

# Inverse Linking

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## §0 Introduction

In this paper, we will consider a phenomenon known as *inverse linking*, a term coined by May (1977) to describe the most salient readings of sentences such as “Someone from every city despises it.”<sup>1</sup> What is interesting about this sort of sentence is a particular “quirk” in its interpretation, in that the embedded quantifier phrase preferentially receives a wide-scope interpretation. In the example at hand, “every city” has scope over “someone,” so that it is naturally read as meaning that for each city, there is at least one person that despises that city. Inverse linking has prompted much discussion over the last thirty years in the linguistic literature. Our aim here is to explore the influence the inverse linking phenomena has had on syntactic theory, especially with respect to the syntactic representation of quantifier scope. By examining such issues, we hope to demonstrate how the understanding of this phenomenon has highlighted the difficulties in investigating the link between language and meaning.

In the discussion to follow, we will initially address research conducted during the 1970's and 1980's on the significance of inverse linking for the issue of the logical representation of natural language in general, and on notions of covert, syntactic movement in particular. As we will see, inverse linking was one of the strongest examples for motivating post Surface Structure (SS) movement of quantifier phrases, a form of covert movement called Quantifier Raising (QR). Ironically, although the effect of these examples is acknowledged in the post-80's literature, post-80's theories of QR are gener-

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<sup>1</sup>The “inverse” label stems from the fact that the quantifiers are interpreted in the inverse of their surface word order, “every city” has scope over “someone” in the example sentence, whereas the “linking” label is used to describe how the broader scope quantifier binds a variable contained within the restriction of the narrower scope quantifier.

ally incompatible with inverse linking. In an effort to rid ourselves of this irony, we will focus on two of the principle works on inverse linking, viz. Larson (1985) and May (1985). We hope to re-establish the judgments concerning this type of quantifier interaction while also discussing some of the specifics of Larson's and May's theoretical machinery.

## **§1 Initial Accounts**

In this section, we explore the earlier syntactic theories and their accounts of inverse linking, before discussing more modern syntactic theories with a focus on how they could possibly deal with deriving inversely-linked interpretations.

The beginning of the linguistic history of the inverse-linking phenomenon started with Hintikka (1974), who used such interpretations as evidence for a theory of branching quantification. Gabbay & Moravcsik (1974), in response to an unpublished draft of Hintikka's paper, also take note of such interpretations in their efforts to incorporate branching quantification into a Montague style semantics, as does Reinhart (19) in her discussion of binding. However, although these authors used these constructions within their linguistic analysis, no author really dealt with the full syntactic complexity of inverse linking until May (1977). It was within this work, that the main premises are introduced arguing for a syntactic level of Logical Form (LF) and a syntactic operation called QR, and it was amongst these issues that inverse-linking had its greatest influence. So, here is where we will begin our discussion, exploring some of the details discussed in May (1977) before examining some of the more recent literature.

May (1977) hypothesized that scope ambiguity could be derived by syntactic movement. He conjectured that there was another syntactic level beyond Surface Structure called Logical Form (LF)

derived by syntactic movements obeying familiar constraints on movements. It was at this level that Quantifier Phrases (QPs) moved to adjoin to a phrase above all inflectional elements; in the parlance of the day, adjoining to S. C-command relations determined scope interpretations. In sentences with multiple quantifiers, all else being equal, the final arrangement of the QPs was indeterminate relative to surface order, either QP free to move above the other, scope ambiguity being dependent on this choice.

One of the important insights recognized at the time by May was that syntactic constraints affected the possibilities of semantic interpretation vis-a-vis the possible scope order of multiple QPs. Although it is important to show the ability of syntactic theory to derive permissible interpretations, it is equally important (if not more so) to demonstrate that some inadmissible interpretations can be explained by syntactic conditions. For May (1977), inversely linked constructions were a prime example for demonstrating such a syntax-semantics interaction.

To see why, consider the sentences in (1):

- (1) a. \*Which did the girl kiss boy?  
b. Which boy did the girl kiss?

These sentences demonstrate the well-known condition that overt movement affects a whole wh-phrase, not just part of that phrase. As May (1977) saw the examples in (1), it is only the wh-element “which” that is targeted for movement, but a certain syntactic constraint, the Condition on Analyzability,” (hereon COA), requires the whole NP “which boy” to move. May used this movement restriction to derive interesting results in inversely linked constructions. Consider the sentence in (2).

- (2) Each of the members of a key congressional committee voted for the amendment.  
(May 1977:62, example 2.1d)

According to May's theory of QR, the quantificational elements “each” and “a” are targeted for movement. Thus, in compliance with the COA, the entire phrase “a key congressional committee” and “Each

of the members of . . .” must move to adjoin to the S-phrase. This means that the following two LF forms can be derived for the sentence in (2), where “y” marks the original position of “a key congressional committee” and “x” marks the original position of “Each of the members of a key congressional committee”.

- (3) a.  $*[_S [_{\text{Each of the members of } y}]_x [_S [_{\text{a key congressional committee}}]_y] [_S x \text{ voted for the amendment}]]]$   
 b.  $[_S [_{\text{a key congressional committee}}]_y] [_S [_{\text{Each of the members of } y}]_x] [_S x \text{ voted for the amendment}]]]$

(3a) represents the interpretation where “each” scopes over “a key congressional committee” (i.e. where every member of any of the congressional committees voted for the amendment), whereas (3b) represents the inversely linked interpretation (i.e. where there is one congressional committee such that each of its members voted for the amendment). The interesting result for May was that (3a) is ill-formed since “a key congressional committee” does not properly bind the variable “y”. As a result (3a) is ruled out by a general syntactic condition barring the occurrence at LF of unbound traces of movement.<sup>2</sup> What is of importance to note here is the general form of the argument May employs: syntactic constraints can explain the restricted interpretation of inversely linked constructions, and thus provide evidence that covert QR exists as a mechanism for explaining quantifier ambiguity.

By the mid 1980's, inverse-linking was generally taken to be centrally important for establishing an operation of quantifier movement. As May (1985:72) put it, “inverse linking serves as an existence argument for the level of LF itself,” and the structures and operations employed to account for inversely

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<sup>2</sup>Note that the issue here is not whether the scope order of the quantifiers shown in (3a) is possible. It is, as May (1977, 1985), (also Gabbay & Moravcsik, (1974) observe, but not with the logical with the structure of (3a). Rather, the representation will be one in which the scope of the narrow scope quantifier is wholly *contained* within the restriction of the broader scope quantifier. We might paraphrase this reading as something like “Each of the members who are on a key congressional committee voted for the amendment.” hence the moniker “relative reading” given this construal in May (1977). In May (1985), these cases are analyzed by allowing for NP internal adjunction structures. Larson (1985) also discusses these cases, in his efforts to establish the quasi-syntactic operation of quantifier retrieval (based on Cooper 1983).

linked sentences were also used to account for simpler structures without embedded quantification. The relevance of inverse linking in establishing the existence of a level of Logical Form did not go unnoticed in the subsequent literature. Chomsky & Lasnik (1995:65), in their review of Government and Binding theory, state, "The examples of 'inversely linked' quantification discussed by May . . . clearly indicate that S-Structure configuration does not suffice". Hornstein (1995:25), in his review of LF through the period under discussion, also states that inverse linking provides strong evidence for LF. Although neither of these reviews gets into the full complexity of the issues surrounding inverse linking, they do acknowledge the importance of the phenomenon, especially in sentences that have inverse linking combined with pronomial binding, as in (4).

