

# The Implications of dependent plural readings\*

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NELS 36  
10/30/2005

## 1 Introduction

- In this talk, I present a semantics for bare plurals in English (in the reading in which they do not denote kinds).
- I focus on an old problem - dependent plurality - from a new perspective, bringing it together with recent work on the semantics of plurality in non-dependency contexts (Krifka (2003), Sauerland (2003), Sauerland et al. (2005)).
- In doing so, I show that there is no need for a separate mechanism for dependent plurality; rather, a uniform plurality condition can account for the behavior of bare plurals in all environments.

## 2 Dependent plurals

- Dating back to Chomsky (1975), it has been known that sometimes plural NPs get a reading that is unexpected if they simply meant “more than 1 N”. This phenomenon has been named **dependent plurality** by de Mey (1981).
- For example:
  - (1) a. Male lions have a mane.  
b.  $\forall x[\text{LION}(x) \rightarrow \exists y[\text{MANE}(y) \ \& \ \text{HAS}(x)(y)]]$
  - (2) a. Male lions have manes.  
b.  $*\forall x[\text{LION}(x) \rightarrow \exists Y[\text{MANES}(Y) \ \& \ \text{HAS}(x)(Y)]]$

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\*I'd like to thank Anna Szabolcsi, Mark Baltin, Liina Pylkkänen, Uli Sauerland, Barry Schein, my fellow students at NYU, the audience for the LANYU forum, and the NELS reviewers for all their useful discussion and criticism.

(1a) corresponds to the logical form in (1b). By analogy, (2a) would be expected to have the logical form in (2b) - i.e. if something is a lion, it has (a plurality of) manes. Clearly, however, this is not the case. Instead, it seems that (2a) is true even though no lion possesses more than one mane.

- On the other hand, it isn't true that there is no notion of plurality involved in such sentences. For example, compare:

(3) Ten students live in a New York borough

(4) Ten students live in New York boroughs

(4) is a dependent plural, as it can be true if every one of the students has only one dwelling place. If all the ten students in question live in Manhattan, (4) is not true in this situation, but (3) is.

- Thus, as a rough description, a sentence has a dependent plural reading when it contains a plural NP that can be interpreted as if it were singular within the scope of another plural element in the sentence, while at the same time requiring a plurality overall.
- Note that in upwards entailing environments, if the dependent reading exists, then it is also true in all cases in which the expected, non-dependent reading is true (e.g. a lion having at least two mane entails that it has at least one mane). Thus, in these cases, there is no *a-priori* way to determine whether there are two readings or whether the dependent plural is the only reading available. I will discuss downwards-entailing environments below.

### 3 Are dependent plurals cumulative readings?

- The most common approach to dependent plurals (e.g. de Mey (1981), Roberts (1990), Beck (2000)) is to take them to be cumulative readings, such as familiar from numerical indefinites:

(5) a. Three women gave birth to five babies.

b. *A total of 3 women gave birth to babies, and a total of 5 babies was born.*

- Whatever mechanism accounts for (5a) having reading (5b) could indeed account for a large amount of dependent plural readings.
- Nonetheless, dependent plural readings are possible in environments where cumulative readings are not possible for numerical indefinites.

- One such environment is in the scope of the quantifiers *most* and *all*. In both the following pairs, the first member lacks a cumulative reading but the second member allows for a dependent plural reading:

- (6) a. Most students read thirty papers.  $\nRightarrow$   
*Most students read papers and a total of 30 papers were read.*
- b. Most students read papers.  $\Rightarrow$   
*Most students read papers and more than 1 paper was read.*
- (7) a. All the students read thirty papers.  $\nRightarrow$   
*All the students read papers and a total of 30 papers were read.*
- b. All the students read papers.  $\Rightarrow$   
*All the students read papers and more than 1 paper was read.*

- A second environment in which dependent plural readings exist yet cumulative readings do not is when the other plural element is not a quantified DP but rather an adverbial. This can be seen in the following example (adapted from de Mey (1981)):

- (8) Three trains leave every day to Amsterdam from this station.  $\nRightarrow$   
*At least 1 train leaves every day, and a total of 3 trains is involved overall.*
- (9) Trains leave every day to Amsterdam from this station.  $\Rightarrow$   
*At least 1 train leaves every day, and more than 1 train is involved overall.*

- Thus, there are clear cases in which a cumulative account will not explain dependent plurals.

