A Scope Freezing Effect with Negated Quantifiers

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Abstract: I document a scope freezing effect found with negated quantifiers (distinct from the scope freezing effect discussed in Collins 2016). I will show how this scope freezing effect can be explained in terms of the analysis of negated quantifiers given in Collins and Postal (2014) and Collins (2016).

Keywords: scope freezing, negation, *many*

1. Introduction

Collins (2016) discussed sentences of the following form:

(1) Not many people are there.

He showed that this sentence can only have interpretation (2a) and not (2b) (see also Lasnik 1972/1976: 24). In other words, in (1), *many people* cannot take scope outside of negation.

(2) a. Few people are there.
    b. Many people are not there.

Collins (2016) labelled this fact *scope freezing*. The metaphor signals that in certain cases the scope relation between two elements Q_1 (e.g., *not*) and Q_2 (e.g., *many*) is fixed by principles of grammar. Collins (2016) showed how this scope fact followed from assuming that [not many people] in (1) forms a constituent, and the semantics of negation in Collins and Postal 2014 (henceforth, CP2014).

In this paper, I discuss a distinct scope freezing effect. Consider (3):

(3) Not many people like every one of the movies.

This sentence lacks the most natural reading of the following sentence:

(4) It is not true that every one of the movies was liked by many people.

I will show how this fact follows from the assumption that [not many people] is a constituent in (3), and the semantics of negation in CP2014.

In section 2, I lay out the problem of the missing interpretation of (3). In section 3, I discuss the missing interpretation of (3) in relation to the theory of negation developed in Lasnik 1972/1976. In sections 4 and 5, I discuss the semantics of *not many*. In section 6, I explain the missing interpretation of (3). Section 7 is the conclusion.

2. Scope Freezing

Consider the following sentence with two quantificational DPs.

(5) Many people like every one of the movies.

This sentence has two different interpretations, corresponding to the following two LF representations:

(6) a. [many people]$_1$ [every one of the movies]$_2$ [DP$_1$ like DP$_2$]
b. [every one of the movies]$_2$ [many people]$_1$ [DP$_1$ like DP$_2$]

Consider the following concrete situations. In situation 1, there are three movies and a total of twenty people. Each of the movies is liked by sixteen of the twenty people. I assume that in this context sixteen people counts as many. Furthermore, I assume that each of the movies is disliked by four different people. For example, John, Bill, Mary and Sally do not like movie 1, but they do like the others. This assumption implies that there is a common set of only eight people (20 – 3x4) that like all the movies. I assume that eight people does not count as many. Situation 1 can be schematized as follows:

(7) Situation 1:
M1 -- 16 people
M2 -- 16 people
M3 -- 16 people

In situation 2, there are once again three movies and a total of twenty people. But this time there is a single set of 19 people that likes all three movies. The remaining person doesn't like any of them. Situation 2 can be schematized as follows:

(8) Situation 2:
19 people -- M1, M2, M3

Now, given these situations, it follows that (6a) is false in situation 1, since in that situation only eight people like all three movies. (6a) is true in situation 2. (6b) is true in both situation 1 and situation 2. It is easy to see that (6a) entails (6b), but not vice versa:

(9) (a) $\vDash$ (b) ((a) entails (b), whenever (a) is true, so is (b))
(b) $\nvDash$ (a) ((b) does not entail (a))

Now, consider the negation of (5):

(10) It is not true that many people like every one of the movies.

Once again, this sentence corresponds to two different LF structures:

(11) a. It is not true that [[many people]$_1$ [every one of the movies]$_2$ [DP$_1$ like DP$_2$]]
b. It is not true that [[every one of the movies]$_2$ [many people]$_1$ [DP$_1$ like DP$_2$]]

It is easy to see that (11a) is true in situation 1 and false in situation 2. Furthermore, (11b) is false in both situation 1 and situation 2.

Now lastly consider the following sentence:

(12) Not many people like every one of the movies.

First, unlike the sentences in (5) and (10), this sentence is not ambiguous, Second, (12) seems to correspond to (11a) in that it is true in situation 1 and false in situation 2.

Why is (12) missing the interpretation (not > every > many), which would make it false in both situations 1 and 2? I will return to this issue in section 6 after presenting some background material.

3. Lasnik 1972/1976

Lasnik (1972/1976) compares two different theories of negation in sentences like (1), which he calls the Determiner Theory (DT) and the Pre-S Theory (Pre-ST). The two theories are presented as follows:

(13) **a.** **Determiner Theory**: "…*not* is potentially generated in the auxiliary and in the specifier of noun phrases and adverbials." (pg. 1)
b. **Pre-S Theory**: "…*not* is again generated in the Aux, but its second position is pre-sentential." (pg. 1)

Lasnik elaborates that in the Pre-S theory "…Pre-S is not an independent node, but rather part of the complementizer node." (pg. 22) In other words, the pre-sentential NEG in the Pre-S theory is in the same position as complementizers such as *that, for, if*, etc.