(4) Someone from every city despises it. (May 1985, example 26)

The sentence in (4) can be interpreted with the quantifier "every city" binding the pronoun "it" (i.e. For every city, someone from that city despises it, it being the city). On the standard assumption that this form of binding requires c-command, and on the assumption that the object position of the preposition does not c-command the Verb Phrase (VP), "every city" must move from its apparent surface position to a higher position c-commanding the pronoun.<sup>3</sup>

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<sup>3</sup>Hornstein (1995:25) provides an argument that non-quantificational elements in the prepositional object position do not c-command into the VP. He uses the lack of so-called "sloppy" readings of the pronoun to demonstrate his case. According to Reinhart (1983) sloppy readings of pronouns require c-command even with non-quantification noun phrases. So consider the sentences in (i) and (ii).

(i) John loves his mother and Bill does too

(ii) The woman who likes John loves his mother, and the woman who likes Bill does too.

The sentence in (i) can be interpreted with the sloppy reading as John loves John's mother and Bill loves Bill's mother. On the other hand, (ii) cannot be interpreted as referring to one woman liking John's mother and the other liking Bill's. The reason for this, according to Reinhart, is that "Bill" c-commands the elided VP in (i), but not in (ii). Hornstein claims that the sentence in (iii) also lacks the sloppy reading.

(iii) People from LA love its beaches, and someone from NYC does too.

In other words, (iii) cannot mean that people from LA love LA beaches, and someone from NYC loves NYC beaches. Hence NYC cannot c-command the elided VP. However, note that May (1985:68) claims that sentences such as (iii) can have sloppy readings. For example, May claims that (iv) can be interpreted as saying that Nobody from NYC rides NYC subways, but everybody from Tokyo rides Tokyo subways.

(iv) Nobody from New York rides its subways, but everybody from Tokyo does. (May 1985:65, example 29)

Also, Fiengo and May (1994) have argued at considerable length that Reinhart's claim itself is incorrect, and that sloppy readings are possible in the absence of c-command.

With such observations peppered throughout the recent literature on LF, one would think that the theories of QR and LF since 1985 would at least be able to account for the phenomenon. In many cases, however, this does not seem to be borne out.

This lacunae is acknowledged by some authors. For example, Kayne (1998:183) in trying to reduce covert movement to overt movement, mentions inverse linking as a problem that will have to be reanalyzed within his framework. However, although a solution via Kayne's analysis might be possible, it seems difficult to naturally create an overt structure for sentence (4) with the inversely linked interpretation, where "every city" c-commands the VP or at least the trace of the VP, while also c-commanding the QP "someone from . . ." or at least the trace of the QP. The structure would have to be something like (5).

(5) [ [<sub>IP</sub> [someone from t<sub>1</sub>] t<sub>2</sub>]<sub>3</sub> [ [every city]<sub>1</sub> [[<sub>VP</sub> despises it]<sub>2</sub> t<sub>3</sub>]]]

Crucial to this structure is that the object of the preposition is overtly in a separate phrase than the actual preposition. Certainly a very suspicious consequence, especially considering that sentences such as "Someone from incidentally every city despises it" are unacceptable in English. Further research may be able to establish or avoid this problem, but either way, the road ahead for Kayne's hypothesis seems very rocky indeed.

While Kayne makes it known that he is aware of the problem, others do not. For example, Aoun & Li (1993) never even mention inverse linking. Yet, the phenomenon is a direct counter-example to their theory. Consider their two principles that they employ to syntactically derive quantifier scope; the Minimal Binding Requirement and their Scope Principle.

**Scope Principle:**

A quantifier A may have scope over a quantifier B iff A c-commands a member of the chain containing B. (Aoun & Li 1993: 21)

**Minimal Binding Requirement: (MBR)**

Variables must be bound by the most local potential A-bar'-binder.<sup>4</sup>

Now consider a much simpler version of the sentence in (4) without the pronoun. (Also a much more felicitous version, since Esme happens to be my beautiful daughter.)

(5) Someone from every city loves Esme.

In a sentence like (5) with the inversely linked interpretation, Aoun & Li (1993) must hypothesize, in accordance with their Scope Principle, that “every city” c-commands at least one member of the chain containing “someone”. However, if “every city” has scope broader than the operator “someone”, then this structure would violate the MBR; a variable bound by “every city” (namely the object of the preposition) would have a closer possible binder, i.e. “someone”. (See the generalized structure in (6a), where the offending variable is in bold.)

- (6) a. [. . . [every city]<sub>x</sub> . . . [someone]<sub>y</sub> . . . [in x] . . .] . . . t<sub>y</sub> loves Esme]  
 b. [. . . [someone]<sub>y</sub> . . . [every city]<sub>x</sub> . . . y in x] . . . t<sub>y</sub> loves Esme]

Giving up this possibility, the only other strategy for Aoun & Li is to have “every city” take scope below the operator “someone” but above a member of the chain containing “someone”. However, if this were so, then the MBR would be violated once again; a variable of “someone”, namely the variable connected to the preposition, would have a closer binder, i.e. “every city”. (See the generalized structure in (6b), where the offending variable is again highlighted.)<sup>5</sup>

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<sup>4</sup>Note that the trace in the VP subject position is not a variable, but a trace that is A-bound by the subject in Spec-IP.

<sup>5</sup>Note that Aoun & Li are unable to rescue their proposal by claiming that “someone” moves out of the NP to the Spec of IP without carrying along the PP, thus leaving an A-bound trace behind (a solution employed to get around the MBR for the VP-internal subject trace). If this were so, then emphatic “did” should be able to separate the subject from its trace in the Prepositional Phrase (see sentence (b) below), as it can separate the subject and its trace in the VP (see sentence (a) below). As the sentences in (i) demonstrate, the subject and the PP are not separable.

- (i) a. Someone did love Esme.  
 b. \*Someone did in every city love Esme.  
 c. Someone in every city did love Esme.

Other syntactic theories suffer from comparable difficulties. For example, as first noted by Fox (1999:46, footnote 35), theories that rely on explaining scope variation through case checking are particularly challenged by inverse linking. Such theories include Hornstein (1995), and Kitahara (1996). In each of these theories, case-checking movements are employed to account for the ambiguous quantifier interpretations, scope being determined by c-command relations. However, movement motivated by case-checking is an operation usually applied to verbal arguments. It is unclear how case-checking would work for NP-internal, prepositional objects. To account for inverse linking and pronominal binding (required for the most salient interpretation of sentences like (4) above), these theories would need the prepositional object to move to a case-checking position that c-commands the entire [NP PP] constituent, while also c-commanding the matrix VP. Hypothesizing such a position seems a little too problem specific to be plausible.

However, the problems with inverse linking are rather more serious than this. Hornstein's own arguments concerning inverse linking claim that non-quantificational NPs are not able to c-command out of PPs that are embedded within NPs, while in contrast QPs seem to have this ability (see Hornstein, 1995:25, and footnote 3 in this paper). Yet, in a theory of movement for case-checking purposes, there should not be any difference between the movement of QPs and other non-quantificational NPs. Hence, it cannot be just the case-checking position that allows a QP to move and c-command out of an [NP PP] constituent. The obvious way out of this dilemma is to hypothesize a type of movement targeting quantifiers specifically. But this would just be reintroducing QR, when the whole purpose of case-checking theories of quantifier scope was eliminate this rule.