## 4 The overall plurality requirement

- A second approach (Kamp and Reyle (1993), Spector (2003)) takes the dependent plural to be identical to the singular, except in that it is obligatorily low-scope. This approach gives the right distributive behavior, but does not account for the overall plurality requirement.
- In the rest of this talk, I will focus on the plurality requirement, and show how it may be accounted for. In doing so, I will end up with a single semantics for bare plurals, in all their environments.
- (3) above already showed that dependent plurals may carry an overall plurality requirement. It is easy to find many more such examples:

- (10) a. My friends own German cars.  $\Rightarrow$   
*More than 1 car overall*

- b. The men saw beautiful women.  $\Rightarrow$   
*More than 1 woman overall*
- c. Three students were reading linguistic books.  $\Rightarrow$   
*More than 1 book overall*
- d. The children enjoyed the movies.  $\Rightarrow$   
*More than 1 movie overall*
- e. Exactly ten rabbits hid in the bushes.  $\Rightarrow$   
*More than 1 bush overall*
- f. John usually rides taxis to work.  $\Rightarrow$   
*More than 1 taxi overall*
- g. Comets grace our night sky every decade  $\Rightarrow$   
*More than 1 comet overall*

- However, not all sentences feature such a requirement:

- (11)
- a. Few men ate apples  $\nRightarrow$   
*more than 1 apple overall*
  - b. Israel's olympic team almost never won medals  $\nRightarrow$   
*more than 1 medal overall*
  - c. You must consult relevant articles.  $\nRightarrow$   
*more than 1 article overall*
  - d. If my opponents crash into trees, I will win the ski race.  $\nRightarrow$   
*more than 1 tree overall*
  - e. Do all your friends like cooking shows?  
 $\#$  No, they all like "The Frugal Gourmet".  
Yes, they all like "The Frugal Gourmet".

- The environments in which the plurality requirement does not apply are hardly unfamiliar. In the same environments, conversational implicatures are canceled. For example, numerals normally carry an "exactly" implicature, while *some* typically implies "not all":

(12) Most men saw three movies  $\Rightarrow$   
*Most men saw exactly 3 movies.*

(13) Most men saw some movies  $\Rightarrow$   
*Most men saw some but not all of the movies.*

- However, in the same environments as above :

- (14)
- a. Few men ate three apples.  $\neq_{conv}$   
*Few men ate exactly 3 apples.*
  - b. Israel's olympic team almost never won three medals.  $\neq_{conv}$   
*Israel's olympic team almost never won exactly 3 medals.*

- c. You must consult three relevant articles.  $\neq_{conv}$   
*You must consult exactly 3 relevant articles.)*
- d. You must consult some relevant articles.  $\neq_{conv}$   
*You must consult some (but not all) of the relevant articles.)*
- e. If my opponents crash into two trees, I will win the ski race.  
 $\neq_{conv}$   
*If my opponents crash into exactly 2 trees, I will win the ski race.*
- f. Do all your friends like two cooking shows?  
# No, some of them like more than two.  
Yes, and some of them even like more than two.
- g. Did those men share some pizzas?  
# No, they shared all of the pizzas.  
Yes, they shared all of the pizzas.

- A further similarity between conversational implicatures and the plurality requirement is that, even in upwards entailing environments, they can be canceled when the pragmatic conditions are appropriate:

(15) [FBI investigator:]All the suspects live in big cities, perhaps even the same big city.

(16) [FBI investigator:]Some suspects live in big cities, perhaps even all of them.

- Also, note that in non-monotone environments, both traditional implicatures and the plurality requirement of dependent plurals hold:

(17) Exactly three guests ate steaks.  $\Rightarrow$   
*More than 1 steak overall*

(18) Exactly three guests ate two steaks.  $\Rightarrow$   
*Exactly 3 guests ate exactly 2 steaks.*

- I propose, then, that the plurality requirement falls under the umbrella of generalized conversational implicature. Note that this is a descriptive claim, independent of the particulars of how conversational implicatures are handled.
- To reiterate, it seems that dependent plurals arise because bare plurals have a number-neutral denotation similar to that of indefinite singulars, except that they also come with a plurality implicature.

