

On the Interaction of Modals, Quantifiers, and *If*-Clauses

Kai von Fintel and Sabine Iatridou
MIT, April 2001

1. Introduction

It is a routine fact that natural language displays scope ambiguities galore. Quite often when a sentence contains two quantificational items, the sentence will in fact be ambiguous between two logical structures which differ in the relative scope of the two quantifiers. According to a view that had been quite widely shared until recently, scope ambiguities are often due to an instance of Move Alpha called Quantifier Raising (QR), which was assumed to operate quite freely (although it was known to be constrained by finite clause boundaries).¹ Parallel to the study of QR, there have been investigations into the syntax, semantics and pragmatics of structures that restrict quantificational elements (e.g. Diesing 1992, von Fintel 1994, and many others). The assumption was, and is, that the investigation of QR and of the topological properties of restrictors will yield an increased understanding of that level of syntactic representation that interfaces with the interpretive component.

Along the way, consensus has been converging toward certain beliefs. We have learned about many ways in which scopal relations are much more rigid than previously suspected.² At the same time, scopal relations seem freer than one would expect if one looks at the properties of indefinite quantifiers (e.g. indefinites can scope out of islands). In order to reconcile these potentially contradicting conclusions, a currently popular approach is that for indefinite quantifiers there are alternative ways of scoping, including choice-functions, Skolem functions,

* The authors are listed in alphabetical order. This paper has been presented at colloquia at the University of Massachusetts at Amherst, at the University of Arizona, and at the University of Connecticut. We thank the audiences for their kind remarks and helpful criticism.

¹ See among others Rodman (1976), May (1977, 1985).

² See among others Aoun & Li (1993), the papers collected in Szabolcsi (1997), Fox (2000), Bruening (2001). Early work already contained much evidence for strong constraints on quantifier scope, see e.g. Ioup (1975).

and unselective binding by overt or covert operators.³ In other words, it is only an illusion that QR as a movement is freer than overt (A-bar) movement; when indefinites scope higher than you expect them to, it is not QR that is responsible. On the other hand, the conclusion that QR is more restricted than originally thought *is* taken to be real, as researches uncover the existence of different sorts of intervention effects and other constraints that block QR.

In this paper, we add to this exploration two new observations. The first one is a constraint on the scopal interaction of quantifiers with epistemic modals:

- (1) The Epistemic Containment Principle (ECP)⁴
A quantifier cannot scope over an epistemic modal.

The second observation concerns the interaction of quantifiers with restrictive *if*-clauses:

- (2) The Modal *If* Hypothesis (MIH)
An *if*-clause can only restrict quantifiers over possible situations/worlds, not quantifiers over individuals.

We will go into considerable detail into finding arguments for each of these two constraints on quantificational elements. Before we embark on that, however, we want to place them in a somewhat broader context and discuss why and to what extent we should consider our two findings surprising.

1.1 The ECP and previous assumptions

The ECP came somewhat as a surprise to us because we had come to believe that sentences containing quantifiers and modal/aspectual/temporal elements usually show clear scope ambiguities. For example, quantifiers appear to show scope ambiguities with temporal operators:

- (3) Most of our students will be professors in a few years.
- (4) Most of our students will be foreigners in a few years.

³ See Heim (1982) for unselective binding. See Reinhart (1997a,b), Winter (1997), Kratzer (1998) for choice-function indefinites.

⁴ The name of this constraint was carefully chosen by one of the authors. The other author warned that he vaguely remembered from syntax courses he took as a graduate student that there was another principle that went with the abbreviation ECP. But he was assured that that had been a temporary aberration in the science and that the competing principle had now deservedly sunk into complete oblivion.

The most natural readings for these two sentences involve different scopes: (3) says that most of our current students will in a few years be professors (**most of our students > will**), while (4) says that in a few years most of our students then will be foreigners (**will > most of our students**).⁵

Quantifiers also appear to show scope ambiguities with deontic modal operators:

- (5) Most of my neighbors ought to water their lawns more often.
- (6) Most of my books ought to be returned by Friday.

Again, we seem to have two different natural scope readings: (5) says that most of my neighbors have the obligation to water their lawns more often (**most of my neighbors > ought**), while (6) says that it ought to be the case that most of my books are returned by Friday (**ought > most of my books**).