Additional problems can be located with Kitahara's (1996) version of the case-checking theory, a version that adopts a Scope Principle much like Aoun & Li's (1993), stated as follows:

**Scope Principle** (Kitahara 1996:194)

A quantifier X can scope over a quantifier Y iff X c-commands a member of each chain associated with Y at LF

In inversely linked constructions, Kitahara would have to assume that in sentences such as (4) above (repeated below as (7)),

(7) Someone from every city despises it

the prepositional object “every city” c-commands at least one member of the chain associated with “someone” while also c-commanding the pronoun in the VP. It is only through this arrangement that Kitahara can derive the inversely linked interpretation with pronomial binding.

However, such a configuration guarantees that “someone” c-commands a member of the chain associated with “every city”, namely the variable that is the object of the preposition. This would predict that “someone” could have scope over “every city”, even when “every city” binds the pronoun. But this interpretation does not appear to be possible. This is a little hard to demonstrate with example (7), (it would require hypothesizing a person that is from all the cities, a little awkward pragmatically to say the least). Instead, consider the pragmatically clearer example in (8).

(8) At most two senators on every committee voted to abolish it.

Here, pragmatic issues are left behind. According to Kitahara's theory, (8) should be true in the situation where two facts hold: (1) on each committee, many senators voted to abolish that same committee, and (2) there are only two senators that are on every committee and that voted to abolish each of those committees. (8) however is not true in such a situation. Barring some problem specific constraints, Kitahara's theory seems to inherently over-generate when applied to the types of sentences involved in inverse linking.

In summary, it appears that inverse linking has not been much of a consideration in developing

recent theories of LF and QR, despite the emphasis on this phenomenon in originally motivating a need for such theories. Even authors that were aware of the data and its importance have conspicuously left it out of their analyses.

## §2 Linked and Non-Linked Quantification

Given the absence of attention to inverse linking in recent approaches to quantifier scope, we should consider whether this might be justified. Perhaps what is involved in inverse linking is sufficiently different that it does not form a natural class with other aspects of quantification in natural language, and therefore we should not expect a general account to be forthcoming.

While this is a reasonable conjecture, it is not one that is well-supported, considering that inverse linking appears to conform to constraints similar to those governing verb-argument quantification. For example, consider some of the scope freezing effects mentioned in Fox (1999), and accounted for by his principle of Scope Economy.<sup>6</sup>

- (9) a. Two volunteers greeted every producer.  
 b. Two volunteers greeted every producer. Bill did too

The sentence in (9a) is true, whether it was the same two volunteers that greeted each producer, or two different volunteers for each producer. However, (9b) can only be true in the situation where it was the same two volunteers. The same kind of scope-freezing effect also exists for NP-embedded prepositional objects. Consider the sentence in (10).

- (10) a. Two volunteers greeted the producer of every movie.  
 b. Two volunteers greeted the producer of every movie. Bill did too.

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<sup>6</sup>Fox's Scope Economy restricts the ability of the object to scope over the subject, if the following VP-elided sentence does not have a quantifier for a subject. This codifies an observation initially due to Fiengo and May (1994: 231*ff*).

The sentence in (10a) is true whether it was the same two volunteers that greeted each producer, or two different volunteers for each producer. The sentence in (10b) is only true if it was the same two volunteers, just as in (9b).

The similarities in scope restrictions do not end here. NP-embedded prepositional objects also demonstrate a scope-freezing effect involving pronominal binding, and a similar kind of effect can be exhibited with quantifiers in verbal argument positions. This is particularly relevant for inverse linking, since binding is usually hypothesized to require a specific syntactic configuration: that of c-command.

To demonstrate the similarities, consider the sentences in (11).

- (11) a. Some politician disappointed every female voter  
 b. Some politician disappointed every female voter before finishing his acceptance speech.  
 c. Some politician disappointed every female voter that voted for him.

As first noted by Hornstein (1995), the sentence in (11a) is true whether there is one politician that disappointed all the female voters, or whether for each female voter, a different politician disappointed her. However, in (11b) and (11c) where “he” and “him” are understood as referring back to the politician, only the former reading is possible; the one where there is one politician that disappointed all the female voters. The same kind of scope-freezing effects exist for inversely-linked constructions, as we observe in (12):

- (12) a. At most two senators on every committee voted for the bill.  
 b. At most two senators on every committee voted to abolish it.  
 c. At least one senator on every committee that he thought was worthy of his attention, voted for the bill.

(12a) is true in the situation where on each committee, many senators voted for the bill, but where only two senators that were on all the committees voted for the bill. This situation characterizes the surface scope interpretation of the sentence in (12a). In contrast, as already mentioned in section 1, (12b) is

not true in a similar situation: the situation where on each committee, many senators voted to abolish that same committee, but where only two senators that were on all the committees voted to abolish each of those committees. In (12b), the binding of the pronoun “it” by “every committee” forces the sentence to only permit the inversely linked interpretation. Binding of the pronoun “he” by “at least one senator” in (12c) has the opposite consequence. Much like (11c), only the surface scope interpretation is available. This is demonstrated by the fact that the sentence is false in the situation where the following two facts hold: (1) for every committee there is one senator on that committee who both voted for the bill and thinks that his committee is worthy of his attention, and (2) every senator thinks that there are some committees that he is not on, that are worthy of his attention.

In summary, the quantifier positions in inversely linked constructions demonstrate similar kinds of interpretive restrictions as quantifiers in regular argument positions. The similarities argue against any effort to somehow separate quantifier operations that apply to verbal arguments from those that derive inversely linked interpretations.

### **§3 Re-acquainting Ourselves with the Eighties.**

Thus far, we have reviewed the early importance of inverse linking, and noted its fading influence within the more recent literature, although as we have just discussed, it is by no means clear that this lack of attention is justified. At this point we need to understand somewhat more deeply what is at stake with inverse-linking; we shall do so by examining in some detail the discussions of Larson (1985) and May (1985). However, before launching into a detailed review, a little background.

As mentioned in section 1, the early assessments of sentences such as “Everybody in some Italian city met John,” were that they were unambiguous (see May 1977:65, and Gabbay & Moravcsik's im-

plication in not mentioning a possible surface scope interpretation in Gabbay & Moravcsik 1974:143). However, things changed in 1985.<sup>7</sup> In *Logical Form*, May (1985:72) suggests that surface scope interpretations are indeed available,<sup>8</sup> and this altered the status of the original arguments developed by May (1977), which used the lack of a surface scope interpretation as support for claiming that quantifier interpretation involved syntactic restrictions. Furthermore, in the early eighties, notions of subjacency became more prevalent as a means of restricting syntactic movement. In the traditional account of inverse linking (May's 1977 account), the QP in the complement position of the preposition, moved out of the subject NP to the adjoin at the sentential level. This movement was in direct violation of subjacency.

It was in this environment that Larson (1985) and May (1985) built their syntactic theories in an effort to capture the subtleties of inverse linking.

### §3.1 Larson (1985).

Before considering the details of Larson's analysis of inversely linking, it is appropriate to recognize his motivations. As we will see below, a great deal of his arguments tacitly assume that syntactic

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<sup>7</sup>As an aside, it is interesting that there are some difficulties in linking scope to c-command notions, while leaving the quantifiers in their surface positions. The two competing structures for the QP + PP constituent are  $[_{QP_1} Q [N [_{PP} [P QP_2]]]]$  and  $[_{QP_1'} [_{QP_1} Q [NP]] [_{PP} P [QP_2]]]$ . In the first structure,  $QP_1$  does not c-command  $QP_2$  since it dominates  $QP_2$ . Q does c-command  $QP_2$ , but if scope was based on the c-command properties of Q, then it is unclear how Q could ever c-command outside of  $QP_1$  (which it must to get sentential scope). In the second structure  $QP_1$  can c-command  $QP_2$ , as long as the definition of c-command does not exclude inclusion of categories. Unfortunately, many definitions do maintain such an exclusion.

