

Distributivity and modality: where *each* may go, *every* can't follow*

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Abstract Von Stechow and Iatridou (2003) observed a striking pattern of scopal non-interaction between phrases headed by strong quantifiers like *every* and epistemically interpreted modal auxiliaries. Tancredi (2007) and Huitink (2008) observed that von Stechow and Iatridou's proposed constraint, the Epistemic Containment Principle (ECP), does not apply uniformly: it does not apply to strong quantifiers headed by *each*. We consider the ECP effect in light of the differential behavior of *each* and *every* in the environment of *wh*-, negative, and generic operators as described by Beghelli and Stowell (1997). Assuming that epistemic and root modals merge at two different syntactic heights (e.g. Cinque 1999) and that modals may act as unselective binders (Heim 1982), we extend Beghelli and Stowell's topological approach to quantifier scope interactions in order to formulate a novel syntactic account of the ECP.

Keywords: distributivity, modality, quantification, epistemic containment, scope interaction

1 Epistemic containment

Quantificational expressions such as quantificational noun phrases (QNP) are typically assumed to get their relative scope by means of a syntactic displacement operation such as the quantifier rule (QR; May 1977, 1985). Upon postulating such a mechanism, a question immediately arises as to whether there are constraints that limit its operation, and if so, how.

At least two different kinds of approaches to this question can be identified. First, it is usually agreed that the displacement of QNPs is syntactic in nature,¹ and is subject to syntactic restrictions on movement/displacement operations (e.g. island effects, clause boundedness, weak cross-over). Acknowledging this, some

* We would like to thank the audience at SALT, as well as at the Canadian Linguistics Association annual meeting in 2010, and the audience at the first Mid-Atlantic Colloquium for Studies in Meaning in 2010. In addition, we benefited greatly from conversations with Valentine Hacquard, Jeffrey Lidz, Alexander Williams, Anna Szabolcsi, Vincent Homer, Lucas Champollion, Kristen Syrett, and Eytan Zweig.

¹ Although see Jacobson 1999, 2002 for a differing view.

theorists contend that the phenomenon of scope-taking meant to be captured by QR is in effect epiphenomenal on a conception of derivational syntax where movement is feature-driven (Hornstein 1995; Beghelli 1997). In contrast, other researchers advance semantic, or LF, constraints to limit the yield of QR. Such constraints can be found, for instance, in the work of Fox (2000).

The current investigation focuses on cases where, under an otherwise unrestricted theory of QR, the expected scopal interactions between quantificational expressions of different syntactic/semantic categories do not obtain. Specifically, we are concerned with the scopal patterns involving QNPs and epistemic modal expressions. Our starting point is an observation by von Stechow and Iatridou (2003) that strong QNPs like *every student* cannot QR above epistemic modals (EMs). In sentences like (1a) and (1b) that contain an EM and a subject position QNP, only the inverse scope reading of these expressions obtains:

- (1) a. # Every student in this room might be the smartest student.
#MIGHT > EVERY, *EVERY > MIGHT
- b. Every student in this room might be tall.
MIGHT > EVERY, *EVERY > MIGHT

The predicate in (1a), *be the smartest student*, is singly-satisfiable: in any given context, only one individual can be the denotatum of such an expression. What puzzled F&I is that (1a) can only be read on the bizarre reading where all the relevant students are asserted to be the smartest student; a less bizarre reading, where what is predicated is that each relevant individual could be the smartest student (we just haven't tested them yet), is unavailable. (1b) has as its only licit reading one in which it is possible that all of the students are tall.

This pattern is unexpected given assumptions about the relative unrestrictiveness of QR. Further, F&I assume that QNPs and (non-epistemic) modals regularly and freely interact, offering the following example involving the (deontically-interpreted) modal *must*:

- (2) Most of our students must get outside funding —
 - a. for the department budget to work out.
 - b. the others have already been given university fellowships.

They attribute the existence of two readings for (2) to a difference in scope: in line with the paraphrase in (2a), one reading scopes *most of our students* below *must* and imposes a general obligation that a certain proportion of the students get funding. In contrast, the wide scope reading of *most*, brought out by the paraphrase in (2b), imposes an obligation on a particular subset of students, namely those that did not get university fellowships.

To account for the pattern found in (1a) and (1b) above, F&I offer the ECP, stated as a condition on the application of QR.

(3) **Epistemic Containment Principle (ECP)**

A strong QP cannot bind its trace across an EM (a condition on QR).

Such a constraint raises immediate questions. First, why does it apply only to strong quantifiers and epistemic modals? And why should a syntactic operation like QR make reference to the purely semantic notion of epistemicity, which does not obviously correspond to any syntactic category?² A more pressing issue is that the constraint does not apply uniformly to all strong quantifiers: as Tancredi (2007) and Huitink (2009) have observed, it does not apply to QNPs headed by *each*. Reformulating the ECP, then, as a semantic as opposed to syntactic constraint faces immediate challenges.