What our ECP is saying is that parallel facts do not obtain with epistemic modals. So, the ECP predicts that there is no scope ambiguity in (7), with only the order in (7a) being possible, not the one in (7b)

- (7) Most of our students must be home by now.
 - a. **must > most of our students**
 - b. ***most of our students > must**

We say that (7) only has a reading in which the quantifier **most of our students** has narrow scope under the epistemic modal **must**. This means that in order for (7) to satisfy our ECP the quantifier needs to establish narrow scope by LF, presumably through some process of reconstruction, more on which later.

⁵ Of course, there are many issues glossed over here. See Musan (1997) for an in-depth exploration of this topic.

1.2 The MIH and previous assumptions

The MIH should be seen in the context of what we call the Lewis-Kratzer-Heim View of *If*-clauses:

- (8) The Lewis-Kratzer-Heim View of *If*-Clauses⁶
If-clauses are all purpose restrictors.

The idea is that *if*-clauses, rather than being modal operators in themselves (creating sentences with a “conditional” meaning), in fact serve to restrict operators of all sorts. Lewis developed this idea for *if*-clauses in construction with adverbs of quantification. Kratzer extended the coverage by showing that one can see typical conditional structures as arising out of the combination of some overt or covert modal operator with an *if*-clause restricting that operator.

It has been noted that *if*-clauses also seem to occur as restrictors of determiner-quantifiers over individuals. One example of such a use of *if* should suffice at this point, with more discussion to follow later:

- (9) Nobody will be admitted into the country if he doesn't have a valid visa.
(= Nobody who doesn't have a valid visa will be admitted into the country.)

As indicated in (9), the *if*-clause appears to function in a way that makes it equivalent to a restrictive relative clause. While this kind of example is not a problem for the Lewis-Kratzer-Heim theory, it seems to be in conflict with the claim we make with our MIH. We take sentences like the following to be paradigmatic:

- (10) I saw a woman if she works for Clinton.
(≠ I saw a woman who works for Clinton.)

For us, the fact that the *if*-clause in (10) is not interchangeable with a relative clause shows that *if*-clauses cannot in general restrict determiner-quantifiers. This of course leaves the existence of (9) as the surprising fact, which we will address later on.⁷

⁶ See Lewis (1975), Kratzer (1978, 1986), Heim (1982).

⁷ Of course, the existence of (9) is very puzzling from the perspective of any analysis that sees *if* as always creating a conditional meaning. In fact, sentences like (9) have even been taken as evidence for non-compositionality in natural language by authors like Higginbotham (1986) and Pelletier (1993, 1994). As shown in von Stechow (1998), the Lewis-Kratzer-Heim view has no problem with (9).

1.3 The ECP and the MIH in action together

The biggest part of this paper is devoted to finding separate arguments for the ECP and the MIH individually. However, it is also possible to witness the effects they have in tandem.

We are standing in front of an undergraduate residence at the Institute, wondering whether our friend Chris is home. You tell me that

(11) Chris must be home if his light is on.

Your implicit suggestion is to find the window of Chris' room and check whether the light is on. If it is on, we can conclude that Chris is home. I ask you how you can be so sure. You tell me that Chris is a very conscientious guy and would never leave the light on when he leaves his room. In fact, you think that every student who lives in this dorm has this property. So, you might be tempted to assert that

(12) *Every student_i must be home if his_i light is on.

The puzzling fact is that you can't say what you are tempted to say. The sentence in (12) is unacceptable under the intended meaning (where the quantifier *every student* binds the pronoun *his*). We want to understand what is wrong with it. We will see that without the ECP and the MIH, (12) should in fact have more than one well-formed and intelligible construal. However, armed with the ECP and the MIH we correctly predict the actual status of (12).

Our sentence is characterized by four crucial elements: an epistemic modal auxiliary *must*, an *if*-clause, a quantifier over individuals *every student*, and a desired variable-binding relationship between the quantifier and a pronoun in the *if*-clause (indicated by co-indexing in (12)). Without the ECP and the MIH, (12) is predicted to have certain readings resulting from making two independent decisions: whether the *if*-clause is restricting the quantifier (as in A and B) or the modal (as in C and D), and whether the quantifier has scope over the modal (as in A and C) or the modal has scope over the quantifier (as in B and D).

