

Plurality, Implicatures and Events

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This paper presents a semantics for bare plurals in English, in their indefinite reading. It focuses 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, it shows that there is no need for a separate mechanism for dependent plurality; rather, a plurality implicature can account for the behavior of bare plurals in all environments. A formalization of this implicature will be suggested, building on work by Schein (1993).

1. Introduction

While much of the work on bare plurals in English has focused on the fact that they often denote kinds, they also have a second reading where they denote indefinites. However, ever since Chomsky (1975), it has been known that taking this reading to be simply the plural counterpart of the singular indefinite cannot be the full story. Instead, bare plural noun phrases that fall in the scope of another plural 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). The dependent plurality reading is demonstrated in the following sentence pair:

- (1) a. Male lions have a mane.
b. $\forall x[\text{LION}(x) \rightarrow \exists y[|y| \geq 1 \ \& \ \text{MANE}(y) \ \& \ \text{HAS}(x)(y)]]$
- (2) a. Male lions have manes.
b. $\# \forall x[\text{LION}(x) \rightarrow \exists y[|y| > 1 \ \& \ \text{MANES}(y) \ \& \ \text{HAS}(x)(y)]]$

Abstracting away from issues of genericity, (1a) corresponds to the logical form in (1b). By analogy, (2a) may 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, speakers of English uniformly take (2a) to be true, even though they know that no lion possesses more than one mane.

At the same time, contrary to Chomsky's original proposal, it is not the case that the dependent plural can be treated as a purely morphological plural that is semantically identical to the singular. For example:

- (3) Ten students live in New York boroughs.
- (4) Ten students live in a New York borough.

(3) is a case of dependent plurality, as it can be true if there are ten students, each of which has only a single dwelling place which is in one of the New York boroughs – for example, if five of them live in Manhattan and five in Brooklyn. Replacing the object with a singular DP (4) results in a sentence that is also true in such a scenario. However, if all the ten students in question live in the same borough (for instance, Manhattan) (3) would not be judged true, unlike (4).

Informally speaking, 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; yet at the same time, there must be more than one thing which it refers to overall.

2. *Are dependent plurals cumulative readings?*

A well-known phenomenon that seems to be closely related to dependent plurality is the existence of 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 were born.*
- (6) a. Ten judges presided over a thousand cases last year.
b. *A total of 10 judges presided over cases, and a total of 1000 cases were presided over.*

This has been the basic line of inquiry taken by de Mey (1981), Roberts (1990) and Beck (2000), among others. While these works disagree on how to implement cumulativity (in fact, Roberts (1990) seeks to assimilate the phenomenon of cumulativity itself into collective readings), they all share the insight that dependent plurality and cumulativity are very similar. This can be easily demonstrated by the following minimal pair:

- (7) Three women gave birth to babies.
- (8) Three women gave birth to more than one baby.

The most natural reading of (7) is a dependent plural reading, while (8) is most readily understood with a cumulative reading (as opposed to the reading in which each of the women had at least twins, which is also available but less salient). Both seem to mean the same thing. Taking into account the fact that (8) seems to be an explicit spellout of the 'more than 1 N' reading that the bare plural is otherwise expected to have, it is not surprising that it is tempting to take cumulative and dependent readings to be manifestations of the same phenomenon.

Indeed, there is large overlap in the environments in which both dependent plural and cumulative readings are possible. In such environments, it could well be that the cumulativity mechanism also gives rise to the dependent plural readings. However, 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 sentence lacks a cumulative reading but the second sentence allows for a dependent plural reading:

- (9) a. Most students read thirty papers. \nRightarrow
 Most students read at least 1 paper, and a total of 30 papers were read overall.
 b. Most students read papers. \Rightarrow
 Most students read at least 1 paper, and more than 1 paper was read overall.
- (10) a. All the students read thirty papers. \nRightarrow
 All the students read at least 1 paper and a total of 30 papers were read overall.
 b. All the students read papers. \Rightarrow
 All the students read at least 1 paper and more than 1 paper was read overall.

A second environment in which dependent plural readings can be found but cumulative readings do not exist is when the other plural denoting element in the sentence is not a quantified DP but rather an adverbial. (11b) (adapted from de Mey 1981) is an example of a dependent reading with an adverbial element; (11a) does not have a parallel cumulative reading. (12b) and (12a) show the same for a locative adverbial:

- (11) a. 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.
 b. 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.
- (12) a. Three king sized beds can be found in every room. \nRightarrow
 At least 1 bed in every room, and a total of 3 beds is involved overall.
 b. King sized beds can be found in every room. \Rightarrow
 At least 1 bed in every room, and more than 1 bed is involved overall.