Tancredi supposed that the relevant generalization to explain the failure of *every*-QNPs to take scope over an EM was related to the notions of subjective versus objective modality (Lyons 1977), namely that such QNPs are restricted from taking such scope when the epistemic modal is interpreted subjectively.³ We cannot consider this approach in any detail here, as adequate tests for subjective versus objective modality are difficult to assess.⁴

Consistent with Beghelli's (1997) and Beghelli and Stowell (1997)'s analysis of *each*- and *every*-QNPs in the environment of negation, *wh*-, and GEN, we will suggest that the differential behavior of *each* and *every* in the environment of EMs

2 EMs come in the form of modal auxiliaries, as already seen, but also as main verbs like *need to* and *have to*. Neither of these forms excludes either flavors of modality, e.g. deontics. The same issues arise for reference to strong quantifiers, assuming a semantic definition of quantifier strength like that of Barwise & Cooper 1981.

3 On the ability of "D-linked" quantifiers like *each* being able to take wide scope, the claim is that here the modal is interpreted metaphysically. We will not address this complicated issue here.

4 We conducted two truth value judgment tasks with naive subjects that attempted to test this claim, namely whether the ECP effect can be obviated when one 'forces' a modal like *might* to be interpreted objectively versus subjectively. We presented participants with a story read by a woman, followed by a target sentence spoken by a man. The task was to decide whether they thought the man's comment was right or correct given the story. Tancredi offers the possibility of at least encouraging an objective interpretation by prefixing an expression such as 'Objectively speaking' to the front of a target sentence; we attempted this, as well as (intuitive) manipulation of whether it was the speaker's or the speaker plus some larger community's evidence that was relevant to evaluating the modal claim. On sentences with *every*-QNPs and epistemic modals, participants overwhelmingly rejected the target sentence when the inverse scope reading was false (regardless of whether it appeared with 'Objectively speaking' and a more 'objective' context), while the wide scope reading (if available) was true. Tancredi admits that it is difficult to 'force' objective readings, but in the absence of an explicit theory of subjective versus objective modality, we cannot find evidence for or against such an account of the ECP effect. For these reasons, we also do not consider Huitink's 2009 analysis, which also relies on the subjective/objective status of the modal.

is syntactic in nature. Under this analysis, all of these operators have the ability to bind (the set variable introduced by) *every*-QNP⁵. In this we follow Heim (1982) and Portner (2009), who suggest that modals, like quantificational adverbs, can bind free variables. The only further assumption our account requires is that different modals (epistemic and root) merge at different syntactic heights, an assumption that has been widely argued for independent of the current work (see e.g. Jackendoff 1972, Piccolo 1990, Cinque 1999, Butler 2003, and Hacquard 2006).

In the next section, we review various data from the literature that QNPs headed by the strong quantifiers *each* and *every* interact differentially with various other quantificational expressions. Then, we show how this pattern extends quite naturally to the environment of epistemic modals. Following this, we detail explicitly how a topological approach to quantifier scope can account for the ECP effect, and demonstrate that it makes the right predictions with respect to subject/object and epistemic/root asymmetries.

2 Non-uniform containment

F&I's account of the lack of interaction between EMs and QNPs like *every* in terms of the ECP only stands as stated if it applies uniformly to all strong quantifiers. In this section, we briefly consider tests for strong quantifiers, showing that both *each* and *every* satisfy these tests. Yet, the ECP does not obtain with *each*-QNPs, thus casting doubt on the ECP as a viable grammatical constraint.

Under Barwise and Cooper's (1981) definition of quantifier strength, a strong quantifier is one which exhaustively considers the members of the set it lives on. This can readily be tested by embedding quantifiers in the template *D N is a N/are Ns*, such that a quantifier is judged strong if its embedding in this frame yields either a tautology or a contradiction under all possible models; the quantifier is considered weak otherwise. Both *each* and *every* are strong quantifiers by this test, e.g. both (4a) and (4b) are always true.

- (4) a. Every gnu is a gnu.
b. Each gnu is a gnu.

The labels strong and weak originate with Milsark (1977), who draws the distinction on the basis of a quantifier's ability to figure in a *there*-existential construction. Strong quantifiers, such as *every*, cannot figure in such constructions (5a), whereas weak quantifiers like *some* can (5b). Clearly, *each* again patterns with *every* (5c).

- (5) a. * There is every boy in the kitchen.

⁵ We explain the notion of 'set variable' below.

- b. There is some boy in the kitchen.
- c. * There is each boy in the kitchen.

However, in the environment of EMs, the differential behavior of *each* and *every* is evident. Consider a scenario in which there are 5 girls, 2 of whom it is absolutely certain have kissed John, and 3 of whom it is absolutely certain have not kissed him. Suppose further that we really don't know, for any one of the girls, whether she was one of the girls that kissed John or not. Now consider the sentences in (6a) and (6b).⁶

- (6) a. Every girl *might_{epi}* have kissed John.
 ?EVERY > MIGHT, MIGHT > EVERY
- b. Each girl *might_{epi}* have kissed John.
 EACH > MIGHT, ?MIGHT > EACH

Here, (6a) can readily be judged to have an inverse scope reading of the modal, but cannot yield a surface scope reading of the sentence (the ECP effect). Turning to (6b), however, we find that the QNP headed by *each* can take widest scope here, which is not predicted by the ECP as stated.⁷

In the next section, we show how this asymmetry between *each*- and *every*-QNP parallels that found in a number of other environments. We then show how B&S account for the differential behavior of these expressions in terms of a topological approach to quantifier scope-taking, and then, in §3 we extend B&S's account so that it can account for the ECP effect.