A **every + if > must**

every [λx . student_x if his_x light is on] [λx . must [λw . x be_w home]]

B **must > every + if**

must [λw . every [λx . student_x if his_x light is_w on] [λx . x be_w home]]

C **every > must + if**

every [λx . student_x] [λx . must [λw . if his_x light is_w on] [λw . x be_w home]]

D **must + if > every**

must [λw . if his_x light is_w on] [λw . every [λx . student_x] [λx . x be_w home]]

The structure that comes closest to being available for (12) is the one in D. But note that in D, the quantifier cannot bind the pronoun, since there is not the requisite c-command relation between the quantifier and the pronoun.⁸ So, the pronoun in D remains free. What is correct is that a sentence pronounced the same as (12) has the D reading, where the pronoun remains unbound by the quantifier. We can understand it as meaning something like: “if his (e.g. the janitor, or some other salient individual) light is on, it must be the case that every student is home”. But the fact remains that there is no reading where the pronoun is bound. A more precise statement of this central piece of data looks like this:

(12') Every student_i must be home if his_j/*_i light is on.

So we think we know why D cannot yield the relevant reading of (12). What about the structures in A, B, and C? Well, if we succeed in convincing you of the existence of the ECP and the MIH, you will be able to predict the degraded status of (12). The ECP rules out A and C, the MIH rules out A and B.

Note that the ECP only concerns the interaction of quantifiers with epistemic modals. So, as soon as we use a non-epistemic modal, we should find acceptable structures, which is correct:

(13) Every student_i must contact the dean if he_j is too sick to attend the exam.

In this sentence the modal *must* has a deontic reading stating an obligation following from some body of rules and regulations.

⁸ We of course assume the following near triviality:

- (i) LF-Condition on Variable-Binding
Quantifiers (or the λ -operators associated with them) can only bind variables in their LF c-command domain.

In addition, we adopt the following common assumption:

- (ii) LF-Locality of Restrictor
At LF, restrictors are local to the elements they restrict.

Actually, sentence (12) will prove pivotal in more ways later in the paper. Let us now turn to looking at the effects of the ECP and the MIH separately.

2. The ECP

Our ECP states that quantifiers cannot scope over epistemic modals. We will explore what precisely the formulation of the ECP should be, will consider possible motivations for why there should be such a principle, and of course we will provide additional evidence for its existence.

2.1 Argument from Binding Possibilities

Sentence (12) shows the combined effects of the ECP and the MIH but it is possible to set up a similar structure, involving epistemic modals, quantifiers and bound pronouns that does not involve the MIH. This can be done with restrictors other than *if*-clauses.

There are two types of *because*-clause. There are run-of-the-mill *because*-clauses which introduce the cause of an event

- (14) John must be home because he has caught this bug that is going around.

And there are “epistemic” *because*-clauses, which do not introduce the cause of an event but specify the grounds for an epistemic state:

- (15) John must be home because his light is on

What happens if we try to bind a pronoun in the *because*-clause by a quantifier in the matrix subject position (the position of *John*)? Assuming that epistemic *because*-clauses are local to the epistemic modal at LF, we predict that a quantifier will not be able to bind into an epistemic *because*-clause, because to do so it would have to scope over the modal+*because*-complex, violating the ECP.

- (16) a. **(must + because) > every** ECP: OK, but Q too low bind pronoun in
because-clause
b. **every > (must+because)** ECP: *, but necessary for pronoun binding

This prediction is borne out:

(17) Every student_i must be home because his_j/*_i light is on.

On the other hand, a run-of-the-mill *because*-clause can be low enough for the quantifier to bind into it without the quantifier having to attempt the impossible cross over the epistemic modal:

(18) Every student_i must be home because he_j/_i has caught the bug that is going around.

And since epistemic *because*-clauses can appear without an overt epistemic modal. (we assume that there is a covert modal which will still induce ECP effects) we also predict the status of (19):

(19) Every student_i is home because his_j/*_i light is on.