On the Pre-S theory, the structure of (1) is:

(14) [not [many people are there]]

From the perspective of the data discussed in section 2, it is unclear why (15a) and (15b) would have a different range of interpretations:

(15) a. [not [many people like every one of the movies]]
b. It is not true that [many people like every one of the movies]

Another component of Lasnik's theory is what he calls Not Adjustment (NA): "…I propose that there is a late rule, perhaps more an 'adjustment rule' than a transformation, that re-brackets sentences with initial *not*. By the operation of this rule, which I will call Not Adjustment (NA), *not* is incorporated into the first constituent on its right." (pg. 13)

Lasnik proposes NA to account for the difference in (16a,b) below.

(16) a. *Not John left.
b. Bill left, not John

Briefly, in (16a) *not* is incorporated into the constituent [not John], which then has the semantic consequence that *John* is negated. According to Lasnik, negated constituents must be [-referential] which contradicts the fact that a proper name is inherently referential (see pg. 42). In

(16b), the structural description for NA rule is not met, so *not* is not incorporated into a [not John] constituent, and there are no semantic problems.

If one adopted the rule of NA, perhaps it would be possible to account for the differences in interpretation of (15a,b). After all, only (15a) would involve NA, and this might block one of the a priori possible interpretations.

However, in PP/Minimalist syntax, the NA rule is not possible. If NA is a movement rule, it is downward movement, which is not admitted in PP/Minimalist syntax. But even if NA is not considered a movement rule, it still violates the Extension Condition (see Collins and Stabler 2016 for a formalization), since NA would change an embedded constituent (the subject *John* would be changed to [not John]).

4. *many* as a Cardinality Predicate

In order to analyze (1), we need a theory of the semantics of *many*. The following sentence is suggestive:

(17) The men are many (in number)

(17) suggests that *many* is a cardinality predicate with the following semantic value:

(18) $[\![\text{many}]\!] \quad = \quad \lambda y[|y| \geq n]$

(18) says that *many* is a predicate, and it is true of those sums (or sets or pluralities) whose cardinality is greater than n, which is a contextually specified number.

Partee (2004: chapter 12) argues that *many* is ambiguous between a cardinal and a proportional reading. The interpretation in (18) is equivalent to the cardinal reading given by Partee (2004: (1a)). Whether or not cardinality/proportional distinction interacts with negation of quantificational expressions is a topic that I leave for future research. Adopting (18) does not obviously lead to problematic truth conditions for any of the sentences I discuss in this paper.

Given (18), the interpretation of (17) is:

(19) $|\iota y.\text{MAX}(\text{men})(y)| \geq n$

In this formula, MAX is an operator that takes a predicate and returns a predicate of maximal sums (see Heim 2011: 998). In English, (19) says that the sum total of men is greater than or equal to n.

If (18) is the right semantic value of *many*, it raises the question of the analysis of (20):

(20) many people are here.

Here *many* is serving as a quantifier, not a cardinality predicate. Since *many* is a quantifier, a natural way to analyze its semantic value is as follows:

(21) $[\![\text{many}]\!] \quad = \quad \lambda P\lambda Q\ [\exists x\ (P(x) \wedge Q(x) \wedge |x| \geq n)]$

This formula says that there is an x that is both P and Q and whose cardinality is greater than n. So for example, (4) would have the following interpretation (* turns a predicate true of indivduals into a predicate true of sums):

(22) $\exists x\ (\text{people}^*(x) \wedge |x| \geq n \wedge \text{here}(x))$

However, even though (22) yields the correct truth conditions for (20), it fails to capture the commonality between the use of *many* in (20) (a generalized quantifier) and the use of *many* in (17) (a cardinality predicate). I suggest that the semantic value in (17) is general, and that *many* never has the semantic value in (21).

Under the assumption that *many* is always a cardinality predicate, and never a generalized quantifier, it must be the case that (20) contains a covert existential quantifier (see Champollion 2015: 14 for another use of a null existential quantifier, and a survey of silent existential quantifiers in the semantics literature).

(23) [SOME [many people]] are here.

