Inverse Linking and Extraposition

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Abstract: This squib makes the observation that inverse linking readings are dependent on extraposition of the embedded quantifier to a higher position within the nominal. Evidence comes from cases where there is an additional modifier in the nominal, which indicates whether or not extraposition has taken place; when the PP containing the second quantifier is not extraposed, it does not take wide scope of the embedding quantifier.

Keywords: inverse linking, QR, extraposition, quantifier scope

1 Background

The term *inverse linking* describes the phenomenon whereby a DP that is embedded within a PP takes scope over the DP that seems to contain that PP (see May 1977, Larson 1985, Heim and Kratzer 1998, Sauerland 2005, Kobele 2010; see May and Bale 2006 for an overview). An example of a sentence with a salient inverse linking reading is given in (1), where the relevant interpretation is one where the embedded DP *every Factory regular* (call this DP1) takes wide scope with respect to *a picture* (DP2); that is, the sentence has a meaning paraphrasable as 'Every Factory regular is such that Warhol painted a picture of them', and it is compatible with a situation where Warhol painted pictures of numerous different individuals who were regulars at his Factory studio. Giving DP2 embedded scope would derive the interpretation where Warhol painted a single picture that depicted all the Factory-goers at once, a collective interpretation of sorts (the details of which I will ignore for the remainder of this squib).

(1) Warhol painted a picture of every Factory regular. $\forall > \exists$

The question that previous work has sought to address is how this inverse linking reading is derived. This is of interest since most analyses of the surface order of (1) take the PP to be a complement to the noun *picture*, and hence within the c-command domain of the indefinite determiner α; on the widely held assumption that the scope of a quantifier is its c-command domain, this makes inverse linking an instance of *inverse scope.* The proper analysis of inverse linking thus speaks directly to theories of inverse scope and scope-taking more generally.

In his original analysis, May (1977) argued that inverse linking readings are derived by Quantifier Raising (QR), an LF movement rule that moves DP1 to an IP-adjoined position from which it may c-command and hence scope over DP2. This QR rule is taken to be broadly similar to the one that May invokes to derive inverse scope for sentences like *Someone likes everyone*, where an object scopes over the subject. However, Larson (1985) notes a problem for this

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account, observing that it predicts that DP1 should be able to scope over additional higher quantifiers, for instance, the subject (DP3); that is, it predicts that an example like (2) should have a reading corresponding to the paraphrase 'Every Factory regular is such that two famous artists painted a picture of them'. But (2) and similar examples like it lack this "split scope" interpretation. May and Bale (2006) call this *Larson's Generalization.*[1]

(2) Two famous artists painted a picture of every Factory regular. $*\forall > 2 > \exists$

A number of different analyses have been proposed to account for Larson's Generalization. Larson (1985) and Kobele (2010) propose that inverse linking involves the formation of a complex quantifier, utilizing additional machinery to get the semantics to work accordingly, and the machinery is such that it does not lead us to expect the split scope reading to be possible in general (i.e., there is no QR of DP1 to an IP-adjoined position). May and Bale (2006) revive the QR-based approach proposed in May 1977, 1985 by appealing to the islandhood of NPs, arguing that split scope readings are absent because DP1 simply cannot leave DP2.

Although they are quite distinct, these analyses are united in assuming that there is no role for overt syntax in deriving inverse linking; rather, they all invoke QR or equivalent mechanisms to get the inverse scope readings. In this squib, I argue that this is on the wrong track: although movement is indeed required to derive inverse linking, what is required is *overt* movement, and not QR or any other covert or purely semantic mechanisms (cf. Kayne 1998). As I will show, surface structure has more of a role to play in determining inverse linking than has been recognized up to now.

2 Inverse Linking and Additional Modifiers

My starting point here is the new observation that the availability of inverse linking readings is sometimes conditioned by the order of the PP containing DP1 (call this PP1) and other postnominal material within DP2.[2] Consider the examples in (3). (3a) is a standard case where DP1 is contained in a PP complement to the head noun, where

[1] But see Neeleman and Van de Koot 2009 for relevant remarks about sentences involving three quantifiers.