The availability of dependent plurals in environments in which cumulative readings do not seem to be an option shows that the former cannot simply be a sub-case of the latter. Therefore, some other account must be provided for the availability of dependent plural readings.

3. The overall plurality requirement

A second approach to dependent plurality in the literature, which dates back to Chomsky (1975) and has had more recent incarnations in Kamp & Reyle (1993) and Spector (2003) accounts for dependent plurality by claiming that the bare plural in the relevant sentences is semantically identical to the singular, except in that it is obligatorily low-scope. This approach gives the right distributive behavior, but does not explain the overall plurality requirement.

To see if such a theory can serve as the basis of an explanation of dependent plurality, then, it is necessary to understand the plurality requirement.

(4) above already showed that dependent plurals may carry an overall plurality requirement. It is easy to find many more such examples:

- (13)
- a. My friends own German cars. \Rightarrow
More than 1 car is owned overall
 - b. The men saw beautiful women. \Rightarrow
More than 1 woman was seen overall
 - c. Three students were reading linguistic books. \Rightarrow
More than 1 book was read overall
 - d. The children enjoyed seeing whales. \Rightarrow
More than 1 whale was seen overall
 - e. Exactly ten rabbits hid behind bushes. \Rightarrow
More than 1 bush hid rabbits overall
 - f. John usually rides taxis to work. \Rightarrow
More than 1 taxi is involved overall
 - g. Comets grace our night sky every decade \Rightarrow
More than 1 comet shows up overall

However, there are sentences that contain bare plurals that allow singular distribution, but do not feature such a requirement:

- (14)
- a. Few men ate apples \nRightarrow
more than 1 apple was eaten overall
 - b. Israel's olympic team almost never won medals \nRightarrow
more than 1 medal was won overall
 - c. You must consult relevant articles. \nRightarrow
more than 1 article overall must be consulted
 - d. If my opponents crash into trees, I will win the ski race. \nRightarrow
more than 1 tree must be crashed into overall for me to win
 - e. Do all your friends like cooking shows?
No, they all like 'The Frugal Gourmet'.
Yes, they all like 'The Frugal Gourmet'.

These environments, in which the plurality requirement does not apply, are hardly unfamiliar. In the same environments, conversational implicatures are similarly absent. Taking two well-known examples of conversational implicatures, numerals normally carry an 'exactly' implicature, while *some* typically implies 'not all':

- (15) Most men saw three movies \Rightarrow_{impl}
Most men saw exactly 3 movies.
- (16) Most men saw some movies \Rightarrow_{impl}
Most men saw some but not all of the movies.

However, in the same environments as listed above, conventional implicatures are not available:

- (17) a. Few men ate three apples. \nRightarrow_{impl}
Few men ate exactly 3 apples.
- b. Israel's olympic team almost never won three medals. \nRightarrow_{impl}
Israel's olympic team almost never won exactly 3 medals.
- c. You must consult three relevant articles. \nRightarrow_{impl}
You must consult exactly 3 relevant articles.
- d. You must consult some relevant articles. \nRightarrow_{impl}
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. \nRightarrow_{impl}
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:

- (18) [FBI investigator:] Some suspects live in big cities, perhaps even all of them.
- (19) [FBI investigator:] All the suspects live in big cities, perhaps even the same big city.

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

- (20) Exactly three guests ate steaks. \Rightarrow_{impl}
More than 1 steak was eaten overall
- (21) Exactly three guests ate two steaks. \Rightarrow_{impl}
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 best accounted for.

In summary, it seems that dependent plurality is best accounted for as follows:

- (22) Bare plurals have a number-neutral denotation similar to that of indefinite singulars, except that they also come with a plurality implicature.

A possible question in this point is how does the 'more than 1 N' reading that plurals are intuitively taken to have fit into the picture? Given (22), it becomes apparent that it does not exist as a separate reading. If bare plurals were ambiguous between a number-neutral and a

‘more than 1 N’ reading, then, when embedded under negation they should also allow for a ‘not more than 1 N’ reading in addition to the ‘no N’ reading - but as discussed above, this reading is unavailable. The same holds for other downwards-entailing environments. On the other hand, in upwards and non-monotone environments, satisfying the truth conditions for a putative ‘more than 1 N’ reading would also automatically satisfy the truth conditions for the number neutral + plurality implicature reading. Thus, since we independently know we need the latter reading, there is no reason to posit ambiguity.

