

A Scope Freezing Effect with Negated Quantifier Phrases
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Abstract: I document a scope freezing effect found with negated quantifier phrases (distinct from the scope freezing effect discussed in Collins 2016a). In a sentence with a negated quantifier phrase of the form [NEG DP₁], no quantifier phrase DP₂ can take scope between NEG and DP₁. I show how this scope freezing effect can be explained in terms of the analysis of negated quantifier phrases given in Collins and Postal (2014) and Collins (2016a).

Keywords: scope freezing, negation, *many*, split scope

1. Introduction

Collins (2016a) 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 (2016a) labelled this fact *scope freezing*. The metaphor signals that in certain cases the scope relation between two elements Q₁ (e.g., *not*) and Q₂ (e.g., *many*) is fixed by principles of grammar. Collins (2016a) 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.

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

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

Sentence (3) lacks the most natural reading of (4):

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

I will show how the possible interpretations follow from the assumption that [not many people] is a constituent in (3), and the semantics of negation in Collins and Postal 2014.

In section 2, I lay out the problem of the missing interpretation of (3), and give several additional examples illustrating scope freezing. In section 3, I discuss the missing interpretation of (3) in relation to the theory of negation developed in Lasnik 1972/1976. In section 4, I discuss my semantic assumptions. In section 5, I explain the missing interpretation of (3). In section 6, I discuss split-scope readings that are available with modals. 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 (see May 1977 on Quantifier Raising). In these representations the higher occurrence of a DP is not pronounced, and the lower occurrence is a copy.

- (6) a. [many people]₁ [every one of the movies]₂ [DP₁ like DP₂]
b. [every one of the movies]₂ [many people]₁ [DP₁ like DP₂]

Consider the following 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:
M1, M2, M3 -- 19 people

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) = (b) ((a) entails (b), whenever (a) is true, so is (b))
(b) ≠ (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 [DP₁ like DP₂]]
b. It is not true that [[every one of the movies]₂ [many people]₁ [DP₁ like DP₂]]

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 one of the movies > many people), which would make it false in both situations 1 and 2? I will return to this issue in section 5.

The effect described above is completely general. For a variety of different quantifier types in subject and object position, if the subject quantifier phrase is negated, there is a scope freezing effect. Consider the following example involving a universal quantifier in subject position:

- (13) a. Every student saw exactly three movies.
b. Not every student saw exactly three movies.

Once again (13a) has two different interpretations, corresponding to the following two LF representations:

- (14) a. [every student]₁ [exactly three movies]₂ [DP₁ like DP₂]
b. [exactly three movies]₂ [every student]₁ [DP₁ like DP₂]

Consider the following situations. In situation 1, there are five movies and five students. Every student saw three of the movies, but not the others. The students differed in the movies they saw. In fact, there is no single movie that all five students saw. Situation 1 can be schematized as follows:

- (15) Situation 1:
S1 -- M1, M2, M3
S2 -- M1, M2, M4
S3 -- M1, M2, M5
S4 -- M2, M4, M5
S5 -- M3, M4, M5

In situation 2, there are once again five movies and five students. But in this situation, there are three and only three popular movies that have been seen by all the students. Some students have seen more than three movies, but even for students who have seen four or five movies, they have also seen the same three popular movies M1, M2, M3.

- (16) Situation 2:
S1 -- M1, M2, M3, M4
S2 -- M1, M2, M3
S3 -- M1, M2, M3, M4

- S4 -- M1, M2, M3
 S5 -- M1, M2, M3, M4, M5

Now, given these situations, it follows that (14a) is true in situation 1, and false in situation 2. Furthermore, (14b) is true in situation 2, but false in situation 1. So neither (14a) nor (14b) entails the other.

Now consider the interpretation of (13b). Intuitively, it is true in situation 2, but false in situation 1. If negation could take scope over (14b), then (13b) should also have an interpretation where it is true in situation 1, but it does not. In other words, (13b) lacks the most natural interpretation of the following sentence:

- (17) There are not exactly three movies that were seen by every student.

Another example with a universal quantifier in subject position is given below:

- (18) a. Every student saw more than half of the movies.
 b. Not every student saw more than half of the movies.

Intuitively, (18b) can not be equivalent to the following sentence, involving inverse scope:

- (19) There isn't a set consisting of more than half of the movies that were seen by every student.

This would be true if every student saw more than half of the movies, but the set of movies that every student had in common did not consist of more than half of the movies. But (18b) is intuitively false in this situation.

Another example involving an NPI is given below:

- (20) Not many tourists have seen any famous actors.

This sentence intuitively lacks an interpretation equivalent to the most natural interpretation of the following sentence:

- (21) There are no famous actors that have been seen by many tourists.