[2] Quite late in the review process, it was brought to my attention by Klaus Abels (pers. comm.) that a similar observation about effects of additional modifiers on inverse linking is made by Zimmermann (2003), who notes an effect whereby a universal quantifier in an adjunct PP can only take wide scope if it is right-peripheral. (The examples in (i) have been adapted slightly from Zimmermann 2003:474.)

(i) a. One person with good manners from every province was invited. $\forall > \exists$

b. #One person from every province with good manners was invited. $*\forall > \exists$

the inverse linking reading is readily available. (3b) is identical except that DP2 also contains a PP modifier, *by Warhol*, which occurs to the right of PP1, and yet in this example the inverse linking reading is unavailable, contrasting clearly with (3a). However, it is not the mere presence of a PP modifier that removes the availability of an inverse linking reading, because the reading becomes available once more if the PP complement occurs in an extraposed position to the right of the modifier, as in (3c).

(3) a. I saw a picture of every Factory regular. $\forall > \exists$
b. I saw a picture of every Factory regular by Warhol. $*\forall > \exists$
c. I saw a picture by Warhol of every Factory regular. $\forall > \exists$

This effect of PP order is systematic, as demonstrated for a few different configurations in (4)–(6).[3] The (c) examples are not always perfect, but their inverse linking readings are always much more accessible than those of the (b) counterparts. Judgments on these examples seem to be stable, perhaps surprisingly so given the variable nature of scope judgments.

(4) a. I've met at least one supporter of every English Premier League team. $\forall > \exists$
b. I've met at least one supporter of every English Premier League team from China. $*\forall > \exists$
c. I've met at least one supporter from China of every English Premier League team. $\forall > \exists$

(5) a. I've read a summary of each of Chomsky's books. $\forall > \exists$
b. #I've read a summary of each of Chomsky's books by Neil Smith. $*\forall > \exists$
c. I've read a summary by Neil Smith of each of Chomsky's books. $\forall > \exists$

Zimmermann proposes a non-QR-based analysis of this effect whereby the PP that ends up taking wide scope is a small clause predicate and some operator higher in the DP derives the right reading. However, Zimmermann does not consider cases where the DP1 is most likely an argument of the higher noun (this is surely the case with the *supporter* examples in (4) at the very least), which are unlikely to submit to his analysis, and he also does not discuss the effect of extraposition of such PPs on their scope. I conclude that the observations here go beyond Zimmermann's, and they do not follow in an obvious way from his analysis.

[3] Here I focus on pairs of quantifiers where DP1 is a quantifier that would normally scope over DP2 by means of QR—that is, where inverse scope cannot be obtained by in-situ scoping mechanisms and the inverse scope reading would not be obtained in configurations associated with scope freezing (e.g., as two objects of a ditransitive, when separated by a finite clause boundary).

(6) a. I've heard a cover of every David Bowie single. $\forall > \exists$
b. I've heard a cover of every David Bowie single by The Melvins. $*\forall > \exists$
c. I've heard a cover by The Melvins of every David Bowie single. $\forall > \exists$

The contrast between the (b) and (c) examples indicates that word order has some role to play in determining the availability of inverse linking readings.[4] This is contrary to what is expected by the approaches to inverse linking described above, which derive inverse linking by covert movement. If anything, the opposite pattern would be expected: if the (c) orders were derived by extraposition of PP1 to an adjoined position within the nominal, then the extraposed PP might be expected to be an island for subsequent QR of DP1 to its scope position, wherever that may be.

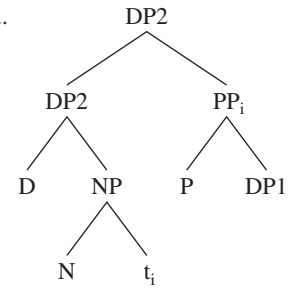
What the above pattern suggests is that extraposition of PP1 is what conditions the availability of inverse linking readings, since the order of PP1 with respect to PP2 is the only obvious difference between the (b) and (c) examples. If the modifiers are analyzed as NP-adjuncts,[5] then the order in the (b) examples should diagnose a low position for PP1 and the order in the (c) examples should diagnose a high DP-adjoined position for PP1. As for the (a) examples with just one PP, these are in principle compatible with an analysis whereby PP1 has been extraposed string-vacuously to a DP-adjoined position, and this extraposition must be optional since the inverse linking reading is not forced. So, if it is extraposition that licenses inverse linking readings, it could be that the only difference between the (a) examples and the (c) examples is that word order allows us to "see" the effect on word order. Such an extraposition-based analysis makes sense if scope is determined by hierarchy: the landing site of the extraposed constituent can be analyzed as being located above the scope-taking determiner of DP2, either in a DP-external position or in some high DP-adjoined position within the nominal.[6] Simplified versions of these two options are diagrammed in (7).