<sup>8</sup>The evidence that May considers come from sentences such as *Every house near a river faces danger from flooding* or *The head of every public authority in New York was Robert Moses* (May, 1985:72). Other examples that do not rely on the vicissitudes of definite and indefinite articles, (on the latter see Reinhart 1997, Diesing 1992, Fodor & Sag 1982 among others), can be adduced:

(i) Less than three senators on every committee voted for the bill.

(ii) Every senator on more than two committees voted for the bill.

(i) is true in the situation where several senators on each committee voted for the bill, but only one or two senators that was a member of every committee did. (ii) is true in the situation where every senator that was on more than two committees voted for the bill but no committee was unanimous in their vote.

positions are mirrored by functional, logical combination (following Montague, 1974, in this regard). With this underlying concern, Larson begins by exploring whether the object of a preposition moves at some syntactic level or not. For Larson (1985), this concern was not as straightforward as it was for May (1977), who assumed that the quantifiers embedded within the prepositional phrase took sentential scope. However, Larson demonstrates that this is not necessarily always the case. Consider the sentence in (13):

(13) Max needs a lock of mane from every unicorn in an enchanted forest. (Larson, 1985, example 4a)

According to Larson, the sentence in (13) has a reading where "every unicorn" scopes over "a lock of mane" but where "every unicorn" scopes under the intensional operator of the verb. In other words, (13) can have a *de dicto* reading, even when the object and the embedded quantifier are inversely linked. To establish this, Larson claims that (13) is true in the following context: "Max requires locks of unicorn mane for the performance of some magic spell. The spell stipulates no particular forest nor any particular pieces of mane. It is only necessary that he have some bit of mane from every unicorn in whatever forest is selected." (Larson 1985:2)

Larson argues from this example that, ". . . if we are to retain Montague's analysis of intensional object NPs, then the fact that each of these NPs may be read *de dicto* clearly entails that such quantification must take place *before* the object NP is combined with the intensional verb." (Larson 1985:2) In other words, as long as intensional verbs are thought to have scope only over their objects, then sentences such as (13) must demonstrate an inversely-linked reading localized within the object NP itself. Furthermore, Larson claims that this internal NP derivation can be accomplish via a small modification

of Montague's Grammar (Montague 1974). No syntactic operations need apply.<sup>9</sup>

This is an interesting conjecture that at first seems to undermine the syntactic enterprise of describing inverse linking. However, Larson quickly moves on to the problematic data for his internal-NP theory of inverse linking. Consider the examples of pronominal binding as in (4) repeated here:

(4) Someone from every city despises it.

Assuming that “every city” is a generalized quantifier of type  $\langle \langle e,t \rangle, t \rangle$  (Barwise & Cooper, 1981), then “every city” must combine with a predicate such as “ $\lambda x \exists y (\text{PERSON}(y) \ \& \ \text{FROM}(y,x) \ \& \ \text{DESPISE}(y, x))$ ”. Otherwise, “every city” would not be able to bind the pronoun object (represented as the variable 'x' in the relation “DESPISE”). However, this predicate contains the logical representation of the transitive verb and its arguments. This suggests that “every city” must combine at the sentential level and not within the NP subject. A minor alteration to Montague Grammar will not be able to derive the pronominal binding while maintaining that the QP remains within the NP. For Larson, the obvious solution is to move the quantifier out of the NP and let it combine sententially above the subject. Perhaps syntactic movement is required after all.

But now there is something of a paradox taking shape. There are two reasons that Larson thinks that movement out of the subject NP in (4) should not be permitted. First, complex NPs are typically an “island” for movement, as demonstrated by the unacceptable (14).

(14) \*Which city does [someone from e] despises it. (May 1985, sentence 30a)

However, whether “islands” apply to covert movement has always been a controversial subject in the

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<sup>9</sup>Larson's modification consists of reducing two expressions, A and B of the type  $\langle \langle e,t \rangle, t \rangle$  to one expression, C of the type,  $\langle \langle e,t \rangle, t \rangle$ , where  $C = \lambda Q [A [\lambda x B\text{-with-}x\text{-in-formula } (Q)]]$ . For example, suppose  $A = \lambda S \exists (x) [E(x) \ \& \ \text{IN}(x,y) \ \& \ S(x)]$ , and suppose  $B = \lambda R \forall (z) [(W(z) \ \& \ \text{From}(z,q)) \supset R(z)]$ . C would then equal  $\lambda Q \{ \lambda S \exists (x) [E(x) \ \& \ \text{IN}(x,y) \ \& \ S(x)] \} \lambda q \{ \lambda R \forall (z) [(W(z) \ \& \ \text{From}(z,q)) \supset R(z)] \} Q$ , which reduces to  $\lambda Q \{ \exists (x) [E(x) \ \& \ \text{IN}(x,y) \ \& \ \forall (z) [(W(z) \ \& \ \text{From}(z,x)) \supset Q(z)]] \}$ . The representation of a QP as  $\lambda P \exists (x) [\text{Man}(x) \ \& \ R(x) \ \& \ P(x)]$  where R is a free variable which can be  $\lambda$ -abstracted, is from Bach and Cooper (1978) who use it to account for relative clauses. Thus PP's can be bound into QP.

syntactic literature,<sup>10</sup> so this might be taken as only weak motivation for not allowing movement out of the NP. His second reason for restricting movement is somewhat stronger. According to Larson, allowing movement to the sentential level predicts some unattested interpretations. Consider the sentence in (15).

(15) Two politicians spy on someone from every city. (Larson 1985:5, example 12)

If the quantifier embedded in the PP is permitted to take sentential scope, then like a normal verb object it should be able to scope over the subject. Furthermore, since the embedded quantifier would be able to scope out of the NP, it should not need to carry that NP with it when it moves. In other words, movement out of the NP (without any further restrictions) seems to predict that (15) should have an interpretation where the embedded quantifier “every city” has scope over the subject “two politicians,” but where “someone” has scope under “two politicians.” This means that (15) should be true in the situation where the following three facts hold: (1) For every city, there are two politicians who each spy on someone from that city, (2) No politician spies on more than one person, and (3) no politicians spy on the same person as another politician. But as Larson observes, (15) is not true in this circumstance.

This result is particularly damaging since (15) does seem to allow an interpretation where the embedded quantifier “every city” has scope over the subject, but where the object also has scope over the subject. For example, (15) is true in the situation where the following two facts hold: (1) for every city, there is someone from that city that two politicians are spying on, and (2) every politician only spies on people from his own city.<sup>11</sup>

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<sup>10</sup>This is a main theme of May (1985, especially chapter 3). See also remarks in Reinhart (1997), who argues that as a matter of principle, all movement whether covert or overt should obey the same movement restrictions.

<sup>11</sup>Although this situation is true of both the interpretation where “someone” has scope over “two politicians” and the interpretation where “two politicians” has scope over “someone,” the lack of the second interpretation in the previous situation suggests that it can only be the first interpretation that makes the sentence true.

In observing the interpretations available for (15), Larson makes the following generalization. If the quantifier embedded in the object's PP has scope over the subject, then the object must also scope over the subject. This result would make perfect sense if the embedded quantifier were unable to move out of the NP, since to move this quantifier above the subject would require moving the whole NP.<sup>12</sup>

What we see from Larson's observations is that evidence from pronomial binding suggests that the embedded quantifiers move outside of the NP in which they are embedded in, while absence of certain interpretations suggests that the embedded quantifiers are unable move out of the NP.