2.2 Simpler Evidence

The ECP should, of course, reveal itself in much simpler structures. In particular, we expect ECP effects in structures involving simply a quantifier and an epistemic modal in the same clause. The quantifier should be unable to take scope over the epistemic modal. In many of our examples so far, we had the universal quantifier *every student* and the epistemic necessity modal *must*. With those particular items, it is hard to see a lack of ambiguity in simple cases, which is why it takes more complex structure with pronoun binding to show the effect of the ECP. With other choices of quantifiers and modals, ECP effects become apparent to the naked eye even in simple structures.

Imagine that we are standing in front of the same undergraduate residence mentioned earlier. Some lights are on and some are off. We don't know where particular students live but we know that they are all conscientious and turn their lights off when they leave. So, for every particular student it is compatible with our evidence that he or she has left. At the same time, we know that some students are home (because there are lights on). In this light, consider the following sentence:

(20) Every student may have left.

(i) every student x (may x have left)	every > may	True, *ECP
(ii) may (every student have left)	may > every	False, ^{OK} ECP

Informants reliably judge (20) to be false in the scenario we sketched. This is predicted if the ECP is operative. It would force (20) to be read with narrow scope for the quantifier *every student*, which gives rise to a reading that is false in our scenario. The ECP prohibits the reading where *every student* has scope over the modal, a reading that would be true in the given scenario. A raw truth-value judgment then supports our claim that there is an ECP.

The judgment is perhaps even sharper when we consider a continuation of (20) that would be only consistent with the scoping **every** > **may**, which we say is ruled out by the ECP. We expect a clear feeling of contradiction:

(21) *Every student may have left but not every one of them has.

Indeed, (21) is beyond repair.⁹

Here is another case showing that *every* cannot scope over *may*:

(22) #Every student is the tallest person in the department.

(23) #Every student may be the tallest person in the department.

- | | | |
|--------------------------------------------|---------------------------|-----------------------------|
| (i) every student x (may x be the tallest) | every > may | sensible, *ECP |
| (ii) may (every student be the tallest) | may > every | nonsense, ^{OK} ECP |

If there was no ECP, (23) would be predicted to be sensible since the quantifier would be able to scope over *may*. But because of the ECP, this is not possible and the obligatory narrow scope of the quantifier leads to a pragmatically odd reading on a par with the oddness of (22).

Imagine that we have a group of people who were exposed to an infectious agent. From anonymous test results we have concluded that half of the people are healthy, but we don't know which ones they are. So, for any one person we don't know whether he or she is infected. If the ECP didn't hold, we would have been able to report this situation to the people involved as follows:

(24) Half of you are healthy. #But everyone may be infected.

- | | | |
|----------------------------------------|---------------------------|---------------------------------|
| (i) every person x (may x be infected) | every > may | consistent, *ECP |
| (ii) may (every person be infected) | may > every | inconsistent, ^{OK} ECP |

⁹ We have sometimes encountered people who thought that with the right kind of intonation they might get readings that our ECP would rule out. We are unsure about whether this is sometimes possible. But (21) at least is a clear case where no amount of prosodic acrobatics helps.

However, this sequence seems utterly inconsistent. The reason is by now clear: the second sentence can only be read as asserting the possibility that everyone is infected, which contradicts the first sentence.¹⁰

We can see the ECP effect with quantifiers other than universal *every* as well. Consider the following example, which indicates that the scope order *must* > *fewer than half* is possible:

- (25) Fewer than half of the students must have passed the test.
(Otherwise there wouldn't be this uproar.)

We claim that (25) lacks the reading "Fewer than half of the students are such that it can be said with certainty about them that they have passed the test." This is the reading ruled out by the ECP. We can show that the reading is absent by combining the sentence with a continuation that would force the wide scope reading of the quantifier over the modal. We obtain a contradictory statement:

- (26) #Fewer than half of the students must have passed the test, but perhaps all of them did.

(26) is contradictory since the ECP forces an interpretation like "It must be the case that fewer than half the students passed the test, but perhaps all of them did".