[4] The judgments here are my own, and they have been confirmed by upward of 20 native speaker linguists, who all get the core contrasts. A reviewer wonders whether the contrasts are as strong as I report here, noting that the contrasts are less clear for their nonnative English. The analysis I outline below leaves some wiggle room to account for noise in the judgments; see footnote 10.

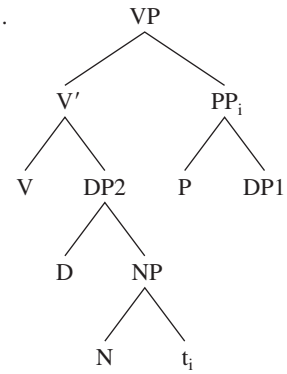
[5] I exclude the possibility of analyzing PP modifiers as DP adjuncts because PP modifiers contribute to the restriction of the quantification introduced by D. See Partee 1976.

[6] A reviewer asks whether there is independent evidence to indicate that a rightward-displaced quantifier should take wide scope with respect to other operators in the c-command domain of its derived position. Evidence that extraposing a constituent gives it wide scope is to be found in Williams 1974, Taraldsen 1981, Culicover and Rochemont 1990, Fox and Nissenbaum 1999, Fox 2002, and Reeve and Hicks 2017. Arguably, some of the effects described

(7) a.



b.



If we follow Pesetsky (1995) in assuming that PPs are transparent for c-command,[7] then in both configurations DP1 will c-command some segment of DP2, and so we may expect DP1 to scope over DP2, as is required for inverse linking. We can quickly narrow our analytical options by considering examples such as (8) where the DP-external adjunction analysis in (7b) is not possible: when DP2 is in Spec,TP, extraposing PP1 to a DP-external position would put it in a postverbal position and so would be incompatible with the observed word order. The pair in (9) shows that the key contrast between cases with visible

by Kayne (1998) support this point too, depending on one's understanding of the term *extraposition* and of rightward processes more generally. For Kayne, rightward movement is derived by a combination of two leftward movements, and he discusses cases involving verb particles where a negative quantifier is able to take wide scope when it occurs to the right of the particle. If the mechanisms involved in those derivations are the same as those involved in regular extraposition, then Kayne's effects are of a piece with those showing effects of extraposition on scope. However, I do not know of a thorough Kaynean treatment of the scope effects described in those works.

[7] If we decided to jettison this assumption, maintaining an extraposition-based analysis of the facts above would require invoking DP-extraposition from the complement of P, where the ban on P-stranding under extraposition had a partially linear explanation (see Drummond, Hornstein, and Lasnik 2010 for one suitable proposal).

DP-internal extraposition and without it is maintained in the subject position as well.[8]

(8) At least one supporter of every English Premier League team attended the match. $\forall > \exists$

(9) a. At least one supporter of every English Premier League team from China attended the match. $*\forall > \exists$

b. At least one supporter from China of every English Premier League team attended the match. $?\forall > \exists$

Thus, the fact that (8) and indeed (9b) have the inverse linking reading indicates that DP-external extraposition should be sufficient for deriving an inverse linking reading, and that the extraposition involved is not necessarily extraposition to VP.[9] This does not rule out the possibility that some inverse scope readings are derived by extraposition to VP, but at least it indicates that extraposition to VP will probably not prove sufficient to account for the full range of data.[10]

An interesting wrinkle in the empirical picture appears when we consider the effect of relative clauses on inverse linking readings. While placing a PP modifier to the right of DP1 removes the inverse linking reading, placing a relative clause to its right does not always

[8] Thanks to an anonymous reviewer for pressing the importance of showing that this effect also obtains in the subject position. Admittedly, the inverse linking reading is not quite as clear as it is for (8) and the (c) examples in (4)–(6), but (9a) clearly contrasts with (9b). I presume the markedness of (9b) has something to do with the information structure of extraposition and its relationship to the topicality of the subject.