### **§3.2 Is Larson's generalization really general?**

Stepping back a little from Larson's approach, it seems appropriate at this point to examine the judgments concerning (15) a little more closely, for there are some apparent difficulties surrounding Larson's claims about this example. First of all, (15) involves indefinite quantifiers, and as has been demonstrated repeatedly in the linguistic literature (see Reinhart 1997 for both a demonstration, and a list of other works), indefinites do not have the same scopal behavior as other quantifiers. Second, May (1985:82-83) reports a counter-example to Larson's generalization. Consider the sentence in (16).

(16) Some student will investigate two dialects of every language. .

According to May (1985), there is an interpretation of (16), where "every language" is understood as taking scope over "some student," which in turn takes scope over "two dialects." Ignoring for the moment the indefinites in (16), how is it possible to tell that (16) has the interpretation that May claims? Normally, one would construct a situation that isolates the meaning. However, any situation where May's interpretation is true, is also a situation where, for every language, there are two dialects that were

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<sup>12</sup>As an aside, we note that Heim and Kratzer (1998) use Larson's Generalization to argue for the NP internal structure.

each investigated by a student.<sup>13</sup> This makes it impossible to isolate the interpretation where the subject has scope over the object from the interpretation where the object scopes over the subject (this is assuming that “every language” has widest scope). So, to use Reinhart's (1997:341) turn of phrase when explaining just this point, “. . . there is no obvious way to know” whether the sentence has the scope reading it is claimed to have or not.

To avoid both the problem with indefinites, and the problem with May's (1985) counter-example, consider the sentence in (17).

(17) More than half of the students will investigate at least one dialect of every language.

The sentence in (17) contains no indefinites. In addition, it is easy to isolate the reading where the embedded QP has widest scope, and the subject scopes over the object. For example, consider the situation where two thirds of the students were assigned to investigate a dialect from every language except one: the excluded language differing for each student. Also, for each language, more than half of the students investigated a dialect from it, but no student investigated the same dialect as another. It seems difficult to understand (17) as being true in such a situation, even though this interpretation should be available if Larson's generalization did not hold. This is despite the fact that (17) is true in the situation where, for every language, there is at least one dialect that more than half of the students will investigate.

So, perhaps Larson's generalization does indeed hold.<sup>14</sup>

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<sup>13</sup>To be more explicit, whenever it is true that for every language there is some student that is investigating two dialects from that language, it is also true that for every language there are two dialects of that language that are being investigated by some student. It just happens to be the same student for the second proposition.

<sup>14</sup>There is some other evidence in support of Larson's generalization, although matters here are quite subtle, as well as theory dependent. If an object and subject are scopally commutative (according to Fox's, 1999, definition), then Fox's Scope Economy should prevent the quantifier embedded in the object from scoping over the subject. Consider, the sentence in (i), where the object and subject are scopally commutative.

(i) A volunteer greeted an exchange student from every country.

### §3.3 Quantifier retrieval and storage

So, how does Larson account for the observations under consideration? Building on a system first hypothesized by Cooper (1983), Larson proposes a dual operation for moving quantifiers, Quantifier Storage followed by Quantifier Retrieval. Leaving the (important) algorithmic details for the reader to explore independently, we will only review the general design of the system. The idea proposed by Cooper was that during the course of combining the logical representations of the sub-sentential phrases into the logical representation of the entire sentence (from the bottom of the tree up), two possible operations could apply to QPs. Either, a QP could be combined and processed like other phrases, thus allowing the quantifier to take surface scope, or the QP could be stored, replaced by a variable, and later combined at the sentential level. When it is combined at the sentential level, the variable is first  $\lambda$ -abstracted, thus forming a predicate, and this predicate can then be logically combined with the QP, represented as a Generalized Quantifier.<sup>15</sup>

In this manner, a QP is able to move into a position where it can take wide scope (the object moving above the subject, for instance). Cooper also worked in the notion of islands into his storage and retrieval system. For him, islands can be incorporated by adding a constraint which renders a phrase that is an island (an NP for instance) uninterpretable if there is a QP of some kind already in storage.

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Can this sentence have a reading in which the quantifier “every” has scope over “a volunteer”? To isolate this reading, consider the situation where the following two facts hold: (1) no volunteer greeted more than one of the exchange students, (2) For every country, an exchange student from that country was greeted by a volunteer. The sentence in (i) seems false in such a situation. This is interesting because this sentence can have the interpretation where there is one volunteer that greeted each of the exchange students. If Fox’s Scope Economy blocks the object from moving over the subject, then the sentence in (i) demonstrates that the object must be able to scope over the subject in order for the internal NP quantifier to do so.

<sup>15</sup>The following is an informal description of the operation. To store a quantifier, replace its position by a variable, (actually by  $\lambda P(x)$ , but basically this is the same thing), and then store the ordered pair  $\langle QP, x \rangle$  where  $x$  marks the “variable address” for the quantifier. Then, to retrieve the quantifier, first  $\lambda$ -abstract the variable given in the “variable address,” and finally apply the quantifier. For example, consider “Esme loves everybody.” First replace the QP with a variable, leaving “Esme loves  $x$ ” with  $\langle \text{everybody}, x \rangle$  stored. Then  $\lambda$ -abstract and combine, leaving “Everybody  $\lambda x$  (Esme loves  $x$ )” after retrieval. For a critical notice of Cooper (1983), see May (1987).

To quote Larson (1985:8), the desired result of this kind of constraint is “. . . to require that all stored quantifiers in the interpretation of an island node be quantified out or “discharged” before that node is combined semantically with another constituent.”<sup>16</sup>

Larson (1985) modifies this system, by changing Cooper's storage operation (Quantifier Storage) into a push-down mechanism. Thus, for Larson multiple QPs could be stored at the same time, the only constraint being that the quantifiers have to be retrieved in the reverse order that they were stored. The consequence of this is that if two quantifiers are stored, then the resulting interpretation will almost always have the inverse scope of the surface word order.

With this minor change, Larson can now explain the apparent paradox noted above. In inversely-linked constructions, the embedded QP cannot be stored and then later retrieved at the sentential level. This would violate Cooper's island constraint. However, Larson redefines Cooper's constraint, such that if the NP is a QP, then this QP can be stored on top of the embedded QP. The island constraint thus would not apply, since the island would be in storage.<sup>17</sup>

In this way, the embedded QP is allowed to have sentential scope through movement, but only if the NP in which the QP is embedded, is itself stored and combined at the sentential level. Since the storage system employs a push-down mechanism, the resulting structure after retrieval necessitates that the embedded QP scope over the NP in which it was embedded. A welcome result, considering the scope freezing effects already mentioned to exist in this section and in section 2 above. For example, recall that in sentences like (8) above, repeated here as (18), pronominal binding forces the inversely-

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<sup>16</sup>For a more thorough description of Cooper's approach, see Cooper, 1983:134 *ff.* Note that Cooper treats *wh*-elements as quantifiers.

<sup>17</sup>Larson re-defines Cooper's constraint on quantifying out of islands as follows: If  $\alpha$  is a structural description and  $\alpha \in I$ , then INT assigns no interpretation  $\beta'$  to  $[\beta \dots \alpha \dots]$ , where  $\beta' = \langle \Phi, \langle Q', x_n \rangle \rangle$ , and where  $\alpha' = \langle \Psi, \langle Q', x_n \rangle \rangle$ .  $I = \{NP, Q, R\}$  where Q and R are [+WH] S's.

linked interpretation.

(18) At most two senators on every committee voted to abolish it.