2.1 Other asymmetries

Beghelli & Stowell (1997), among others, have identified a number of environments in which *each* and *every* behave differently in the scope of certain operators, namely negation, *wh*-, and, crucially for our purposes, GEN. The main contrast is whether (like *each*) the QNP necessarily distributes or fails to (like *every*).

First, B&S pointed out a distinction in acceptability when the quantificational expressions occur in object position, when both are within the scope of negation. In (7a) and (7b), the sentence involving *each* is degraded as compared to its counterpart with *every*.⁸

⁶ We have subscripted *might* with *epi* in order to indicate unambiguously that this modal's flavor is to be read as epistemic, not as metaphysical (see Condoravdi 2001 for discussion of this distinction).

⁷ It appears that not all native speakers of American English agree with these judgments, which may be due to dialectal variation. Our experience has been that the people who agree with the judgments just reported also agree with the relevant ones presented in the following sections, while those who disagree seem to do so systematically as well. We take the fact that the judgments are systematic as a welcome result, but have nothing to say about the variation here; we consider it in ongoing experimental research.

⁸ We discuss cases with negation in greater detail below.

- (7) a. John didn't read every book.
 b. ? John didn't read each book.

(7a) is naturally read as compatible with John's having read some of the books (just not all of them), while (7b) is odd as it appears to attribute to each book the property of John's not having read it (namely, he read none of them). The *every*-QNP remains within the scope of negation, while the *each*-QNP scopes out.

Turning to the *wh*-operators, B&S further note that, as May (1977) pointed out, *each* and *every* differ with respect to their licensing of pair-list answers to *wh*-questions. That is, a question with *each* in object position suggests such an answer, whereas the same structure with *every* does not. In (8a), the only answer invited is one which specifies who exactly read all of the relevant books, whereas (8b) it is requested to know, for each book, who read that book:

- (8) a. Who read every book?
 b. Who read each book?

As above with negation, it appears that the *each*-QNP can scope above the *wh*-operator, while the *every*-QNP cannot.

Lastly, B&S point out that while *every* is readily acceptable for making generic statements, *each* is not:

- (9) a. Every dog has a tail.
 b. ? Each dog has a tail.

(9a) can be paraphrased as *it is generally the case that, if x is a dog, then x has a tail*, whereas (9b) is more naturally paraphrased as *for each of these dogs x, it is generally the case that x has a tail*, which is odd.

A further example can help explicate the pattern with genericity. B&S provide the following scenario and pair of sentences: Suppose that, after 3 decades of studying lexical semantics, John has made a startling discovery:

- (10) a. Every language has over twenty color words.
 b. ? Each language has over twenty color words.

The relevant contrast between (10a) and (10b) concerns whether they can be read as generic statements about languages beyond John's particular sample: (10a) can be read as signifying that the evidence from that sample is taken to be sufficient to generalize about the number of color words cross-linguistically, while (10b) is only naturally read as a generalization about the particular sample, with no intention to generalize beyond it.

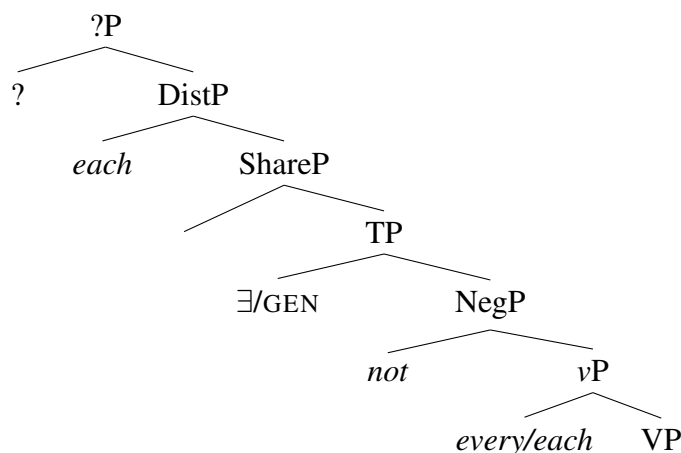


Figure 1 Partial hierarchy of projections as described by Beghelli & Stowell 1997.