[9] An additional empirical issue that is often mentioned in discussion of inverse linking, the significance of which was pointed out by an anonymous reviewer, is the fact that the same embedded quantifiers can also bind pronouns from within the containing nominal, as in (i).

(i) Someone from [every city]$_i$ hates it$_i$.

Such readings would seem to require extraposition right out of the containing nominal on the assumption that variable binding requires c-command, and so it might cause trouble for the analysis here. There are two reasons not to be troubled by this issue. First, high-adjoined quantifiers seem to c-command outside of their containing category in other scenarios, such as with possessors (Kayne 1994). Second, Barker (2012) notes that the claim that variable binding requires c-command is probably too strong more generally. For these reasons, I leave a full discussion of the variable binding data for another time.

[10] This ambiguity might have a role to play in accounting for the variability with the judgments that was mentioned in footnote 4 (and attributed to a reviewer). For the crucial cases involving two PPs, one potential analysis I have not ruled out is one where both the PP containing DP1 and the PP that nominally marks the right edge are extraposed to VP-adjunction positions, a configuration that could potentially derive a wider range of inverse linking readings than I described as being available above. I believe this is not a serious problem, as there are reasons to believe that multiple extraposition is not generally possible in English (see Guéron and May 1984 and Larson and May 1990 for relevant discussion), but the matter warrants a more thorough investigation, particularly in light of the fact that potential cases of multiple extraposition have been noted for other languages such as Dutch (De Vries 2002:249).

have this effect, as example (10) shows. The locative adjunct *in the letters pages* is construed as modifying the matrix VP, thus controlling for extraposition of the relative clause out of the DP.

(10) *Private Eye* will always publish at least one picture of every politician that makes him look foolish in the letters pages.
$\forall > \exists$

This cements the claim made above that it is nothing about adding a modifier that restricts the inverse linking interpretation, since the relative clauses make a semantic contribution that is similar to that of PP modifiers. But why do they differ with respect to inverse scope? An answer is provided by the raising analysis of relative clauses, as in Kayne 1994 and much subsequent work. Such works argue that relative clauses may be derived by raising of the head nominal from the gap position within the relative clause; although the implementations in the literature differ in how they analyze the phrase-structural relation between the head nominal and the relative, they are united by the common assumption that the head noun starts out in the relative. Following Bianchi (1999), I furthermore assume that the nominal projection that is raised from within the relative may be large enough to contain quantificational items such as numerals; that this is possible is supported by the fact that a numeral on the head NP may scope below a quantifier located within the relative (Bianchi 1999).

(11) I phoned the two patients that every doctor will examine tomorrow.
$\forall > 2$

If the relativized nominal can contain the projection hosting a numeral, then it should be possible to extrapose a PP complement to a position above that numeral *prior to relativization*; that is, the rightward position of the relative with respect to the head nominal is derived by leftward movement of that nominal, rather than by right-adjunction of the relative. Extraposing the PP and then fronting the nominal projection containing that PP would derive the inverse linking reading in (10), and it would allow us to maintain the claim that inverse linking readings are derived by extraposition.

One other issue to address, which was raised by a reviewer, is that the present account does not speak to the matter of how to explain Haddock's Puzzle (Haddock 1987, Champollion and Sauerland 2011), which is the effect of restrictors on the interpretation of inverse linking sentences: (12) means that every basket that contains an apple contains a rotten apple, not that all baskets contain rotten apples.

(12) An apple in every basket is rotten.

However, I believe the explanation for this restrictor effect must lie elsewhere, as it is more general than inverse linking. To see this, consider the pair of sentences in (13). (13a) is provided by Champollion and Sauerland (2011), and they note that it is true in the context given by the picture in (14) (also from their paper). The observation

here is that the same holds with the sentence in (13b), whose structure is different.

(13) a. The circle in the square is white.
b. The circle that's in the square is white.

(14) 

The key point is that neither of these sentences gives rise to a presupposition that there is only one square in the context described, and so neither gives rise to a presupposition failure in the context of (14). This means that they show the same effect on the restrictor that is seen in (12) (narrowing of the restriction of the embedded nominal), and so are within the purview of Haddock's Puzzle. However, in (13b) the lower nominal is embedded in a relative clause, and relative clauses are typically scope islands for strong quantifiers; that is to say, (12) contrasts with (15) in that (15) lacks the inverse linking reading (and is strange as a result). This is unsurprising for an extraposition analysis, since relative clauses are islands for extraposition; see (16).