In Larson's system, "every committee" has to combine at the sentential level in order to bind the pronoun "it". In effect, the push-down mechanism guarantees that "every committee" scopes over "at most two senators" when there is a pronoun acting as a bound variable in the VP.

Also, this kind of quantifier movement easily accounts for Larson's generalization, mentioned above. In sentences such as (17), repeated as (19), there are three quantifiers.

(19) More than half of the students will investigate at least one dialect of every language.

To move "every language" above "more than half of the students," "at least one dialect" would have to be stored as well, otherwise the movement would violate the island constraint. Thus, before "every language" could be retrieved, "at least one dialect" would first have to be discharged at the sentential level, where it would scope over the subject. Even if the subject itself were stored, the push-down mechanism guarantees that in the resulting interpretation, quantifier scope will be the exact inverse of the surface word order ("every language" having scope over "at least one dialect" which scopes over "more than half of the students"). In this way, Larson's system forces the object to scope over the subject, whenever the QP embedded in the object scopes over the subject.

This is a very strong result. Not only does Larson's system account for the available, inversely-linked interpretations, it also rules out potentially invalid interpretations. Furthermore, Larson can maintain a unified account of island effects between covert and overt movement.

However, although Larson's system works well for inversely-linked constructions and even common declaratives, its Achilles heel seems to be double object constructions. As noted by Breuning (2001), double object constructions seem to only allow surface scope. Consider the sentence in (20).

(20) My daughter Esme showed at least one newborn baby every wooden toy in the room.

The sentence in (20) is true in the situation where there is one newborn to whom Esme showed each of the wooden toys, but it is false in the situation where Esme showed every wooden toy to a different newborn. The second situation is what characterizes the inverse-scope reading. In Larson's system, if the objects of ditransitive verbs are subject to Quantifier Storage and Retrieval, then it would be difficult to explain why the inverse-scope reading is unavailable. Especially problematic, is the fact that the sentence in (21) is acceptable.

(21) What did Esme show her mother?

Since Larson employs his quantifier movement operations to account for *wh*-movement, the grammaticality of (21) suggests that these operations should apply to double object constructions.

### §3.4 Switching Tactics: the basic argument of May 1985.

Like Larson, May (1985) is chiefly concerned with where the embedded quantifier moves. However, unlike Larson, he has no intent to maintain an isomorphism between syntactic structures and some kind of logical representation. May's underlying theme is that syntax simply constrains or enhances the range of flexibility involved in semantic interpretation, not that it determines this interpretation. With this in mind, let's consider May's (1985) theory of inverse linking.

In contrast with his earlier work, May (1985) is a little bothered by the idea of moving a quantifier out of an NP island. He asks rhetorically, "Why can QR extract a phrase from NP in mapping onto LF, but *wh*-movement cannot in mapping onto S-Structure?" (May, 1985: 69). In the end May thinks that island constraints are in a certain sense inapplicable to Quantifier Raising (see the discussion below). Nonetheless, with this question serving as background motivation, May (1985) proposes

an alternative to his earlier theory of inverse linking. Instead of raising the embedded QP out of the NP to a sentential position in order to derive the inversely linked reading, May suggests that the QP adjoins to the NP in which it is embedded. Under this hypothesis the representation of “Someone from every city despised it” would be as in (22). (See May 1985:70-71.)

(22) [<sub>S</sub> [<sub>NP1</sub> [every city]<sub>x</sub> [<sub>NP2</sub> someone from x]]<sub>y</sub> [<sub>S</sub> y despised it<sub>x</sub>]]

In (22), the subject NP “someone from every city” still adjoins at the sentential level, however “every city” adjoins to the NP “someone from x”. Of course, now that May has this structure, the obvious question is how to derive the scope relations and quantifier binding effects. Crucial to both of these issues is May’s (1985) definitions of c-command, Government, and his Scope Principle. The definitions of c-command and Government are quite straight forward, and are presented below.

#### **C-command**

A c-commands B iff every maximal projection that dominates A dominates B, and A doesn't dominate B.

#### **Government**

A govern B iff A c-commands B and B c-commands A, and there are no maximal projection boundaries between A and B.

The Scope Principle is a little more complex, but it can be summed up informally as follows. If two QPs are not in a government relation with each other, then scope is dependant on constituency hierarchy. However, for any set of quantifiers that are all governed by one member of that set, any quantifier ordering is possible. For example, take a set of quantifiers A, B, and C, where A governs B and C, then the possible quantifier orderings would be ABC, ACB, CAB, CBA, BAC, and BCA. The scope relation would be dependant on the quantifier order that is chosen.<sup>18</sup>

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<sup>18</sup>This is an informal presentation. May’s more formal definition is as follows. “Let us call a class of occurrences of operators  $\Psi$  a  $\Sigma$ -sequence if and only if for any  $O_i, O_j \in \Psi$ ,  $O_i$  governs  $O_j$ , where . . . members of  $\Sigma$ -sequences are free to take on any type of relative scope relation” (May 1985:34).

In considering the application of the Scope Principle to inverse linking, May relies on his articulation of adjunction structures on which the segments of a maximal projection, such as the segments of the NP in the adjunction structure in (22), are not themselves maximal projections, but only parts thereof. Thus, any element adjoined to some phrase is not dominated by that phrase. What this means for adjunction structures of the form  $[_{XP1} A [_{XP2} \dots]]$ , is that A will always c-command XP, and XP will also c-command A. In addition, since the only node intervening between A and XP are the segments of XP, A governs XP.

The consequence for the QP and the NP in (22), is that “every city” governs “someone from x”. In principle, this means that either scope relation should be available: the inversely linked interpretation or the surface scope interpretation. However, since the NP contains a variable that must be bound by the QP, only the inversely linked interpretation is permitted by May (see May 1985:75, where this aspect of the Scope Principle is fully spelled out).

So, what about surface scope interpretations? As mentioned earlier, unlike May (1977), May (1985) recognizes that he has to account for surface scope interpretations. To get this interpretation, May raises the embedded QP to adjoin to the NP-internal PP rather than to the NP itself. For example, the sentence “At most two senators on every committee voted for the bill,” under the surface scope interpretation where “at most two senators” scopes over “every committee,” would have the representation in (23). (See May 1985:72.)

(23)  $[_S [_{NP} \text{At most two senators } [_{PP1} [\text{every committee}]_x [_{PP2} \text{on } x]]]_y [_S y \text{ voted for the bill}]]$

In (23), constituency hierarchy determines that “At most two senators . . .” has scopes over “every committee.” In this way, May (1985) is able to separately derive both kinds of scope relations for inversely linked constructions. But as has been discussed through-out this paper, being able to derive scope ambi-

guity is not enough. What is important is to explain the lack of certain interpretations through syntactic means. In this area, May's theory fairs quite well.

Consider the lack of surface scope availability, in sentences such as (8) above, repeated as (24).

(24) At most two senators on every committee voted to abolish it.

The sentence in (24) would have the following two possible derivations, according to May.