4. *Number-neutral bare plurals outside dependent plurality*

So far, I have shown that dependent plurals provide empirical support to the idea that bare plurals are in some sense number-neutral. Further support for this position can be found in recent work that makes similar proposals based on evidence outside the context of dependent plurals.

Both Krifka (2003) and Sauerland et al. (2005) discuss cases in which there is only one plural in a sentence, and show that in environments similar to the ones outlined in the previous section, bare plurals do not seem to evoke a plurality requirement:

(23) John doesn’t own small cars.

(23) clearly does not mean ‘John does not own more than one car’, and is false if John owns a single small car.

While Krifka (2003) is mainly concerned with aspects of bare plurals that go beyond the concerns of this paper (such as kind readings), the discussion in Sauerland et al. (2005), like the present work, uses an implicature to explain why plurals in sentences such as (24) cannot be used to express singular reference:

(24) John owns small cars.

The nature of the implicature proposed by Sauerland et. al, however, is different than the one argued for here. According to Sauerland and his co-authors, the plural and singular are identical in truth-conditional meaning, but the singular presupposes that it refers only to a singular atomic entity, while the plural carries no presuppositions. Furthermore, they claim that competing morphemes interact based on a pragmatic principle called *maximize presupposition*, which was first introduced in Heim (1991). This principle says that when choosing between two morphemes, the one whose stronger presuppositions can be satisfied must be chosen. Since only the singular is argued to have a presupposition, this means that if the singular can be used, it must be used. Which means that if the plural was used, a conversational implicature arises that the singular could not have been used in that context.

While this seems to work well in the sentences that involve one plural, this makes the wrong predictions for dependent plural cases where singulars are often also appropriate:

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

(26) Most of my friends own nice cars.

In a situation where most of my friends only own a single car (and the others own no cars at all), (25) is appropriate; therefore, Sauerland et. al's reasoning predicts that (26) should be unavailable. However, both are perfectly fine in this context, ruling out an explanation by lexical blocking.

On the other hand, the approach taken by the present paper, wherein the number-neutral plural is supplemented by an implicature of a total plurality, rather than of non-local singularity, can account for the single plural data as well. (24) can be paraphrased as below:

(27) John owns at least 1 small car, and more than 1 small car is owned overall.

Since there is no quantification in this sentence that can result in a plural amount of cars except the cars actually owned by John, the plurality implicature means that John owns several cars.

5. Formulating the plurality condition

We have seen that the plurality requirement of bare plurals is best thought of as a conversational implicature, and that this works both in cases where there is another plural present (i.e., dependent plurals), and in cases where the bare plural is alone. What remains is to state what the implicature actually is.

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 their meanings into a conjunction, which can be represented as below:

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

(28) 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:¹

(29) *therein* =_{def} In the relevant second-order event that contains the plural element.

We can make use of a similar element to formulate the plurality condition. Assuming, following Carlson (1980), that bare plurals will not undergo QR, we arrive at the following LF:

- (30) a. My friends have big heads.
 b. *assertion*: $\exists E \forall x [\text{MY FRIEND}(x) \rightarrow \exists e \in E [x \text{ has 1 or more big heads in } e]]$
implicature: **|big heads therein| > 1**

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

(31) a. John owns expensive cars.

¹Schein models this analysis after E-type analyses of donkey anaphora.

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

Similarly, it accounts for cases where a quantifying adverb is involved:²

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

In a downwards entailing environment, the assertion follows the similar model, but the implicature will be suppressed:

- (33) a. My friends didn't eat tacos.
 b. *assertion*: $\exists E \forall x[\text{MY FRIEND}(x) \rightarrow \neg \exists e \in E[x \text{ ate 1 or more tacos in } e]]$
implicature: *none*

5.1. Intervention effects

However, the story provided above is not sufficient, for there is one additional aspect of the plurality condition which has not yet been discussed - it is subject to intervention effects.

To see this, it is necessary to look at a sentence where more factors are in play:

- (34) All the boys gave a girl flowers.