(15) #An apple that's in every basket is rotten.

(16) a. I heard [the language you learned [in the Western Isles]] yesterday.
b. *I heard [the language you learned t_i] yesterday [in the Western Isles]$_i$.

The fact that the domain-restricting effect of Haddock's Puzzle effects is seen in contexts where inverse linking is not available constitutes evidence for treating Haddock's Puzzle effects as coming about via mechanisms distinct from those that derive inverse linking. The fact that extraposition gives no means by which to understand the domain restriction effect is thus not a problem for my analysis of inverse linking.

3 Outlook

In the foregoing discussion, I have argued that restrictions on the availability of inverse linking readings are best explained if these readings are derived by extraposition. What about QR? If QR were available to derive inverse linking readings, then none of the observed restrictions would be expected: Larson's Generalization would be unexpected,[11] as Larson (1985) originally noted, and the effect of modi-

[11] Although the foregoing discussion takes Larson's Generalization as a settled result, there is clearly more to investigate on the empirical side. An anonymous reviewer makes the intriguing observation that Larson's Generalization, in their view, is in fact violated in cases with other kinds of subject quantifiers, such as those in (i).

fiers noted above would not be expected either. We might conclude, then, that QR is not capable of giving an embedded quantifier scope over a c-commanding quantifier within DP. This ought not to be surprising in the wider context of inverse scope facts. While QR can clearly reverse the scope of two quantifier arguments, there are many situations where it cannot—for instance, in double object constructions (Bruening 2001) and various other constructions where the higher quantifier unambiguously c-commands the lower one (Elliott and Thoms 2015). QR is clearly able to give objects scope over subjects; it is only able to do so when the subject reconstructs (Hornstein 1995), even though it can be shown with independent evidence that QR can give object DPs high scope above IP-level modifiers (Johnson 2000). Taken together, these facts suggest that the characterization of QR as a free adjunction rule is on the wrong track, and that to the extent that it is available at all, it is restricted by the presence of other intervening nominals.

One other point to take away from this discussion is that the mechanisms that have been posited in the literature for deriving "complex quantifiers" should either be excluded from the theory or restricted from applying within DP. Kobele (2010) shows that inverse linking readings can be derived with the compositional rule of function composition, which has been proposed independently in the literature. But if this rule were indeed part of the grammar, then we would not expect these readings to be unavailable in the cases with additional modifiers noted above. The general picture that emerges, consonant with work such as Kayne's (1998) and Fox and Nissenbaum's (1999), is one where there is more isomorphism between surface syntax and interpre-

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(i) a. Some artist or other will paint a picture of every participant.
$\forall >$ some artist $>$ a picture
b. Many artists painted a picture of each seascape.
$\forall >$ many artists $>$ a picture

The reviewer also notes that split scope is even available with the same kind of subject quantifier in sentences such as (ii).

(ii) Two representatives greeted a delegate from every foreign country.
$\forall > 2 > \exists$

The reviewer claims that the difference between the good cases and Larson's (2) is that DP2 (the container DP headed by *a* in (ia) and (ib)) may be construed as an event variable once DP1 has been extracted to a position where it may scope over the subject DP3; constraints applying to extraction from DP that depend on the construal of that DP (for instance, those discussed by Davies and Dubinsky (2003)) may thus serve to derive the full range of data. This is compatible with an analysis like mine where the extraction of DP1 is extraposition; that is, the PP containing DP1 would be extraposed to some vP-adjoined position where it would scope over the reconstructed subject (Hornstein 1995, Fox 2000). This analysis does not introduce any additional complications for my analysis of the modifier effect, as far as I can tell, since extraposition for inverse linking may be entirely nominal-internal, as noted above, and so not subject to any constraints on subextraction. Whether the reviewer's analysis of these exceptions to Larson's Generalization is the correct one must be left for another occasion.

tation than has been recognized, at least once we take into account the role of extraposition.