To account for this range of observations, B&S propose an account with four crucial ingredients: (i) there is a (at least relatively) fixed hierarchy of projections in the syntax; (ii) quantifier scope-taking proceeds via QR; (iii) QR is driven by strong and weak syntactic features; and (iv) QNPs are not to be understood as occupying a uniform category, neither syntactically nor semantically. Their approach requires that different types of quantifiers are subject to different syntactic derivations depending on their particular lexical features, which are themselves defined in Minimalist terms.⁹

While both *each* and *every* are in principle capable of receiving distributive interpretations (and they do), *each* seems to necessitate such an interpretation whereas *every* does not. This difference between the two universals is captured in B&S's system by the use of strong versus weak features. The presence of the feature [Dist] on both of these quantifiers triggers syntactic movement to the specifier of DistP, located higher than T in the structure. The [Dist] feature on *each* is strong, meaning that the phrase headed by that expression must undergo movement in order for its feature to be checked. *every*, on the other hand, has the same feature but in a weak form, meaning that it is not required to be checked in the course of the derivation.

The topology proposed by B&S is given schematically in Figure 1. (Here we gloss over whether the leaves of the tree are to be understood as heads or specifiers.)

B&S's analysis turns on the point that *every*-QNPs contribute a set variable which may be bound by various other quantificational operators, such as those we

⁹ Tunstall (1998) has a different formulation of the asymmetries evident between *each* and *every*, which we do not consider here for reasons of space.

have been considering, namely negation, *wh*-, and GEN. This use of the set variable was suggested by Szabolcsi (1997a), where such a variable is taken as the minimal witness set of the quantifier, i.e., “(i) an element of GQ, and (ii) a subset of the smallest set GQ lives on” (Szabolcsi 1997a: 122). Indeed, under B&S’s system, if an *every*-QNP is base generated in the scope of these operators, it is not permitted to move past them to DistP.¹⁰

There is a further requirement imposed by the Dist-head: a *proper argument*¹¹ must have moved to its syntactic sister, which B&S label ShareP. The argument in spec-ShareP represents that distributed over by the QNP after it has moved to DistP. If such an argument is not available, then ShareP is not licensed, so that in turn the requirements of DistP are not met, and no distributive reading will be available.

We can explicate how this works in greater detail by considering the asymmetric behavior of *each* and *every* with negation, in response to whether there is, in addition to the QNP, another DP in the sentence or not. First, (11a) is perfect, since negation binds *every*’s set variable, but (11b) is out since *each* must move to DistP to check its strong feature, but negation binds the event variable that would otherwise have occupied ShareP, and licensed DistP. In such a case, DistP is unavailable, and *each*’s strong feature goes unchecked.

- (11) a. John didn’t read every book.
b. ? John didn’t read each book.

An interesting contrast emerges when there is a “counting DP”, e.g. *one boy*. Under B&S’s account, these DPs raise to the specifier of ShareP, licensing DistP. Since negation is present, *every*’s set variable will be bound in position and it will receive a non-distributive interpretation regardless of that DP’s presence (12a), whereas *each* will move to DistP and distribute (12b).

- (12) a. One boy didn’t read every book.
b. One boy didn’t read each book.

The contrast between (11) and (12) is striking: the addition of an expression that may be distributed over (*one boy* but not *John*) reveals a difference in acceptability and in the available readings for the two quantifiers.

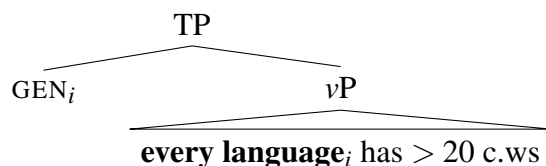
¹⁰ Even if the *every*-QNP moves for syntactic reasons, i.e. to get nominative case in spec-TP, semantically its scope is frozen at its merge site in these cases.

¹¹ In B&S’s terminology, such arguments can either be a counting QP (e.g., QPs headed by expressions such as *few*, *fewer than five*, *between six and nine*), a group denoting QP (e.g., QPs headed by expressions such as *some*, *several*), bare numeral QPs like *one student*, *three students*, definite DPs such as *the student*, or, lastly, the event variable quantified over in the sentence.

To illustrate the account more explicitly, as well as to foreshadow our account of the ECP effect, we illustrate the structures and interpretations of *each*- and *every*-QNP with GEN, as in (10a) and (10b) above.

As we saw, the *every*-QNP in (10a) is most felicitous in a context in which the properties of languages are being discussed generically. Under B&S's account, the *every*-QNP in that sentence is bound by GEN, which is merged higher than *every*'s merge site. This is shown in (13), with the binding relation indicated by the subscript *i*.

(13)

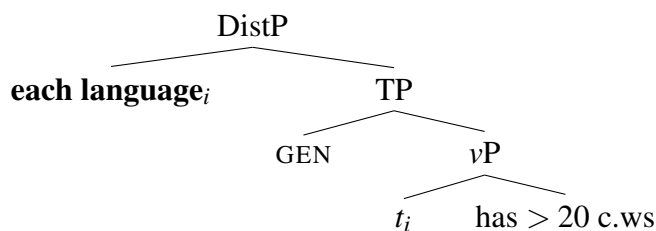


Somewhat schematically, the logical form for the structure in (13) is given below in (14). Here, the generic operator performs its usual function of binding a world argument, but it also binds the set variable *X* contributed by *every*. The interpretation, then, is that for every generically accessible world *w*, there is a set of languages *X* such that each language in that set has more than 20 color words.