- (25) a. [<sub>S</sub> [<sub>NP1</sub> [every committee]<sub>x</sub> [<sub>NP2</sub> At least two senators from x]]<sub>y</sub> [<sub>S</sub> y voted to abolish it<sub>x</sub>]]  
 b. [<sub>S</sub> [<sub>NP</sub> At most two senators [<sub>PP1</sub> [every committee]<sub>x</sub> [<sub>PP2</sub> on x]]]<sub>y</sub> [<sub>S</sub> y voted to abolish it<sub>x</sub>]]

As mentioned in section 1, 2, and 3.3, when “every committee” is interpreted as binding the pronoun “it,” the sentence in (24) can only have the inversely linked interpretation. This is exactly what May's structures would predict. Assuming that a QP must c-command a pronoun in order to bind it, only the structure in (25a), the inversely linked representation, would allow “every committee” to c-command “it.” In (25b) the maximal projection NP dominates “every committee” but not the pronoun.<sup>19</sup>

However, even though May can account for the pronoun binding effects, Larson's generalization is still a problem. This is not surprising considering that May (1985) claims to have a counter-example to this generalization. But as we saw in section 3.2, the counter-example is rather weak. Recall that Larson's Generalization maintains that a QP, embedded in the object, cannot scope over the subject unless the object also scopes over the subject. Since May (1985) does not have island restrictions that apply to QR (more on this later), the embedded QP is free to move to a position where it scopes over the subject, while the object can move to adjoin to a phrase below the subject. Yet, even if island constraints were maintained, Larson's generalization would still be out of reach for May's theory. Consider

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<sup>19</sup>Because May is unconcerned with maintaining a Montagovian semantics, binding need not be equated with  $\lambda$ -abstraction, as it was with Larson (1985).

the sentence “Two politicians spy on someone from every city.” May’s account would allow a representation such as in (26).

(26) [<sub>S</sub> [<sub>NP1</sub> [<sub>NP1'</sub> [every city]<sub>x</sub> [<sub>NP2'</sub> someone from x]]<sub>y</sub> [<sub>NP2</sub> Two politicians]<sub>z</sub>]] [<sub>S</sub> z spied on y]]

In (26), “every city” is adjoined to “someone from x”, and this whole object phrase is adjoined to the subject phrase “two politicians.” There are two interesting things about this structure, first “every city” does not move passed the NP island, second “every city” governs both “someone from x” and “two politicians.” According to May’s (1985) Scope Principle, (26) should allow the interpretation where “every city” has scope over the subject “two politicians,” while the object “someone from x” has scope under the subject. Larson’s Generalization is still violated.<sup>20</sup>

### **§3.5 Simplifying May’s Theory and Accounting for Larson’s Generalization.**

Since Larson’s Generalization is a problem for May’s theory, it seems appropriate to discuss some minor changes to May’s (1985) proposal that would allow for an account. While the validity of this generalization is not beyond doubt, (cf. section 3.2 and fn. 14), it will still be useful to see how small alterations to a theory can dramatically affect its descriptive adequacy.

Early in his chapter on inverse linking, May (1985) uses concern about island restrictions to motivate his adjunction structure. Later in the text (May 1985:80), he explicitly denies the notion of

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<sup>20</sup>An alternative to (26), would be a double adjunction structure as in (i) below, where the complex object NP is adjoined sententially along with the subject:

(i) [<sub>S1</sub> [<sub>NP1</sub> [every city]<sub>x</sub> [<sub>NP2</sub> someone from x]]<sub>y</sub> [<sub>S2</sub> [<sub>NP2</sub> Two politicians]<sub>z</sub> [<sub>S3</sub> z spied on y]]]  
 May (1985) actually has a constraint on double adjunction, so (i) is an invalid derivation according to May, and hence not mentioned as a possible derivation in the main text. However, even if (i) were permitted, “every city” still governs both “someone” and “two politicians.” Thus this structure would also violate Larson’s generalization.

islands having any effect on LF movement, proposing a new constraint as a replacement.<sup>21</sup> This constraint involves forbidding double adjunction as represented by the template in (27).

$$(27) [_{XP1} \dots [_{XP2} \dots [_{XP3} \dots ]]]$$

As a result of this restriction, if an argument has already adjoined sententially, then the embedded QP cannot adjoin sentential. Thus, the constraint forces it to adjoin to the NP or PP in which it is embedded. May (1985) suggests that this may be a general constraint on phrase structure, but in the context of the theory, he only needs it to apply to quantifiers (i.e. no two quantifiers can adjoin to the same phrase).<sup>22</sup>

As pointed out by Kayne (1995:19), the prohibition against double adjunction structures can be reduced to a constraint involving asymmetric c-command. For example, May (1985) would not have needed to hypothesize a new constraint if his definition of the Scope Principle were something more akin to Hornstein's definition of scope relations (Hornstein 1995):

**Hornstein-like Scope Principle**

A Quantifier Phrase QP1 scopes over a Quantifier Phrase QP2 iff QP1 asymmetrically c-commands QP2.

With this definition, May's double-adjunction constraint comes for free. Any two QPs adjoined to the same phrase would mutually c-command each other. This means that neither QP would scope over the other. An interpretation would be impossible. The problem is that this definition of the Scope Principle would also predict that May's NP adjunction structure could not account for inverse linking, at least not

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<sup>21</sup>May (1985:80) notes the following to show that extraction from islands is possible via QR: "One case is brought up by van Riemsdijk and Williams (1981), who point out that a question such as *Who knows which pictures of whom Bill bought* allows an interpretation in which whom is paired with who in asking a multiple direct question. Representing this, on the view here, involves extracting from an island, so as to move whom to a higher clause . . ."

<sup>22</sup>The actual phrasing of the constraint is ". . . only one operator can be adjoined per projection level . . ." (May 1985:81).

as long as May kept the same definition of c-command. However, notice that if the definition of c-command were altered slightly, then the NP adjunction structure would get the same scope interpretation as May's original theory would have predicted. Consider the definition below.

**C-command**

A c-commands B if and only if every maximal projection that dominates A dominates B, and A excludes B. (For a similar definition see Kayne 1995.)

A *excludes* B if and only if no segment of A dominates B. (Chomsky 1986:9)

With this new definition of c-command and the new Scope Principle, let's revisit the NP adjunction structure in (25a), repeated below as (27).

(27) [<sub>S</sub> [<sub>NP1</sub> [every committee]<sub>x</sub> [<sub>NP2</sub> At least two senators from x]]<sub>y</sub> [<sub>S</sub> y voted to abolish it<sub>x</sub>]]

In (27), "every committee" still c-commands "at least two senators" and the pronoun in the VP as before. However, with the new c-command relation, "at least two senators" does not c-command "every committee," since a segment of "at least two senators" dominates "every committee." This means that "every committee" has scope over "at least two senators," exactly the same result as in May's original theory.

On the surface, these changes to May's theory seem to simplify the definition of the Scope Principle without changing the descriptive adequacy of the system (at least within the limited domain of the inverse linking data). However, there is more. If movement out of an NP island is forbidden at the level of LF, then this new variation of May's theory can account for Larson's Generalization. With island constraints limiting movement, the only way for a QP embedded in the object to move to a position where it c-commands the subject is for the QP to adjoin to the object NP, and for the object NP to either adjoin to the subject NP, or somewhere above the subject NP. The two possibilities are represented in (28).

- (28) a. [<sub>S</sub> [<sub>NP1</sub> [<sub>NP1'</sub> [every city]<sub>x</sub>] [<sub>NP2'</sub> someone from x]<sub>y</sub>] [<sub>NP2</sub> Two politicians]<sub>z</sub>] [<sub>S</sub> z spied y]]  
 b. [<sub>?</sub> [<sub>NP1'</sub> [every city]<sub>x</sub>] [<sub>NP2'</sub> someone from x]<sub>y</sub>] . . . [<sub>?</sub> . . . [<sub>S</sub> [<sub>NP2</sub> Two politicians]<sub>z</sub>] [<sub>S</sub> z spied y]]]

No matter which option is taken, the object NP will always asymmetrically c-command the subject: in (28a) the subject NP has a segment that dominates the object, and in (28b) there is a maximal projection (whatever the node above S would be) that dominates the subject but not the object. Either way, if the embedded QP raises to a position that asymmetrically c-commands the subject, then the object must also raise and asymmetrically c-command the object.