There are many more issues that require resolution here. One issue is how the structures I have sketched are to be interpreted semantically: at a first pass, it seems that interpreting an extraposed quantifier that is DP-adjoined will require some type-shifting (see, e.g., Büring 2001[12]). An anonymous reviewer makes the insightful observation that it is possible that inverse linking still crucially requires QR of both DP1 and DP2, and notes that the role of extraposition could be to move DP1 to an "escape hatch" from which it may undergo QR to a higher scope position.[13] As for the specifics of the role of extraposition, I have sketched a quite simplified view of extraposition as right-adjunction, with fairly conservative assumptions about DP structure and clause structure. It may prove fruitful to reassess these simplifications in subsequent work; to mention one briefly, the analysis just sketched is not readily recast in the manner of Kayne 1998 (where rightward movement is analyzed in terms of leftward remnant movement) in conjunction with Kayne's (1994) view of antisymmetry.[14] Finally, a reviewer notes that inverse linking readings are typically not available when downward monotone quantifiers are involved.[15]

[12] Thanks to a reviewer for directing me to this work.

[13] The same reviewer also notes that such an analysis could bring inverse linking into the purview of a Superiority-based account of QR and its restrictions (as in Bruening 2001); as I understand it, extraposition would allow circumvention of Superiority effects because the extraposition step of movement would not be driven by the same feature as QR. Interesting though this may be, the Superiority-based account of scope freezing has been shown to have a large number of problems (Larson, Antonyuk, and Liu 2019), so I do not pursue it further here.

[14] A Kaynean reanalysis of extraposition, outlined here, can capture the basic facts discussed in the main text on an analysis where the lowest PP is moved to some Spec,XP position above the projection hosting the indefinite determiner and the remnant DP is moved to some higher Spec,YP, as in (i). Reconstructing the remnant DP ought to derive the correct scope configuration within the nominal.

(i) $[_{YP}\ [_{DP_i}$ a picture t_j by Warhol] Y $[_{XP}\ [_{PP_j}$ of every Factory regular] X $t_i]]$

The issue with this analysis is that the fronted PP would not occupy the highest specifier in the nominal, and so it would not c-command out of that nominal even on Kayne's (1994) definition of c-command (which predicts that the highest specifier of a phrase c-commands what that phrase itself c-commands). This may seem to present a problem in light of the variable binding facts discussed briefly in footnote 9. A fuller exploration of the nature of "almost c-command" is required to assess properly what the implications are here.

[15] The reviewer makes this intriguing observation on the basis of examples such as (ia–b).

(i) a. #One person from no major city visited Jo.
b. #No one from every city visited Jo.

These sentences lack the inverse linking readings and are hard to interpret at all. This is particularly intriguing given that a number of the scope effects that Kayne (1998) attributes to overt movement involve negative quantifiers.

The proper analysis of cases such as these, and the broader question of why different determiners might show different scope interactions in general, must also be put off for another time. What seems clear is that there are many empirical issues that remain to be explored in the domain of inverse linking and quantificational interactions within DP.

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I do not fully understand this restriction, but I suspect that there are a number of causal factors to consider relating to the decomposition of negative quantifiers and their kin. One common analysis of negative quantifiers (e.g., Penka 2011) is that they are actually polarity-sensitive indefinites (i.e., negative polarity items) that need to take scope under a covert sentential negative. If this were the case, then the absence of an inverse linking reading for (ib) would reduce to the Immediate Scope Constraint (Linebarger 1980), since giving the universal wide scope with respect to the indefinite would disrupt the indefinite's licensing by negation. This does not generalize in an obvious way to (ia), but I note that in some cases negative quantifiers do seem to take sentential scope from positions within a containing nominal. The following examples (from Google searches) are marginally acceptable with wide scope for negation, and they both involve a bare indefinite as the containing quantifier.

(ii) a. People from none of the provinces or part of the country should have the feeling that people of Pakistan do not care [about] them. (https://dawn.com/news/1482173)

b. People from none of the other five camps returned. (https://indianexpress.com/article/north-east-india/tripura/162-bru-idps-return-from-tripuras-transit-camps-to-mizoram-on-first-day-of-repatriation-6050867)

This is a configuration that is known to also be conducive to the embedding of NPIs within subject quantifiers, as in *Tickets to any of the afternoon concerts were not available* (de Swart 1998:184). Clearly, this matter warrants more careful investigation.

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