(14) $\text{GEN}[w, X], \forall x \in X : x \text{ a lg in } w, x \text{ has } > 20 \text{ c.ws in } w$

In contrast, the strong [Dist] feature on the *each*-QNP requires that it raise above GEN, and be interpreted as distributing over the worlds that GEN quantifies over. This structure is as in (15).

(15)



Now, the universal picks out a set of languages *X* in the actual world, represented by *w**, and every generically accessible world from *w** is one in which those *X* have greater than 20 color words. This semantics is given (again schematically) in (16).

(16) $\forall x \in X : x \text{ a lg in } w^* [\text{GEN}w. x \text{ has } > 20 \text{ c.ws in } w]$ ¹²

¹² Under B&S's system, *each*-QPs also introduce a set variable which is the argument of the distributive operator in DistP. However, given the strong syntactic requirements on these QNPs, they seldom get

In sum, B&S's account takes scope-taking to be reflective of the derivational syntax. Scope is utterly determined by topology, which is responsive to the lexical features of different expressions. The difference now between *each* and *every* is a combination of their (similar yet) different featural specifications, and the semantic effects this permits. *every* contributes a set variable that can be bound by higher quantificational operators, preventing it from raising to DistP and interpreted as distributing over the semantic value of ShareP. *each*, on the other hand, is syntactically required to raise, and is uniformly interpreted as distributing over ShareP.

In the next section, we show that the so-called ECP effect can emerge from a similar pattern, where the modal auxiliary performs the role of an operator binding *every*'s set variable. Conversely, an *each*-QNP is forced to raise higher than the modal, and thus to distribute over it. We will argue, then, that the (non)-interaction of these QNPs and EMs due to derivational mechanisms. The proposal, as we will see, builds on the independent notions that EMs are merged lower than DistP, and that modals may act as unselective binders.

3 Our account

We have observed, following F&I, that *each* and *every* behave differently with respect to their scope-taking behavior in the environment of EMs. We have further seen that this asymmetry is paralleled when these quantifiers are in the environment of a variety of operators, namely negation, *wh*-, and GEN. B&S proposed to account for such asymmetries by positing a hierarchy of projections, different syntactic features on the two quantifiers, and the semantic consequences thereof. In this section, we propose to extend B&S's topological account to include modal operators, thus rendering the ECP extraneous.

First, we briefly review two claims that are integral to our analysis. The first is that there are two syntactic heights for modals, one occurring higher in the structure and correlating with epistemic interpretations, and one occurring lower and correlating with root interpretations. The second is that modals, like quantificational adverbs, can unselectively bind free variables. Following this, we present our unified account of the differential behavior of *each*- and *every*-QNPs in the environment of not only epistemic, but also root modals.

The claim that modals merge at different syntactic heights is not new nor particularly uncommon. Among others, Jackendoff (1972), Picallo (1990), Cinque (1999), Butler (2003), and Hacquard (2006) have found both syntactic and semantic evidence for such a claim. The two positions have been posited to account for the

bound by another operator, with the exception of *wh*-operators as in Beghelli (Beghelli 1997). We will not discuss the specifics of *wh*-questions under such a system here, as it is outside the purview of this current work.

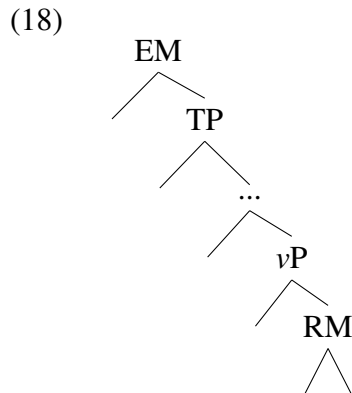
fact that epistemics tend to scope above tense and negation, while roots scope below these elements.

For our purposes, it suffices to review an example that shows epistemics scoping above tense, which is where we will locate the merge site for these modals in our extension of B&S's topology. To illustrate this, we must use the semi-modal *have to*, since the modal auxiliaries do not inflect for tense.

- (17) a. (Given the results of the police investigation) Mary had to be home (at the time of the crime).
b. (Given her parents' orders) Mary had to be home (last night).

In (17a), the inflected *have to* describes an epistemic necessity: given what we know **now**, Mary's location at a past time (the time of the crime) must have been at home. In (17b), in contrast, *have to* is interpreted as describing a past obligation (last night) on Mary's location (last night). Such a contrast has been taken as evidence for the relative scope of epistemic versus root modality.

We follow these other authors in assuming that epistemics are merged just above TP, and modals with root interpretations (e.g., deontic, circumstantial, abilitative) are merged just below vP, as in (18).



The placement of the RM projection below vP is not uncontroversial, however, we place it here for reasons that will become clear by the end of this section.