In summary, with minor adjustments to his analysis, May's (1985) theory is able to account for Larson's Generalization as long as island restrictions apply to Quantifier Raising. The key modification involved in obtaining this result, was to alter the Scope Principle from a definition that involves Government to one that employs asymmetrical c-command.

### §3.6 Is there any need for Government?

May (1985) does provide some evidence in support of his use of Government, at least in terms of his Scope Principle. In light of the possibility of eliminating this notion from May's account, it seems appropriate to review some of the motivations for using this relation.

As noted, in May's original proposal a relative scope interpretation is possible when two QPs c-command each other. In support of this May brings forward cross-binding Bach-Peters type sentences, as in (29), in which both pronouns can be simultaneously construed as bound variables, with a fixed scope interpretation of the quantifiers:

- (29) Some pilot who shot at it hit the navigator of every MIG that chased him. (May 1985:70, example 34)

Higginbotham and May (1981) present a semantic account of these cases in terms of absorbed quantifiers; the account is generalized to all  $n$ -tuples of mutually c-commanding quantifiers in May (1989).<sup>23</sup>

Another argument May presents deals with donkey anaphora. May assumes that a Heim-style, unselective binding mechanism can account for sentences where an indefinite quantifier seems to be interpreted as a universal. For example, the sentence “Everybody that owns a donkey beats it” has an interpretation where it is implied that every donkey is beaten by its owner. Crucial to May's analysis, is that unselective binding can apply only if a variable could not be otherwise interpreted (see May, 1985:75). This is relevant to inverse linking since inverse-linking constructions demonstrate donkey anaphora. For example, in “Every owner of a donkey beats it,” the indefinite phrase “a donkey” is permitted to have a universal interpretation: the interpretation where every donkey is once again beaten by its owner.

May is able to derive this interpretation through his Scope Principle. Recall that May's Scope Principle allows for any ordering of QPs that are in a Government relation. Thus, in a structure such as (31), either “every owner of  $x$ ” can be positioned to scope over “a donkey,” or “a donkey” can be positioned to scope over “every owner of  $x$ ”

$$(31) \quad [{}_S [{}_{NP1} [a \text{ donkey}]_x [{}_{NP2} \text{ Every owner of } x]]_y [{}_S y \text{ beats it}_x]]$$

Normally, only the latter position would be permitted, otherwise the variable “ $x$ ” would not be bound by “a donkey.” However, in the option where “every owner of  $x$ ” precedes “a donkey,” unselective binding is permitted to apply. There is a variable that could not be otherwise interpreted (i.e. “ $x$ ”), and “every” would be in a position where it would scope over the pronoun “it,” the indefinite phrase “a donkey” and

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<sup>23</sup>Conceivably the LF-representation of (29) could one in which the relative clauses are extraposed. If so, the resulting structures would be compatible with the revised proposal. However, as Gueron and May (1984) argue, extraposition is typically undone at LF.

the variable “x.” It is the freedom of positioning created by May’s Scope Principle that derives the proper environment for unselective binding.

This having been said, there is another construction that would allow May to derive the proper environment for unselective binding: namely (32) below.

(32) [<sub>S</sub> Every owner [<sub>PP1</sub> [a donkey]<sub>x</sub> [<sub>PP2</sub> of x]]<sub>y</sub> [<sub>S</sub> y beats it<sub>x</sub>]]

In this construction, “every” once again has scope over “a donkey,” the pronoun “it,” and the variable “x.” Furthermore, the pronoun “it,” if it is represented as a variable, is uninterpretable unless unselective binding is employed. In the end, donkey anaphora can be derived without the intricacies of May’s Scope Principle. Thus, perhaps in this case there is an alternative.

In contrast, there are some phenomena that are easily explained by May’s Government relation, but not by other theories. For example, consider the sentences in (33).

- (33) a. What does somebody from every city despise. (May, 1985:70, example 32)  
 b. What does everybody despise.

(33b) allows for a pair-list answer (i.e. Brad, the local school board, and Jerry, the teachers association).

(33a) does not. On May’s view, the pair-list reading of a question arises when “what” is interpreted as scoping under “every.” Assuming that the subject QP adjoins to the S-phase, and that the *wh*-element is adjoined above the S-phase, then May has a natural explanation for the differences between (33a) and (33b). In (33b), “what” governs “everybody.” However in (33a), the NP to which “every city” is adjoined, blocks “what” from governing “every city” and vice versa. Constituency determines that “what” must scope over “every city.” It is difficult for any other theory to account for the contrast between (33a) and (33b), which makes this lack of the pair-list reading one of the strongest arguments in support of May’s Government definition of the Scope Principle.

### §3.7 Leaving the Eighties.

To summarize, this section reviewed two theories of inverse linking that were developed in the eighties. Although the details are a little dated, the basic properties of the theories are still well motivated by the data. Both theories were not only able to derive the inversely linked interpretation, but also showed how scope interpretation was restricted by (their) syntactic principles. As a result, both May (1985) and Larson (1985) are head and shoulders above the theories reviewed in section 1, and while they are couched within principles and mechanisms that are not wholly compatible with some contemporary approaches to syntax (e.g. the Minimalist approach of Chomsky 1995), their essentials remain viable accounts of inverse linking phenomena. The challenge for more current syntactic theories is to account for the inverse-linking data at least as well as May and Larson did in the mid-eighties. There are some promising beginnings. For instance, Breuning (2001) has suggested that object quantifiers move to adjoin to VP: the only position where they are interpretable. Inverse scope of the subject and object is a side effect of choosing to interpret the subject in its internal VP position, rather than its nominative case checking position higher than the VP. Assuming as Sauerland (2001) does, that QPs embedded in NPs must scope over those NPs for interpretability reasons, Larson's Generalization can be accounted for. If the object NP and the object-embedded QP are adjoined to the VP, then for the subject to be interpreted below the embedded QP, it would have to be interpreted in its VP internal position. This position is also below the NP-object. Thus Larson's generalization holds. However, within the Minimalist framework there still remains the question of how to derive surface scope interpretation of inversely linked constructions without arbitrary stipulation.

Also, there are more general problems with inverse linking that eventually have to be addressed in any syntactic theory of quantifier interpretation. One particularly puzzling difficulty is why with cer-

tain prepositions an inversely linked interpretation is blocked. For example, “A man with every woman likes her” disallows an interpretation where the man can vary for each woman. In addition, “every woman” seems to have trouble binding the pronoun “her.” (See Gabbay & Moravcsik 1974:143, who were the first to note the semantic restriction involved with this preposition.) Why this would be so is unclear, but perhaps it is related to aspects of the internal structure of NPs, and the argument/adjunct distinction.

## **Conclusion**

In this review of inverse linking phenomenon, we have considered various approaches, from the classic accounts of the 1970s and 1980s to more recent proposals. One of our main themes in outlining this history has been to observe how inverse linking has been employed in motivating syntactic explanations for primarily semantic effects. These arguments have taken the form of first accounting for known semantic interpretations through syntactic mechanism, and then explaining the lack of certain interpretations through restrictions derived from the syntactic mechanisms. It is through the execution of arguments of this form that the syntactification of semantic phenomena becomes plausible. Another theme developed in this essay is that inverse linking, along with other phenomena such as weak crossover and antecedent contained deletion, remains central to any syntactic theory which purports to account for logical representation of natural language quantification.

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