Paraphrased, this means: There is a group of individuals y, where y is many and y is a set of people such that y is here. The interpretation can be derived compositionally as follows:

(24) $[\![\text{many people}]\!] = \lambda y[|y| \geq n \wedge \text{people}^*(y)]$ (by predicate modification)

(25) $[\![\text{SOME [many people]}]\!] = \lambda P \lambda Q\ [\exists x\ (P(x) \wedge Q(x))]\ (\lambda y[|y| \geq n \wedge \text{people}^*(y)])$

$= \lambda Q\ [\exists x\ [(\lambda y[|y| \geq n \wedge \text{people}^*(y)])\ (x) \wedge Q(x))]]$
$= \lambda Q\ [\exists x\ [|x| \geq n \wedge \text{people}^*(x) \wedge Q(x))]]$

A piece of evidence for the cardinality predicate analysis of *many* are examples like the following where *many* appears with a definite article:

(26) the many people (here, at NYU, that I know)

Given the analysis of *many* as a cardinality predicate, the semantics of (26) are calculated in a way exactly parallel to (23), replacing SOME by *the* (see Heim 2011: 998 for semantics of *the*):

(27) $[\![\text{the}]\!] = \lambda P\text{: } \exists x \forall y\ [\text{Max}(P)(y) \leftrightarrow x = y].\ \iota x.\text{MAX}(P)(x)$

In English, *the men* is defined if there is a unique maximal set of men, and if it is defined, then *the men* denotes that set.

As before (in the existential case), the semantic value of *many people* is given as follows:

(28) $[\![\text{many people}]\!] = \lambda y[|y| \geq n \wedge \text{people}^*(y)]$ (by predicate modification)

Putting (27) and (28) together, we have:

(29) $[\![\text{the many people}]\!]$ =

$$\lambda P{:}\ \exists x \forall y\,[\text{Max}(P)(y) \leftrightarrow x = y].\ \iota x.\text{MAX}(P)(x)\ (\lambda y[|y| \geq n \wedge \text{people*}(y)])$$
$$= \iota x.\text{MAX}(\lambda y[|y| \geq n \wedge \text{people*}(y)])(x)$$
$$= \iota x.[\ |x| \geq n \wedge \text{people*}(x) \wedge \neg\exists y.[\ |y| \geq n \wedge \text{people*}(y) \wedge x < y]]$$

This can be paraphrased as the sum which consists of a sufficiently large number of people and for which there is no larger such sum.

Although I do not have space to discuss other cardinality predicates here, I will point out that a similar analysis can apply to [the five people], the only difference is that in that case there is no need to use Max(five people), since the cardinality predicate *five* itself guarantees uniqueness of sums.

I predict that if X is a cardinality predicate then it should be able to appear as a predicate following a copula, and should be able to appear as a NP modifier following the definite article.

(30) a. The men are many (in number)
b. The many men

(31) a. The men are three (in number)
b. The three men

(32) a. The men are few (in number)
b. The few men (here/at NYU/that I know)

There are quantifiers that cannot be analyzed as cardinality predicates:

(33) a. *The men are every.
b. *The every man (here/at NYU/that I know)

(34) a. *The men are some.
b. *The some men (here/at NYU/that I know)

(35) a. *The men are most.
b. *The most men

(36) a. *The men are both
b. *the both men

5. *not many*

Putting the results of the previous two sections together, we will now calculate the interpretation of (37):

(37) Not many people are here.

Before doing this, we need to make a syntactic decision about what *not* combines with. There are three possibilities:

(38) a. [[not SOME] [many people]] are here.
b. [SOME [[not many] people]] are here.
c. [not [SOME [many people]]] are here.

The question is whether *not* combines with SOME, or *not* combines with *many*, or *not* combines with the whole DP.

The syntactic structure in (38b) yields the wrong truth conditions. If (38b) was the correct structure, then (37) should mean: There is a group which is constituted of people and whose number is not many and that group is here. But this is the wrong interpretation, since such an interpretation does not preclude large groups of people being here.

A more difficult question, which I will not be able to answer, is what syntactic principle blocks (38b). To make matters more difficult, it appears that in an expression like [the not many people (in the class)], one does have the constituent structure: [the [[not many] people]].

The syntactic structure in (38c) yields the right interpretation, but it makes the wrong prediction about the licensing of NPIs with *not many*. Note that *not many* licenses NPIs in its first argument:

(39) a. Not many people who know any physics are here.
b. Not many people who have ever been to France like it.
c. Not many people who steal anything get caught.

Such data suggests that (38c) is not the right structure (or at least, not the only structure). If (38c) were the right structure, then in (39a) we would have the structure [not [SOME [many people who know any physics]]], and SOME would intervene between the trigger and the NPI, violating Linebarger's (1987: 338) Immediate Scope Constraint.

Given these considerations, we will calculate the semantic value of *not many people* given the structure in (38a). First we following Collins and Postal 2014 in assuming the following about negation:

(40) NEG takes X with semantic value: $\lambda P_1 \ldots . \lambda P_n$ […]
And returns Y with semantic value: $\lambda P_1 \ldots \lambda P_n \neg$[…]

This rule is actually a schema for an infinite number of semantically different NEGs. There will be a distinct semantic value for NEG for each different semantic type: $\lambda P_1 \ldots . \lambda P_n$ […].