For example, (21) is true if there is no particular famous actor that lots of tourists have seen, even though lots of tourists have seen some famous actor or another. But (20) is false in this situation.

The above examples have illustrated scope freezing effects with negated quantifier phrases. There is no such scope freezing effect for two quantifier phrases in the scope of a clausemate negation. Consider the following:

- (22) a. I didn't show many books to every student.
 b. I didn't show every book to exactly three students.
 c. I didn't show every student more than half of the books.

- d. I didn't show many students any books.

The most natural reading of each of these sentences reflects surface scope. However, I do not think scope is frozen, especially if the indirect object is stressed.

Consider (22a). In situation 1, there are 20 books and 3 students. I show sixteen books to student S1, sixteen books to student S2 and sixteen books to student S3. But only eight books are seen by all three students. In situation 2, once again there are 20 books and three students. I show 19 books to all three students, but one book I do not show to anybody. (22a) has an interpretation where it is false in both situation 1 and situation 2. This is what one would expect with the inverse scope order: NEG > every student > many books.

The evidence given in this section is based on my judgments of the truth or falsity of sentences in various contexts. Some possible sources of additional evidence for my claims would be: a Mechanical Turk study or laboratory study of quantifier scope administered on a group of people (carefully presenting the relevant contexts), corpus studies of negated quantifier phrases focusing examples whose context reveals scope, or a cross-linguistic study investigating scope in other languages that permit negated quantifier phrases.

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:

- (23) 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:

- (24) [not [many people are there]]

From the perspective of the data discussed in section 2, it is unclear why (25a) and (25b) would have a different range of interpretations:

- (25) 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 (26a,b) below.

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

Briefly, in (26a) *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 (26b), 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 (25a,b). After all, only (25a) 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]).

In this paper, I assume that there is no Pre-S position for NEG. In other words, there is no projection of NEG in the left periphery of the clause. Rather, I assume that when NEG precedes the subject, it either combines with the DP to yield outer negation [NEG DP] or with the D to yield inner negation [[NEG D] NP] (inner negation is similar to Lasnik's Determiner Theory).

4. Semantic Assumptions

I follow Collins and Postal 2014 in assuming the following about the semantic value of negation:

- (27) If X has a semantic type ending in $\langle t \rangle$, then
 NEG takes X with semantic value: $\lambda P_1 \dots \lambda P_n [\dots]$
 And returns Y with semantic value: $\lambda P_1 \dots \lambda P_n \neg[\dots]$

For propositional variables p (no predicate abstraction), the negation is simply $\neg p$. On this view, negation can combine with constituents of various different types, parallel to the analysis of conjunction given in Partee and Rooth (1983). One way to think of it is that the function negation denotes depends on the type of its argument (where the different types partition the domain of the negation function).

Negation modifies constituents whose semantic type ends in $\langle t \rangle$ (the semantic type of truth values). For example, negation may modify constituents of type $\langle e, t \rangle$, $\langle \langle e, t \rangle, t \rangle$ and $\langle \langle e, t \rangle, \langle \langle e, t \rangle, t \rangle \rangle$. Negation may not modify proper names, definite descriptions or pronouns which are of type $\langle e \rangle$, as shown by the following data:

- (28) a. *Not he left.
 b. *Not John left.
 c. *Not the student left.

Although successful over a wide range of data, the theory of negation in (27) does not explain several cases where a quantifier cannot be modified by negation:

- (29) a. *Not each person was there.
 b. *Not no person was there.
 c. *Not most people were there.

Case (29b) is addressed in Collins (2016b), where it is argued that (29b) is blocked by a general constraint prohibiting multiple negation (not just with negated quantifier phrases). I have nothing further to add about these cases here.

The theory of negation in (27) allows both inner and outer negation of DPs:

- (30) a. [[NEG D] NP] (inner negation)
 b. [NEG DP] (outer negation)

I do not discuss in this paper what determines the choice between inner negation and outer negation. I will simply assume without question that all the negated quantifier phrases in this paper are of the form (30b). Adding (30a) as a possibility would not change the results.

If negation can combine with a DP to form [NEG DP], then why is there a subject/object asymmetry in the distribution of negated quantifier phrases (see Collins 2017 for a much more detailed characterization of the syntactic distribution of negated quantifier phrases):

- (31) Not every student attended the class.

- (32) a. I didn't see every student in class.
 b. *I saw not every student in class.

Collins (2017) suggests that there is an independent syntactic condition on negated quantifier phrases that rules out (32b) and allows (32a). Since the issue is tangential to the topic of this paper, I do not pursue it here.