2.3 Weak Quantifiers

One might wonder whether the ECP concerns only strong quantifiers. But we think there is clear evidence that all quantifiers are subject to the constraint. We start by considering a paradigm suggested to us by Winnie Lechner (pc):

- (27) It isn't raining somewhere in Arlington. Let's go to that place.

somewhere > NEG scope forced by positive polarity of *some*

¹⁰ By the way, the ECP seems to concern not only epistemic modals in the form of auxiliaries. Our example (24) remains bad when we switch to an adverbial modal:

- (i) #Half of you are healthy. But everyone is possibly infected.

We are however not in a position to widen our inquiry beyond modal auxiliaries at this point. So, we will leave the matter with just this one observation.

In (27), we have combined the weak, positive polarity quantifier *somewhere* with sentential negation. The sentence has only a wide scope reading of the quantifier because as a PPI it needs to be removed from the c-command domain of negation at LF.

Now, observe what happens when we insert the peculiar epistemic modal *can't*, which is interpreted as the combination of negation over the epistemic modal *can*:

- (28) John can't be home.
= It's not the case that John can be home.
≠ John can be out.

Consider now the sentence in (29):

- (29) *It can't be raining somewhere in Arlington.

The example is ill-formed because of the conflicting requirements of the ECP and the PPI nature of *somewhere*. The PPI needs to scope over negation but cannot do so because of the ECP: scoping over negation would mean scoping over the epistemic modal as well. A minimal pair is provided by the combination *may not* in whose interpretation the epistemic modal has scope over negation. Here there is a good place for the PPI to scope to: in between the modal and the negation, satisfying both its PPI nature and the ECP:

- (30) It may not be raining somewhere in Arlington.

The paradigm can be reproduced even more spectacularly in Modern Greek.

- (31) *dhen vrexı kapu sto Arlington*
NEG rain somewhere in Arlington
- (32) *bori na mi vrexı kapu sto Arlington*
may/can PARTNEG rain somewhere in Arlington
- (33) **dhen bori na vrexı kapu sto Arlington*
NEG may/can PARTrain somewhere in Arlington

In Greek, we have a choice between matrix negation (*dhen*) or a lower negation (*mi*) in the quasi-infinitival complement of a modal. In (32), we see that the PPI *kapu* can scope over the lower negation but still under the epistemic modal, without any problem just like the non-modal base case in (31). But if we force a wide-scope reading of the negation as in (33), the example becomes bad. The idea again is that the PPI would have to raise above negation but in order to do

that the PPI would have to cross the epistemic modal as well, which it cannot do because of the ECP.

Another illustration of the ECP at work with weak quantifiers:

- (34) #Two friends of John's from Texas may have come to visit him this weekend, but they can't both have come (because they hate each other).

A scenario that would go with the sentence in (34): we know of two friends of John's from Texas that either one of them may well have visited him, but we also know that they did not both visit him. But the ECP forces the quantifier *two friends* to have narrow scope under the modal, which expresses that it is possible that both of them came, which in turn is inconsistent with the follow-up. So, (34) is unacceptable.

We would like to add one last instance of the ECP, noted recently by Heim (2000). Compare:

- (35) The paper is allowed to be less long than that.

Reading A: It is allowed that the paper be shorter than that.

Reading B: It is not allowed that the paper be that long.

- (36) The paper might be less long than that.

Reading A: It might be the case that the paper is shorter than that.

Reading B: It is not possible that the paper is that long. (unavailable!)

Heim suggests that the B reading of (35) is due to LF-movement of the Degree-Quantifier-Phrase across the modal operator. She observes that (36) does not have a B reading. She conjectures that this effect is due to our ECP.

2.4 A Problem with the ECP: A-Movement, QR, and Reconstruction

Our ECP states that a quantifier cannot scope over an epistemic modal. We need to address an immediate puzzle. There are of course many examples where on the surface quantifiers do appear in a position where they c-command an epistemic modal, namely subject quantifiers:

- (37) Every student may/must be home.

- (38) Every demonstrator may/must have been arrested by now.

We will assume that these subjects have moved to their surface positions by some kind of A-movement, driven by Case and/or EPP requirements. That is, the structure one might assign to (37) is:

(39) every student_i [may/must [t_i be home]]¹¹

We have argued that quantifiers cannot move across an epistemic modal, yet we see that in (39) there is movement. Obviously then, the ECP is not a constraint on surface movement, so what is it? What is important to our argument is that at LF, in the final syntactic representation that gets passed on to the semantics, quantifiers do not scope over epistemic modals. So, the ECP in our view is a constraint on LF-configurations: what it rules out are configurations where a quantifier is located above an epistemic modal and binds a variable in its source position across the epistemic modal.