The second independent assumption we make is that modals can unselectively bind free variables (Heim 1982, Portner 2009) just like adverbs of quantification (Lewis 1975). Indefinite expressions like *a NP* are often thought to contribute a free variable that can be bound by various operators, like GEN or a default existential closure operation. Lewis' observation is that, when singular indefinites appear with adverbs like *sometimes* or *always*, the quantificational force of these operators (\exists and \forall respectively) is 'transferred' to or shared with the indefinite. In (19a) and (19b), one gets the sense that there is an equivalence of meaning between the sentences on

the left-hand side of the \approx with the singular indefinite and the temporal adverbials, and the right-hand side with plain quantificational NPs.

- (19) a. A dog sometimes bites. \approx Some dogs bite.
 b. A dog always bites. \approx All dogs bite.

Portner (2009) recently reviewed this evidence, linking it to what appears to be a similar pattern with the abilitative *can* and futurate *will*. Namely, on the relevant interpretation, there is an equivalence of meaning on either side of the \approx in (20a) and (20b), similar to what we saw in the preceding example. Here, the modal is taken to bind the indefinite plural *dogs* and ‘transfer’ its quantificational force.

- (20) a. Dogs can bite. \approx Some dogs bite.
 b. Dogs will bite. \approx All dogs bite.

We understand this pattern to be due to these quantificational adverbs’ and modals’ ability to unselectively bind the free variable that indefinite expressions introduce. We propose that these facts, combined with the claim that *every*-QNPs similarly introduce a variable which may be unselectively bound, suggest that quantificational modals may be responsible for the asymmetric ECP effect.

Recall that GEN can bind the set variable introduced by *every*, thus licensing its presence in a generically-interpreted statement. Indeed, all of the sentences in (21a-21c) are comfortably interpreted as a generic statement about dogs, but (21d) is not.

- (21) a. A dog has a tail.
 b. Dogs have tails.
 c. Every dog has a tail.
 d. ? Each dog has a tail.

The proposal, then, in a nutshell, is that if EMs interact with indefinites and *every*-QNPs in manner familiar to how they interact with negation, *wh*-, GEN, and quantificational adverbs, then a straightforward extension of the B&S topological approach should be tenable here. Thus, the structure we propose is given in Figure 2.

We will briefly illustrate the derivations of *each*- and *every*-QNPs in the environment of EMs parallel to our discussion of these expressions in the environment of GEN. Following this, we will make use of the posited merge site of subjects, objects, and RMs, in order to formulate the novel predictions this account generates.

For the reading where *every* scopes under and is bound by *might*, the structure is as in (22), and the interpretation is given schematically in (23).

- (22) $[_{EM} \text{ might}_i [_{vP} \text{ every girl}_i \text{ have kissed J }]]$

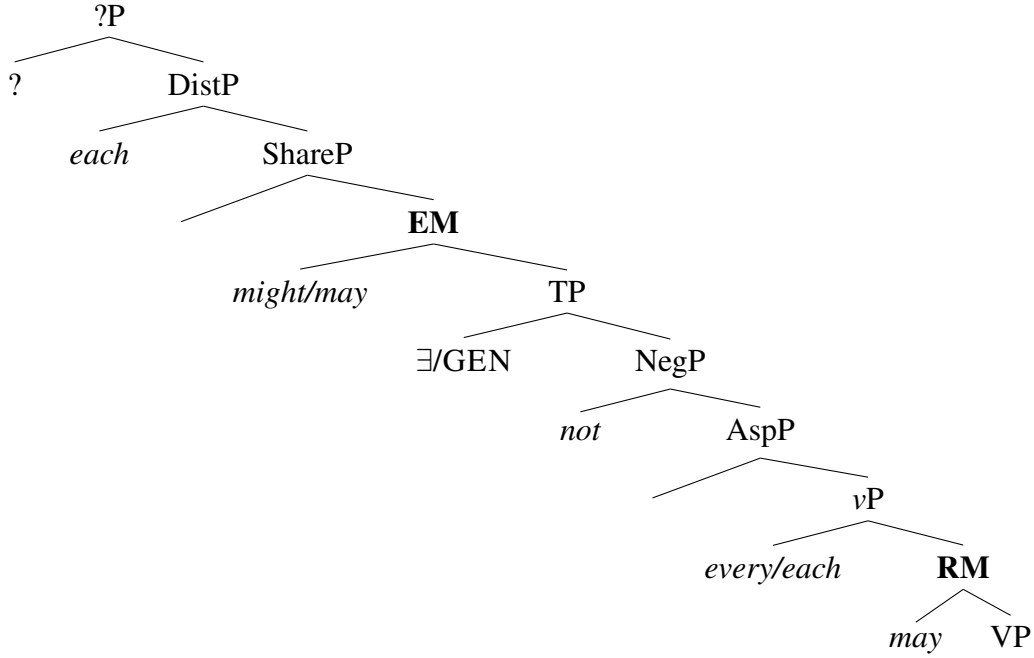


Figure 2 B&S's topology expanded to include projections for modals.