I assume that *many* when used as a quantifier has the following semantic value (where n is a threshold set by context):

$$(33) \quad \llbracket \text{many} \rrbracket = \lambda P \lambda Q. \exists x (P(x) \wedge Q(x) \wedge |x| \geq n)$$

By assuming this semantic value, I am sidestepping many issues. First, Hackl (2000) shows that *many* when used as a quantifier takes a degree argument (to account for comparatives), which is not represented in (33).

Second, the analysis in (33) fails to account for the fact that *many* can also be used as a predicate adjective:

- (34) They are many in number.

Third, Partee (2004: chapter 12) argues that *many* is ambiguous between a cardinal and a proportional reading. The interpretation in (33) is equivalent to the cardinal reading given by Partee (2004: (1a)). Whether or not the cardinal/proportional distinction interacts with negation of quantificational expressions is a topic that I leave for future research. Adopting (33) does not obviously lead to problematic truth conditions for any of the sentences I discuss in this paper.

Putting the assumptions of this section together, consider the following example of a negated quantifier phrase:

(35) Not many people are here.

The semantic value of [not [many people]] is calculated as follows:

(36) \llbracket [many people] \rrbracket = $\lambda Q. \exists x (\text{people}(x) \wedge Q(x) \wedge |x| \geq n)$

(37) \llbracket [not] \rrbracket = $\lambda X. \lambda Q. \neg X(Q)$

(38) \llbracket [not [many people]] \rrbracket = $\lambda Q. \neg \exists x (\text{people}(x) \wedge Q(x) \wedge |x| \geq n)$

My analysis fails to account for one aspect of (35). Normally in uttering (35), 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.

Curiously, this distinction in strength parallels other distinctions:

(39) a. It is not the case that many people are here.
b. Not many people are here.

(40) a. It is not the case that even John is here.
b. Not even John is here.

(41) a. It is not the case that three people are here.
b. Not three people are here.

(39b) has a strengthened reading equivalent to *few*, which is absent from (39a). In (40b) John is the most likely person to be here, whereas such an implication is not obligatory in (40a) (see Collins 2016a). To the extent that (41b) is acceptable, it must mean that two or fewer people are here. (41a) can be true if four people are here. I believe that all these contrasts ultimately support the position that the pre-subject NEG in (39b-41b) modifies the subject. If the pre-subject NEG were in Lasnik's Pre-S position, there would be no way to account for the differences in interpretation between the (a) and (b) examples above. I do not pursue the issue further here.

5. Explaining Scope Freezing

Given section 4 on the semantics of *not many*, let us now return to the problem of explaining the differences between (10) and (12) above. To start, I assume that (42a) has the structure in (42b), putting aside for the moment scope positions.

(42) a. Not many people like every one of the movies.
b. [not [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:

- (43) [not [many people]]₁ [every one of the movies]₂ [DP₁ like DP₂]

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

- (44) It is not true that [[many people]₁ [every one of the movies]₂ [DP₁ like DP₂]]

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

- (45) [every one of the movies]₂ [not [many people]]₁ [DP₁ like DP₂]

The interpretation associated with this structure is not available for the sentence in (42a), so I assume that structure (45) is not available. The fact that structure (45) is not available for (42a) seems to be part of a generalization governing the scope of decreasing expressions and universal quantifiers (see Beghelli and Stowell 1997: section 5.3 for a related observation).

- (46) 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:

- (47) 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.

Finally, consider the possibility that *not* itself moves:

- (48) [not₃ [[every one of the movies]₂ [Q₃ [many people]]₁ [DP₁ like DP₂]]]

In this structure, *not*₃ moves to the clause initial position, and Q₃ is the copy/trace left (modifying [many people]). This structure seems to give the right configuration: NEG > every one of the movies > many people. The question is what are the semantic values of *not* and Q?

Recall that negation denotes a function that takes arguments of various types. If *not*₃ has the interpretation $\lambda X.\lambda P.\neg X(P)$ (as it does for arguments of type $\langle\langle e,t\rangle, t\rangle$), then Q₃ will also have this interpretation by semantic reconstruction (see Lechner 1998 on semantic reconstruction). But then the structure in (48) would be semantically equivalent to the structure in (45).

Suppose that *not*₃ has the interpretation: $\lambda p.\neg p$. Then there are at least two possibilities that yield an interpretation where negation has wide scope in (48):

- (49) a. Movement of *not* leaves no copy/trace.
 b. Movement of *not* leaves a copy/trace that is interpreted as the identity function.