Our discussion so far, taking the plurals to be number neutral and the plurality implicature to apply at a sentential level, results in the reading (35), which is not a reading of (34):

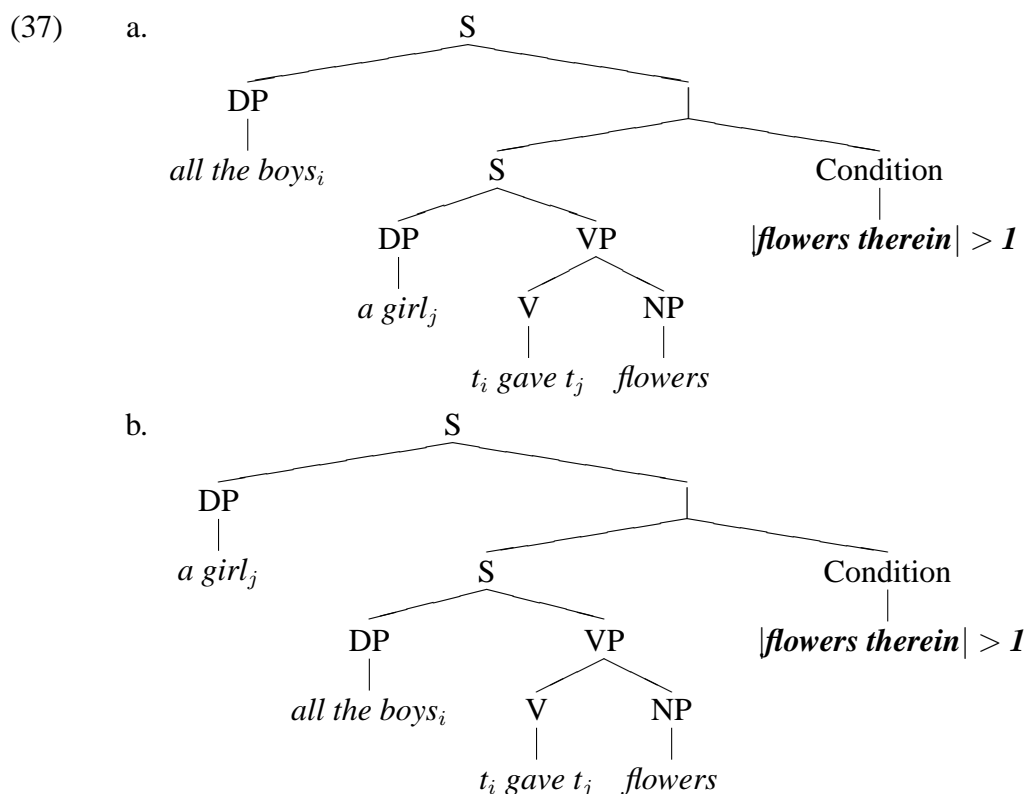
- (35) # *All the boys are such that each gave (at least) 1 girl (at least) 1 flower, and more than one flower was given overall*

Instead, the two readings of (34) are as follows:

- (36) a. *All the boys are such that each gave (at least) 1 girl (at least) 2 flowers*
 b. *There is (at least) 1 girl such that all the 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:

²This LF should not be taken as any form of theory of adverbial quantification, but should be considered 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.^{3,4}

We get the following LF's for the sentence in its two readings (36a) and (36b) respectively:

- (38) a. $\exists E_1 \forall x [\text{BOY}(x) \rightarrow \exists e_1 \in E_1 [\text{AG}(e_1)(x) \& \exists E_2 \subseteq E_1 \exists y [\text{GIRL}(y) \& \exists e_2 \in E_2 [e_2 \leq e_1 \& \text{TO}(e_2)(y) \& \text{GAVE A FLOWER}(e_2)]]]]]$
- b. $\exists E_1 \exists x [\text{GIRL}(x) \& \exists e_1 \in E_1 [\text{TO}(e_1)(x) \& \exists E_2 \subseteq E_1 \forall y [\text{BOY}(y) \rightarrow \exists e_2 \in E_2 [e_2 \leq e_1 \& \text{AG}(e_2)(y) \& \text{GAVE A FLOWER}(e_2)]]]]]$

Each sentence has two second-order variables over events within it, E_1 and E_2 . This is important to solving the problem of providing the correct readings to this sentence. To see this, note that in both cases, it is possible to account for the intervention effects if the plural amount of flowers is required to be present in the (complex) event described by E_2 . In other words, E_2 contains the relevant domain for the plurality effect - in (38a), E_2 is the events of giving a girl one or more flowers for each boy. in (38b), E_2 stands for the total event of receiving flowers from a boy, for the girl in question.

³The 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 paper.

⁴For 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.

This creates a potential problem, as now the definition of the implicature must change to refer to E_2 . And if there were extra levels of embedding, it would need to refer to the lowermost event variable containing the bare plural. This is an unwelcome result, as it seems to indicate that which implicatures arise follows from how deeply embedded the bare plural is, which is not how implicatures are taken to operate.

