*  ‘plural’: *sum reference* (Link 1983)

(3) a. Mary saw *a horse*. (atom only)
   b. Mary saw *horses*. (sum only)

Problem:

•  *Inclusive plurals* (atom + sum)

(4) Do you have *children*?
(5) If you have *children* you may come to the party.
(6) Every/Each person who has *children* knows this.
(7) Mary didn’t solve *problems from this list*.

Account:

•  “*Weak plural/Strong singular*” Hypothesis (WPlH)

(8) *WPl/SSgH*: The plural carries no meaning. The singular is marked for atomic ref.
   (Krifka 1989, Sauerland 2003, Sauerland et al. 2005)

Plan for the talk;

Section 2: challenges a theory of nominal number must meet
Section 3: proposed analysis in informal terms
Section 4: conclusions

2. Challenges

2.1 Number semantics and the parallelism between formal and semantic markedness

(9) Generally, in languages with a morphological distinction between sg. and pl. nominals the sg. is unmarked and the pl. is marked, with overwhelming frequency.

Formal and semantic markedness parallelism

(10) Formal markedness is associated with semantic markedness. Formal lack of marking is associated with lack of semantic marking. (Horn pattern)

Horn (2001) p. 155: “… one member of an opposed pair is literally MARKED (overtly signaled) while the other is UNMARKED (signaled via the absence of an overt signal). Semantically, the marked category is characterized by the presence of some property \( P \), while the corresponding unmarked category entails nothing about the presence or absence of \( P \) but is used chiefly (although not exclusively) to indicate the absence of \( P \) (Jakobson 1939)”.

A. The Horn pattern for nominal number marking

Plural forms should be semantically marked relative to singular forms.

WPl/SSgH contradicts A:

\[ \text{singular: formally unmarked, semantically marked} \]
\[ \text{plural: formally marked, semantically unmarked} \]

Sauerland et al. (2005):

- morphologically singular forms contribute a presupposition

(11) \([\text{sg}](\alpha)\) is defined only if \( \# x = 1 \)
\[ [\text{sg}](\alpha) = x \text{ wherever it is defined} \]

- morphologically plural forms contribute nothing to the semantics

(12) \([\text{pl}](\alpha)\) is always defined
\[ [\text{pl}](\alpha) = x \]

**Puzzle:** how to conform to A but allow for inclusive plurals?

- Default account (Farkas and de Swart 2003, Farkas 2006)

(a) Default atomic reference: if nothing is said, reference taken from atoms.
(b) Effect of [pl]: lifts default and thus allows sum reference.

**Problem with the default account:**

In languages with no number marking (Chinese) NPs are number neutral rather than atomic.

B. The Chinese pattern: Absence of morphological number marking results in number neutrality.
Tasks so far

- account for the existence of inclusive plurals
- capture the Horn pattern as well as the Chinese pattern

2.2 When is the inclusive interpretation of the plural available?

(i) a. What is responsible for the choice between inclusive/exclusive interpretation of a plural?

- why exclusive interpretation in (3b) but inclusive interpretation in (4) - (7)?

Empirial generalization: Inclusive interpretation is possible when the NP is within the scope of negation/antecedent of conditional/question/restrictor of universal quantifier

b. Why should exactly these environments matter?

Issues set aside for now:

Dependent plurals:

(13) Unicycles have wheels.

Cumulative plurals:

(14) All the children sang songs.

Strong distributive each does not license dependent or cumulative plurals.

(15) Each child is wearing hats.

- not appropriate if each child is wearing a single hat.

(ii) Not all inclusive pl. friendly contexts are alike when it comes to hosting plurals (Farkas 2006, Spector 2005)

(16) Do you have children?
(17) Do you have MA degrees?
(18) Does Sam have #Roman noses/a Roman nose?
(19) Does a worm have #an eye/eyes?

Why is there a difference between (16) and (17)? (children vs. MA degrees)
Why is there a difference between (16), (17) and (18)? (children, MA degrees vs. noses)
Why is there a difference between (18) and (19)? (noses vs. eyes)

• Difference not predicted by WPl/SSgH: (16) vs. (17)

2. 3 Sum referring singulars
SSgH: the singular is marked for/presupposes atomic reference

Hungarian: when D entails sum, the singular is used:

(20) a. Három/sok gyerek elment.
   three /many child left
   ‘Three/many children left.’

   b. A gyerekek elmentek
      the child.Pl left.Pl
      ‘The children left.’

C. Hungarian Pattern: Singular forms are used when D entails sum reference.
   
   - Hungarian pattern is problematic for the SSg part of the WPl/SSG hypothesis.

Summary of tasks
- account for A - C
- account for possibility of inclusive plural and the contexts that allow it
- account for the interplay between sg/pl use in contexts that allow inclusive plurals

3. Analysis

Overview
(i) Presence of [pl] requires the variable it is associated with to have sums within its domain of reference; either only sums or sums and atoms; plural forms are polisemous between exclusive and inclusive interpretations.
(ii) The choice between these interpretations is determined by the Strongest Meaning Hypothesis applied to the plural: in downward entailing environments we expect the inclusive interpretation and in upward entailing environments we expect the exclusive interpretation.
(iii) The formal/semantic markedness pattern is explained in terms of bidirectional OT.