## 4.1 Similar approaches

- The picture drawn so far is similar to theories that have been proposed for the interpretation of plurals outside the context of dependent plurals.
- Krifka (2003) and Sauerland et al. (2005) show how a similar effect can be observed with only one plural in the sentence:

(19) John doesn't own small cars.

(19) is just as false if John owns a single small car as it is when he owns multiple small cars.

- Sauerland et al. (2005) propose a number-neutral interpretation of plural morphology that derives the plurality condition from lexical blocking of the singular.
- However, this makes the wrong predictions for dependent plural cases where singulars are often also appropriate. (20) can be used whenever (21) can:

(20) Most of my friends own a nice car.

(21) Most of my friends own nice cars.

- The number-neutral plural + implicature account proposed in this paper can account for the single plural data just as well as the dependent plural cases.

## 5 Formulating the plurality condition

- Even though we have shown that dependent plurality is not the same phenomenon as cumulativity, we can still make use of ideas that originated in the study of the latter phenomenon.
- Specifically, Schein (1993) accounts for (some) cumulative readings by decomposing them into structures such as the following:

(5a) Three women gave birth to five babies.

(22) Three women gave birth to babies, and five babies were born *therein*

- Of interest to us is the element *therein*. This is a definite description over events, that refers back to the events in the first conjunct<sup>1</sup>.
- We can make use of a similar element to formulate the plurality condition. Thus (note that we are assuming, following Carlson (1980), that bare plurals will not undergo QR):

(23) a. My friends have big heads

b. *assertion*:  $\exists E[\text{my friends}][\lambda x.x\exists e \in E. \text{has 1 or more big heads in } e]$

*implicature*:  $|\mathbf{\text{big heads } \textit{therein}}| > 1$

- The same condition gives the right truth conditions even if there is only one plural in the sentence:

(24) a. John owns expensive cars

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<sup>1</sup>Schein models this analysis after E-type analyses of donkey anaphora.

- b. *assertion*:  $\exists E[\text{John}][\lambda x.x\exists e \in E. \text{owns } 1 \text{ or more expensive cars in } e]$   
*implicature*: **|expensive cars *therein*| > 1**

- Similarly, it accounts for cases where a quantifying adverb is involved<sup>2</sup>:

- (25) a. John frequently reads horror novels  
 b. *assertion*:  $\exists E.\text{Frequent}(E) \ \& \ [\text{John}][\lambda x.x\exists e \in E. \text{reads } 1 \text{ or more horror novels in } e]$   
*implicature*: **|horror novels *therein*| > 1**

## 5.1 Intervention effects

- However, the story provided above isn't sufficient, for there is one additional aspect of plurality condition which has not yet been discussed - it is subject to intervention effects.
- To see this, it is necessary to look at a more complicated sentence:

(26) Most boys gave a girl flowers.

- Our discussion so far, taking the plurals to be number neutral and the plurality implicature to apply at the level of the sentential events, results in the reading (27), which is not a reading of (26):

(27) *# Most boys are such that each gave (at least) 1 girl (at least) 1 flower, and more than one flower was given overall*

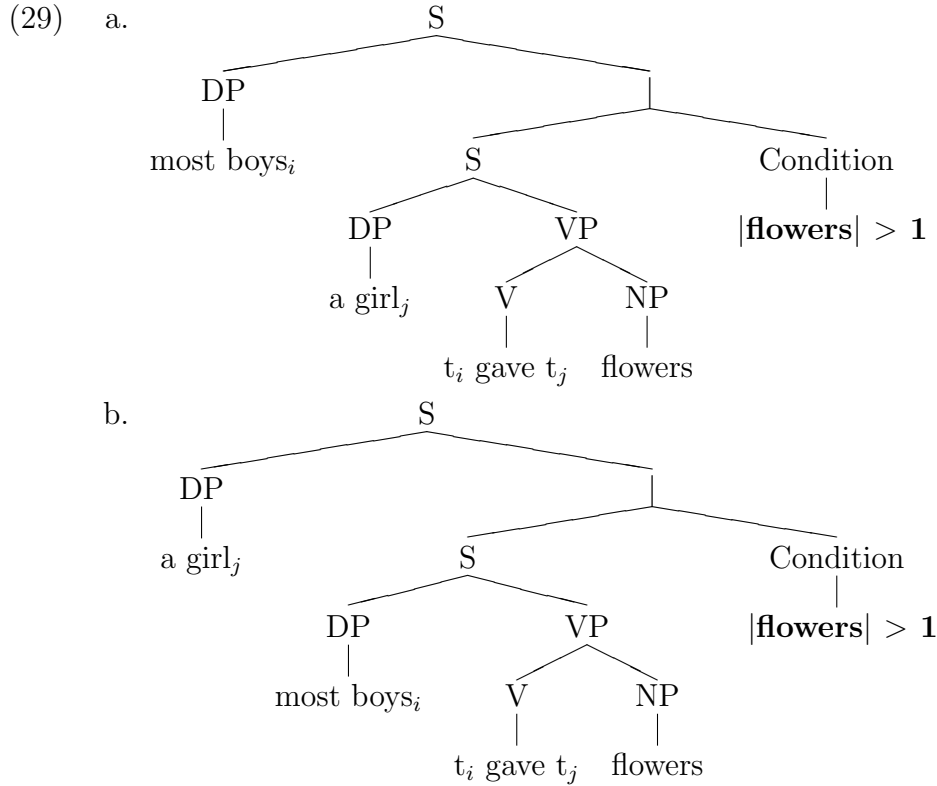
- Instead, the two readings of (26) are as follows:

- (28) a. *Most boys are such that each gave (at least) 1 girl (at least) 2 flowers*  
 b. *There is (at least) 1 girl such that most boys each gave her (at least) 1 flower*

- The plurality implicature here seems to apply at an intermediate level, schematized in the two structures below:

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<sup>2</sup>This LF should not be taken as any form of theory of adverbial quantification, but should be taken as a very rough approximation. I'm assuming that any such theory would have to provide a structure similar in the relevant ways.



- Thus, intermediate quantifiers seem to create domains for the plurality implicature.
- Schein (1993) argues on independent grounds that DPs that undergo QR are followed by quantification over events<sup>3,4</sup>.
- We get the following LFs for the sentence in its two readings (28a) and (28b) respectively:

(30) a.  $\exists E_1[\text{Most boys}] [\lambda x. \text{AG}(e)(x) \ \& \ \exists E_2 \subseteq E_1[\text{a girl}] [\lambda y [\exists e \in E_2 [\text{TO}(e)(y) \ \& \ \text{GAVE A FLOWER}(e)]]]]]$

b.  $\exists E_1[\text{a girl}] [\lambda x. \text{TO}(e)(x) \ \& \ \exists E_2 \subseteq E_1[\text{Most boys}] [\lambda y [\exists e \in E_2 [\text{AG}(e)(y) \ \& \ \text{GAVE A FLOWER}(e)]]]]]$

- **Note that in both cases, we can account for the intervention effects if we propose that there must be a plural amount of flowers in the (complex) event described by  $E_2$ .**
- We now have two second-order variables over events in each sentence,  $E_1$  and  $E_2$ . In both cases,  $E_2$  contains the relevant domain for the plurality effect - in

<sup>3</sup>The discussion that follows is a drastic oversimplification of Schein's proposals and fails to do it justice. A full implementation of Schein's system would also produce the correct results, but is beyond the scope of this talk.

<sup>4</sup>For the sake of simplicity, I am assuming that wide-scope indefinites undergo QR. This is probably incorrect. However, whatever mechanism is used to provide wide-scope readings for indefinites must be coupled with the event structure given below (see Schein (1993)), whether or not it is QR.

(30a),  $E_2$  is the events of giving a girls one or more flowers for each boy. in (30b),  $E_2$  is the events of receiving flowers from a boy, for the girl in question.

- However, note that  $E_1$  is a superset of all the  $E_2$ s. Since this is an upwards monotone relation, if  $E_2$  contains a plurality of flowers, so will  $E_1$ .
- Thus, we need just a minimal modification to our plurality condition. Instead of using a definite description *therein* which means “In the relevant 2nd-order event”, we need a variant *therein'* which means “In all of the relevant 2nd order events”.

## 6 Conclusion

We have seen that dependent plurals provide important insight to the study of the semantics of bare plurals. As other recent work (Krifka (2003), Sauerland et al. (2005)) bare plurals are number-neutral but involve a plurality condition. By exploring dependent plurals, we have shown that this condition patterns like a generalized conversational implicature, and that it involves a definite description of events. As a result, we now have a semantics that can account for bare plurals, whether dependent or not.

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