- (23) $\exists[w, X], \forall x \in X : x \text{ a girl in } w, x \text{ has kissed J in } w$

Here, it is asserted that there is some accessible world w such that the relevant girls, X , are such that each of them kissed John in w . That is, it is possible given what we know now that all the girls kissed John. Such an assertion would be false, for example, if one of the girls most definitely did *not* kiss John, regardless of whether we know the identity of that girl or not.

In contrast, where *each* scopes over and distributes over *might*, the structure is as in (24) and the interpretation as in (25).

- (24) $[_{DistP} \text{ each girl}_i [_{EM} \text{ might } [_{vP} t_i \text{ have kissed J }]]]$

- (25) $\forall x \in X : x \text{ a girl in } w^* [\exists w. x \text{ has kissed John in } w]$

Here, what is asserted is quite different: each girl in the actual world is understood as potentially having kissed John in some accessible world w . Such an assertion would be true in the scenario pointed to above: namely, if there was one girl such that we know that she didn't kiss John, but we are unsure which girls did the kissing and which did not.

Thus we derive the ECP effect: it reduces to the same asymmetry between *each*- and *every*-QNPs that B&S observed, combined with certain assumptions

about the topological positioning of epistemic modals. However, this account makes predictions that go beyond those that are covered by an ECP approach. Since RMs and EMs differ in height with respect to the merge site for subjects (assumed to be spec-vP), an immediate prediction of the current account is that there will be a subject/object asymmetry for *each*- and *every*-QNP with respect to RMs.

First, a brief note why there is no subject/object asymmetry predicted in the environment of EMs. While all of the examples we have looked at so far regarding the (non-)interaction of strong quantifiers with EMs consisted of examples with subject position QNPs, the merge site of subjects is lower than the merge site of the EMs. Thus the same pattern should obtain for objects, which similarly are merged lower than the merge site of EMs. Indeed, this pattern obtains: suppose we know for sure that, of a relevant 5 girls, John definitely kissed 3 and definitely did not kiss 2. We don't know, for any *particular* girl, whether John kissed her or not. In such a scenario, (26a) strikes us as false, and (26b) as true.

- (26) a. John might_{epi} have kissed every girl.
 ?EVERY > MIGHT, MIGHT > EVERY
 b. John might_{epi} have kissed each girl.
 EACH > MIGHT, ?MIGHT > EACH

With respect to RMs, however, the predictions for subject and object QNPs differs. These predictions are summarized in (27)-(28).

- (27) In subject position, *each*- and *every*-QNP easily scope over RMs.
 (28) In object position, *each*-QNP but not *every*-QNP easily scope over RMs.

If we consider Figure 2, it is clear why these predictions follow from the present account. Since the merge site for subjects is higher than the merge site of RMs, the strong feature on *each* and the weak feature on *every* will trigger unrestricted movement of their respective phrases to DistP. However, since the merge site for objects is lower than the merge site of RMs, and since *every*'s set variable may be bound by modals, it is predicted that the *every*-QNP's scope will be frozen below the modal, while the *each*-QNP, as usual, will be able to scope out.¹³

To see that the first prediction obtains, we will use (deontically-interpreted, in this case) *may*. Consider a scenario in which there are two teams competing in a dart competition in a local bar. One team is composed of the men, and the other one composed of the women. Suppose further that the winning team will earn the right to kiss John, a local celebrity, with the critical caveat that only one member of the team is permitted to kiss him. The women win the competition. If uttered just prior

¹³ Assuming that a proper argument is present to satisfy the requirements of ShareP.

to the women deciding which one will get to kiss John, (29a) strikes us as false, and (29b) as true.

- (29) a. Every woman $\text{may}_{\text{de}o}$ kiss John.
 $?EVERY > MAY, MAY > EVERY$
 b. Each woman $\text{may}_{\text{de}o}$ kiss John.
 $EACH > MAY, ?MAY > EACH$

To see that the second prediction obtains, we will again use *may*. Consider a scenario in which John competed in a dart competition, and won. The rules of the tournament are that the winner gets to kiss any one of the competition’s cheerleaders, but, of course, he is permitted to kiss only one of them. In this scenario, just prior to John’s deciding which cheerleader he will kiss, (30) strikes us as false, but (31) as true.

- (30) John $\text{may}_{\text{de}o}$ kiss every cheerleader.
 $?EVERY > MAY, MAY > EVERY$
 (31) John $\text{may}_{\text{de}o}$ kiss each cheerleader.
 $EACH > MAY, ?MAY > EACH$

If this subject/object asymmetry with respect to RMs obtains, it provides strong support for the topological approach we offer for the ECP effect. Namely, the latter style of account treated only of epistemically-interpreted modals, not modals with root interpretations.

4 Conclusions

The ECP was proposed as a grammatical constraint on the application of QR, targeting strong quantifiers in the environment of epistemic modals. However, it was observed that, if such a constraint existed, empirically it applied only to a proper subset of the strong quantifiers in English. Conceptually, such a constraint is unappealing as a syntactic constraint, since it makes critical reference to semantic categories.