(49a) is not possible in minimalist syntax, since it violates the No Tampering Condition (see Collins and Stabler 2016). Under (49b), negation would move to the clause initial position, and since its copy/trace is interpreted as the identity function, (48) would be semantically equivalent to (50) (where Q_3 is absent):

(50) [not₃ [[every one of the movies]₂ [many people]₁ [DP₁ like DP₂]]]]

(49b) would require a new rule of semantic interpretation different from that needed for other types of movement. For example, QR of quantifier phrases such as *everybody* is taken to leave a trace of type $\langle e \rangle$.

A theory internal argument against (49a,b) is that they do not correspond to the assumptions about overt NEG raising in Collins and Postal 2014, where in all cases, a moved NEG is interpreted in its original underlying position (essentially the opposite of (49a,b)).

Therefore, in order to rule out wide scope negation in representations like (48), one of the three conditions could be adopted:

- (51) a. Covert movement of NEG is not possible.
 b. Covert movement of NEG is possible, but obligatorily undergoes semantic reconstruction.
 c. Covert movement of NEG is possible, but is blocked by a c-commanding quantificational DP.

(51a) blocks representations like (48) involving covert movement of NEG. (51b) allows representations like (48) with covert movement of NEG, but only with semantic reconstruction. (51c) allows covert movement of NEG, and allows interpreting the movement as in (49b), but disallows the particular structure in (48), since movement crosses a c-commanding DP quantifier phrase. Deciding between these three possibilities would depend in part on the theory internal considerations listed in the text following (49) and (50), but also might depend on the analysis of split scope (see section 6). I leave this to future work.

To summarize, under the assumption that in (42a), [not [many people]] is a constituent, and assuming the semantics of negation presented in Collins and Postal 2014 and one of the conditions in (51), 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.

6. Split Scope

An outstanding question for further research is the relation between the scope freezing effects discussed in this article and the scope possibilities in modal constructions. Penka (2011: 6) gives the following sentence (attributed to W. Sternefeld):

- (52) Not every boy can be above average height. $\neg > \text{can} > \text{every}$
 ‘It is not possible that every boy is above average height.’

Penka notes: “In the reading (15) [c.c. – example (52)] intuitively has, negation takes scope above the modal verb *can*, but the quantifier *every* is interpreted in the scope of the modal, as is evident in the paraphrase. If the subject is assumed to be the constituent [DP not every boy],

it is not possible to derive truth conditions corresponding to this reading. It rather has to be assumed that the subject [_{DP} every boy] reconstructs to its base position below the modal verb, while negation remains in a higher position. The assumption that preverbal combinations of a negation and a quantifier involves constituent negation cannot derive adequate truth conditions for sentences like (15).”

A reviewer suggests the following additional examples as allowing split scope:

- (53) a. Not many questions have to be answered to pass the exam.
‘It isn’t necessary to answer many questions to pass the exam.’
b. Not many articles can be published this year.
‘It isn’t possible to publish many articles this year.’

For example, (53b) can be said by a publisher if funds are short, and we are planning for the year ahead. Wide scope for [not many articles] over *can* would yield an interpretation that can be paraphrased as:

- (54) There are not many articles that can be published this year.

This paraphrase has an existence implicature that there exists some particular article in the actual world. Whereas (53b), on the split scope interpretation, has no such implicature, since it is possible that none of the articles have been written yet.

Assuming that Penka’s description of the facts is accurate, then in light of the results of this paper, the following generalization holds:

- (55) In a sentence with a negated quantifier phrase of the form [NEG DP₁], no quantifier phrase DP₂ can take scope between NEG and DP₁: *NEG > DP₂ > DP₁.

This generalization allows for the possibility of non-DPs (e.g., a subset of the modal auxiliary verbs) taking scope between NEG and DP₂. I have not investigated whether or not (55) holds generally (for various quantifier phrases and for various modals and intensional verbs). And assuming that (55) is accurate, I do not have an account of it at present.

The literature on scope splitting discusses the following generalization (see Heim 2000:47) (see also Alrenga and Kennedy 2014):

- (56) Kennedy’s Generalization
If the scope of a quantificational DP contains the trace of a DegP, it also contains the DegP itself.

This generalization in (56) has the effect of allowing split scope in degree constructions with intensional verbs, but not with DP quantifier phrases (Heim 2000: 49): “Intervening intensional verbs seem to differ from intervening quantificational DPs in this respect, and Kennedy’s generalization does not carry over to them.”

While the cases of negated quantifier phrases in this paper do not seem to involve degree quantification, we see the same distinction between DP and non-DP quantification in (55) and (56). I leave a detailed investigation of (55) and a detailed comparison of (55) and (56) to further research.

7. Conclusion

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

Combined with the data presented in Collins 2016 (concerning a separate scope freezing effect), the data argues for a theory where negation can modify subject DPs, and against a Lasnik type Pre-S theory of negation.

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