There is a way out of this dilemma. By definition, E_1 is a superset of all the E_2 s. Since a superset cannot contain less than its subset, if E_2 contains a plurality of flowers, so will E_1 . Note that this inference only holds if E_2 is not in a downwards entailing environment, since then E_2 could be a statement about what events are *not* part of E_1 rather than those that are. However, if E_2 is in a downwards entailing environment, the plurality implicature will not arise, and thus the failure of the inference is of no importance. In other words, in all environments in which the plurality implicature will arise, if there is more than one member of a nominal element α involved in the most deeply embedded event, then there will be more than one involved in all events it is a part of.

Thus, all that is necessary is 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'*, as follows:

(39) *therein'* =_{def} In all the relevant second-order events that contain the plural element.

Using *therein'* in the implicature will make no difference for sentences (30)-(32), since they only contain one relevant second-order event each. For the two readings of (34), it will ensure that a plurality is present in the embedded events, as well as the matrix event, resulting in the correct readings.

Note that this entire problem may be potentially avoided if plurality implicatures are calculate locally, as was suggested for scalar implicatures in Chierchia (2002). I will not explore this possibility in this paper.

6. Dependent plural readings and *de re*

A challenge to the view presented in this paper comes from Partee (1985). Partee’s paper discusses dependent plurals, but is not actually about plurality. As such, she does not directly address the issues mentioned above. What she is concerned with is a counter-example to the well-known observation in Carlson (1980) that bare plurals obligatorily have *de dicto* readings when embedded under an attitude verb. She shows that in dependent plural contexts, bare plurals can receive *de re* readings. In doing so, she presents a potential problem to the claim that dependent and non-dependent bare plurals are in fact the same.

For example, she presents the following three-way contrast:

- (40) a. Miles wants to meet a policeman. (✓ *de dicto*/✓ *de re*)
 b. Miles wants to meet policemen. (✓ *de dicto*/**de re*)
 c. All the boys want to meet policemen. (✓ *de dicto*/✓ *de re*)

The first two sentences above are from Carlson (1980). While the singular (40a) has both *de dicto* and *de re* readings, the bare plural in (40b) does not. Partee adds the third sentence. It has

a dependent reading, under which each boy wants to meet a specific policeman; this is a *de re* reading.

This data poses two potential problems to this paper. As mentioned above, the first problem is that my analysis denies special status to dependent plural readings as opposed to bare plurals in other contexts. But Partee's observation seems to make a distinction between the two. It seems to me, however, that Carlson's claim is in itself incorrect. While it is true that in many bare plural cases in non-dependent contexts *de re* readings are difficult to find, it is nonetheless possible to do so, as in the following discussion:

- (41) *In a video rental store*
 Little boy: So, what movies do you want to get?
 Little girl: How about *Alien*? Or *Silence of the Lambs*? Or *American Pie*?
 Little boy: Mom! Mary wants to see R-rated movies!

In (41), *R-rated movies* is a bare plural in a non-dependent context, yet the little boy's claim could clearly be taken to be about his sister's desire to see the actual movies on the list she just provided, as opposed to a general desire to see movies in a certain category. Thus, it seems that the problem Partee identified for Carlson does not hinge on the presence of a dependent plural reading.

However, Partee's observation is still potentially problematic to the analysis given above since I have been assuming, following Carlson, that bare plurals can only take narrow scope. Fully addressing this issue is beyond the scope of the present discussion; however, it is worth noting that there does not seem to be any evidence that bare plurals can scope over other quantificational elements. This suggests that the scope with regard to intensional operators and with regard to quantification/negation are not obtained by the same scoping mechanism (see Farkas (1997) for a proposal on how this might work).

7. Conclusion

This paper has shown that dependent plurals provide valuable empirical insight to the study of the semantics of bare plurals. To fully account for the behavior of these readings, including the disappearance of the plurality condition in certain environments and the intervention effects, it is necessary to split the semantic contribution of bare plurals into two: a number neutral existential statement, and a plurality implicature. The explication of this implicature was given in terms of definite description of events. While this exploration of dependent plurality and its consequences is only a preliminary step in establishing a compositional semantics of plurality, it is an important step as it unifies the semantics for bare plurals that accounts both for the dependent readings, and for the readings that the plurals get when there are no other plurals in the sentence. Thus, it gets us one step closer to a fully general account of the contribution of the plural morpheme.

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