Proposal in some detail

Morpho-syntax of nominal number
- [pl] on plural NPs (in NumP)
- no number feature on singular NPs

Semantics of [pl]

(21) Semantics of [Pl]
   a. \([\text{[Pl]}] = \lambda x. x \in \text{Sum}\) (exclusive interpretation of plural)
   b. \([\text{[Pl]}] = \lambda x. x \in \text{Sum} \cup \text{Atom}\) (inclusive interpretation of plural)

- Choice between the two is regulated by the Strongest Meaning Hypothesis: choose the interpretation that leads to the strongest overall claim.

(22) a. Mary saw horses.
    b. Mary didn’t see horses.

- Downward entailing environments: inclusive plurals
- Upward entailing environments: exclusive plurals

- Plural nominals within the scope of negation, in the Restrictor of universals and in the antecedent of conditionals will be interpreted inclusively.

Context may override the SMH:

(23) There are *children* in this house. (upon seeing toys all around the living room)

*Formal and semantic markedness pattern*

**Assumptions**

In the number marking realm in languages with a morphological distinction between sg and pl, the contrast in form is paralleled by a contrast in meaning.

**BiOT:**
(a) choice of optimal form to convey a particular meaning
(b) choice of optimal meaning given a particular form

Mattausch (2005): abstract system of combining marked form with marked meaning and unmarked form with unmarked meaning

- assumes existence of:

  a.  \(<\text{u-form}, \text{m-form}>\)
  b.  \(<\alpha\text{-meaning}, \beta\text{-meaning}>\)

  where \(\alpha\) is more common than \(\beta\)

- System of universal constraints leads to preferring the combination of \(<\text{u}, \alpha>\) and \(<\text{m}, \beta>\) to the combination \(<\text{u}, \beta>\) and \(<\text{m}, \alpha>\)

**Application to number marking and number interpretation:**

*Markedness of meaning*
- atomic reference is the frequent meaning \(\alpha\)
- reference including sums is less frequent meaning \(\beta\)

*Markedness of form*
- singular is unmarked u-form
- plural is marked m-form

Bi-directional optimization results in the association of the marked form with marked meaning and the association of the unmarked form with the unmarked meaning.

(a) Sum reference is optimally conveyed by a plural form.
(b) The optimal interpretation of a plural form is sum reference.
(c) Atomic reference is optimally conveyed by a singular form.
(d) The optimal interpretation of a singular form is atomic reference.
The use of a singular leads to atomic interpretation without having to give a semantics to singular forms.

The plural is predicted to have either exclusive or inclusive sum interpretation.

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Tableau 1: Optimization over singular/plural form-meaning pairs

* *sg,sum, *pl.at, *pl, sum, *sg, at: constraints penalizing association of form with meaning
* *FUNCTN: constraint penalizing functional projections in nominals
* Mattausch’s system results in the higher ranking of *sg, sum, *pl, at relative to *pl sum and *sg, at.

Consequences

Atomic singulars, inclusive/exclusive plurals

(24) Mary saw a horse. (atomic)
  Mary saw horses. (exclusive plural)
  Mary didn’t see horses. (inclusive plural)
  Each person who saw horses was asked to report to the police. (inclusive plural)
  Each person who reported to the police saw horses. (exclusive plural) !!

A. Markedness pattern is captured -- starting point of the whole analysis.

B. Chinese pattern is captured because the atomic interpretation of the singular in languages involving a morphological contrast between sg. and pl. rests on the unmarked nature of the singular in these languages, which in its turn rests on the existence of the marked plural.

The BiOT pairs interpretations to marked/unmarked forms.

C. Hungarian Pattern:

(19) a. Három/sok gyerek elment.
    three /many child left

    b. A gyerekek elmentek
    the child.Pl left.Pl
- singular form in this language (as in English) does not involve a particular morphological feature with a particular semantics so there is no semantic prohibition against using a singular form with a sum interpretation

**Account**

First observation

- Once the D entails sum reference, there is no contrast in meaning between *three child/three children* and therefore the bi-directional optimization system does not impose the use of the plural in these nominals; the bidirectional system relies on the choice of form being associated with a meaning contrast. The candidates in this system are pairs that contrast in both interpretation and in form.

The system allows a singular form here.

A question:

- How come a plural form is ungrammatical in Hungarian here but required in English?

The answer:

- sum reference has to be signalled, i.e., overtly marked

*English:* overt marking of sum reference requires [pl] even if redundant

*Hungarian:* a sum-entailing D marks sum reference; use of morphological feature only when not redundant

**Further pragmatic effects concerning choice of form**

- the singular and plural forms contrast least in environments where the singular loses its ‘not more than one’ implicature and the plural is interpreted inclusively

(i) Use of plural signals sums witnesses are involved.

(ii) A singular cannot be used when sum witnesses are involved.

(24) a. Does Sam have a Roman nose/#Roman noses?
    b. Does a worm have eyes/#an eye?

(25) a. Do you have an MA degree?
    b. Does your department have MA students?

(26) a. Do you have children?
    b. Do you have a child enrolled at Pacific Collegiate School?

**4. Conclusion**

- Number marking involves a contrast between an unmarked form paired with unmarked meaning and marked form paired with marked meaning
In the languages under consideration, the unmarked form, the singular, is paired with the conceptually unmarked meaning (atomic), and the marked form, the plural, is paired with the conceptually marked meaning (sum reference).
- The plural will be interpreted as inclusive or exclusive but always involving possible sum referents.
- Pragmatics comes into play in deciding between the inclusive and exclusive interpretation (SMH) and in influencing when sums are included in the domain of reference of a nominal.

References
McCawley, J. (1981). Everything linguists always wanted to know about logic (but were afraid to ask), Chicago: University of Chicago Press.