After surveying a number of asymmetries between the behavior of *each*- and *every*-QNPs in the environment of a number of different operators, we included modal operators in that class which have differential effects on how these quantificational expressions are interpreted. Our main syntactic assumption, that there are two merge heights for modals, was based on independently-motivated proposals in the literature, as was our semantic assumption that modals can bind free variables. If such a topological account of the ECP effect can be sustained, it is less arbitrary and more predictive of a greater class of data.

However, this work raises a number of issues. The most immediate concerns the availability of the scopal interpretations *not* discussed in this paper. That is, adopting a strong form of an approach like Beghelli & Stowell's predicts that *might* > *each* and *every* > *might* should be impossible readings, and it is unclear whether this is the case. We are presently conducting experimental research to bear on this question.

Another consequence of the account devised here, and already present in the work of B&S, is a conception of QNPs which departs from that traditionally embraced under generalized quantifier theory. This is because the quantificational force of distributive quantifiers obtains from the semantics of the Dist-head, and not from the QNPs themselves. On this issue, we refer the reader to the essays in Szabolcsi 1997b.

A few general questions are raised by this work, concerning the particular analysis implemented: what is the class of QPs that contribute a set variable? And what composes the class of potential binders for such variables? We leave these questions for future research.

References

- Barwise, John & Robin Cooper. 1981. Generalized quantifiers and natural language. *Linguistics and Philosophy* 4. 159–219.
- Beghelli, Filippo. 1997. The syntax of distributivity and pair-list readings. In Anna Szabolcsi (ed.), *Ways of scope taking*, 349–408. Dordrecht, The Netherlands: Kluwer Academic Publishers.
- Beghelli, Filippo & Tim Stowell. 1997. Distributivity and negation: the syntax of *each* and *every*. In Anna Szabolcsi (ed.), *Ways of scope taking*, 71–107. Dordrecht, The Netherlands: Kluwer Academic Publishers.
- Butler, Jonny. 2003. A minimalist treatment of modality. *Lingua* 113. 967–996.
- Cinque, Guglielmo. 1999. *Adverbs and Functional Heads: A Cross-Linguistic Perspective*. New York: Oxford University Press.
- Condoravdi, Cleo. 2001. Temporal interpretation of modals: modals for the present and for the past. In David Beaver, Stefan Kaufmann, Brady Clark & Luis Casillas (eds.), *Stanford papers on semantics*, Palo Alto, CA: CSLI Publications.
- von Stechow, Kai & Sabine Iatridou. 2003. Epistemic containment. *Linguistic Inquiry* 34(2). 173–198.
- Fox, Danny. 2000. *Economy and semantic interpretation*. Cambridge, Massachusetts: MIT Press.
- Hacquard, Valentine. 2006. *Aspects of Modality*: Massachusetts Institute of Technology dissertation.
- Heim, Irene. 1982. *The semantics of definite and indefinite Noun Phrases*: University of Massachusetts, Amherst dissertation.

- Hornstein, Norbert. 1995. *Logical Form: from GB to Minimalism*. Cambridge, Massachusetts: Basil Blackwell.
- Huitink, Janneke. 2009. Scoping over epistemics in English and in Dutch. In *Current issues in unity and diversity of languages, collection of papers selected from CIL 18, 2077–89*. Korea University, Seoul: Linguistic Society of Korea.
- Jackendoff, Ray. 1972. *Semantic interpretation in generative grammar*. Cambridge, Massachusetts: MIT Press.
- Jacobson, Pauline. 1999. Towards a variable-free semantics. *Linguistics and Philosophy* 22(2). 117–184.
- Jacobson, Pauline. 2002. The (dis)organization of the grammar: 25 years. *Linguistics and Philosophy* 25(5-6). 601–626.
- Lewis, David. 1975. Adverbs of quantification. In E. L. Kennan (ed.), *Formal semantics of natural language*, Cambridge: Cambridge University Press.
- Lyons, J. 1977. *Semantics*, vol. 2 vols. Cambridge: Cambridge University Press.
- May, Robert. 1977. *The grammar of quantification*: Massachusetts Institute of Technology dissertation.
- May, Robert. 1985. *Logical form: Its structure and derivation*. Cambridge, Massachusetts: MIT Press.
- Milsark, Gary. 1977. Towards an explanation of certain peculiarities of the existential construction in English. *Linguistic Analysis* 3(1). 1–30.
- Picallo, M. Carme. 1990. Modal verbs in Catalan. *Natural Language and Linguistic Theory* 8(2). 285–312.
- Portner, Paul. 2009. *Modality*. Oxford: Oxford University Press.
- Szabolcsi, Anna. 1997a. Strategies for scope taking. In Anna Szabolcsi (ed.), *Ways of scope taking*, 109–154. Boston: Kluwer Academic Publishers.
- Szabolcsi, Anna. 1997b. *Ways of scope taking*. Dordrecht ; Boston ; London: Kluwer Academic Publishers.
- Tancredi, Christopher. 2007. A multi-modal theory of I-semantics. ms.
- Tunstall, Susanne. 1998. *The interpretation of quantifiers: semantics and processing*: University of Massachusetts-Amherst dissertation.

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