Therefore, in the case at issue, we have:

(41) ⟦SOME⟧ = $\lambda P \lambda Q\, [\exists x\, (P(x)\ \&\ Q(x))]$

(42) ⟦NEG⟧ = $\lambda X \lambda P \lambda Q\, \neg[X(P)(Q)]$

(43) ⟦NEG SOME⟧ = ⟦NEG⟧(⟦SOME⟧)
= $(\lambda X \lambda P \lambda Q\, \neg[X(P)(Q)])\ (\lambda P \lambda Q\, [\exists x\, (P(x)\ \&\ Q(x)])$
= $\lambda P \lambda Q\, \neg[\exists x\, (P(x)\ \&\ Q(x)]$

Putting this together with the semantic value of *many people*, we get:

(44) ⟦[not SOME] [many people]⟧

$$= \lambda P \lambda Q\ \neg[\exists x\ (P(x)\ \&\ Q(x)]\ (\lambda y[|y| \geq n \wedge people^*(y)])$$
$$= \lambda Q\ \neg[\exists x\ ([|x| \geq n \wedge people^*(x) \wedge Q(x)]$$

Then finally the semantic value of (37) is given below:

(45) ⟦Not many people are here⟧

$$\neg\exists x\ [|x| \geq n \wedge people^*(x) \wedge here(x)]$$

My analysis fails to account for one aspect of (45). Normally in uttering (45), we are conveying that few people are here, which is stronger than saying that it is not true that many people are here. For example, suppose that twelve or more counts as many (in a set of twenty), and eight or less counts as few (in the same set of twenty). Then if I say that not many people are here, normally I am taken as conveying that there are eight or fewer people. I do not have any account for this strengthening here.

6. Explaining Scope Freezing

Given the background sections on the semantics of *not many*, let us now return to the problem of explaining the differences between (10) and (12) above. To start, we assume that (46a) has the structure in (46b), putting aside for the moment scope positions.

(46) a. Not many people like every one of the movies.
b. [[Not SOME] [many people]] like [every one of the movies].

Now, consider various possible ways of putting the DPs in scope positions. First, the object could take scope below the subject:

(47) [[Not SOME] [many people]]$_1$ [every one of the movies]$_2$ [DP$_1$ like DP$_2$]

Applying the semantics of sections 4 and 5, this is equivalent to (11a) above, repeated below:

(48) It is not true that [[many people]$_1$ [every one of the movies]$_2$ [DP$_1$ like DP$_2$]]

Another possibility is that the object could take scope over the subject:

(49) [every one of the movies]$_2$ [[Not SOME] [many people]]$_1$ [DP$_1$ like DP$_2$]

The interpretation associated with this structure is not available for the sentence in (46a), so I assume that structure (49) is not available. The fact that structure (49) is not available for (46a) seems to be part of a large generalization governing the scope of decreasing expressions and universal quantifiers (see Beghelli and Stowell 1997: section 5.3 for a related observation).

(50) If the subject DP denotes a downward entailing generalized quantifier, and the object is a universal quantifier DP, then inverse scope is not allowed.

All of the following resist inverse scope:

(51) a. Nobody saw every one of the movies.
b. Few of the boys liked every one of the movies.
c. At most three boys liked every one of the movies.

Now, let's consider the following (Q_3 is a second occurrence of [not SOME]$_3$):

(52) [not SOME]$_3$ [every one of the movies]$_2$ [Q_3 [many people]]$_1$ [DP_1 like DP_2]

This structure seems to give the right configuration: NEG > every > many. However, Q is not of type <e>, it is of type <<e,t>, <<e,t>, t>>>. But then, the only interpretation of (51) will be one where the semantic value of Q_1 (after assignment of values to variables) is ⟦not SOME⟧, and the interpretation is identical to the interpretation of the structure in (49).

In short, if we assume that in (46a), [not many people] is a constituent, and we assume the semantics of negation presented in CP2014, it follows that (12) will not have all the interpretations in (10). In particular, the interpretation where the universal DP [every one of the movies] intervenes between negation and [many people] will be missing.

7. Conclusion

Negated quantificational expressions (e.g., *not many people*) show a scope freezing effect. It is impossible for another quantificational expression to take scope between negation and modified quantificational expression (e.g., between *not* and *many people*). I have shown how this fact follows from the assumption that [not many people] is a constituent, and from the semantics for negation given in Collins and Postal 2014.

Combined with the data presented in Collins 2016 (concerning a separate scope freezing effect), the data argues for a modern version of Lasnik's Determiner Theory of negation, against his Pre-S theory of negation.

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