Since in examples like (37) and (38), the quantifier is above the modal on the surface but the ECP requires it to be below the modal at LF, we need to ask how the correct LF is derived. There are several devices for reconstruction on the market that one can employ (see for discussion: May 1977, Lebeaux 1994, Kitahara 1996, Hornstein 1995, 1999, Chomsky 1995, 2000, Fox 1999, 2000, Sauerland & Elbourne 1999, and others). We will not choose between them here.¹² All we need is that one of them is applicable. But there is a worry. There has been doubt thrown on the existence of reconstruction in A-chains in the recent literature. Following up on conceptual considerations in Chomsky (1995), Lasnik (1999) has argued that there is no such process. In support of his thesis, Lasnik presents data like the following:¹³

(40) Every Mersenne number was proved not to be prime. ¹⁴

¹¹ We remain agnostic about whether what the quantified subject leaves behind is a trace or a copy of itself.

¹² One might even explore the possibility that the lowered reading of the quantifier is achieved by raising of the modal operator. We are skeptical about this possibility, mainly because of an impression that semantically active raising of verbal or adverbial operators is not usually contemplated in current frameworks (indeed, adverb positions are taken to be topological signposts that don't move around). Further, as a simple empirical problem, note that *not necessarily* cannot mean the same as *necessarily not* but if the modal operator *necessarily* could move around, there wouldn't be any reason to expect this lack of an ambiguity. Lastly, the movement of the modal would have to be one where no semantically active trace is left, again a somewhat bizarre property of this putative process.

¹³ Howard Lasnik (pc) pointed out to us that Partee (1971) had a similar example:

(i) Nobody is (absolutely) certain to pass the test.

But in the intervening 30 years or so, nobody seems to have recognized the problem.

¹⁴ Should you be puzzling over what Mersenne numbers are, we recommend a quick look at this web page:
<http://www.utm.edu/research/primes/mersenne.shtml>

- (41) No large Mersenne number was proven to be prime.
- (42) No one is certain to solve the problem.
- (43) Every coin is 3% likely to land heads.

In each of these cases, there are no readings available where the quantifier takes scope under the modal raising operator.

It doesn't appear to be easy to reconcile Lasnik's arguments against the existence of A-reconstruction with our evidence for the ECP which includes clear examples of subject quantifiers (obligatorily) taking scope under a modal. There are two ways one might go:

- (i) In personal communication, Howard Lasnik brought up the possibility that the ECP may be able to override whatever normally rules out A-reconstruction. The slogan might be that reconstruction is possible when obligatory, otherwise it is impossible.
- (ii) Alternatively, one might take Lasnik's data to show certain restrictions on when A-reconstruction can occur while maintaining that in principle A-reconstruction does exist as a grammatical process.

It seems that the first of these options should be excluded. Consider this additional datum:

- (44) *Nobody may have pushed him. (Maybe he just fell.)
cf. Maybe nobody pushed him. Maybe he just fell.
- | | | |
|------|------------------------|-----------------|
| (i) | may > nobody | OK ECP, *Lasnik |
| (ii) | nobody > may | *ECP, OK Lasnik |

Our informants uniformly reject the sentence (44) as odd. It seems to us that an attractive explanation is that the example has no grammatical construal: the ECP forces the quantifier to be interpreted under the modal, but this is ruled out by whatever explains Lasnik's observation that A-moved negative quantifiers do not reconstruct into their source positions. This appears to refute the idea that reconstruction becomes possible as soon as the ECP makes it obligatory, because then we would expect (44) to be good under the reconstructed reading.

We conclude that some process that allows quantifiers to lower beneath epistemic modals must be available, to explain the existence of acceptable examples like *Everybody may be home*. Lasnik's facts must be due to restrictions on such a process. What these restrictions are is an extremely interesting topic but clearly outside the scope of the present paper.

We also conclude that quite obviously the ECP is an LF-constraint.

2.5 The Nature of the ECP

We have seen that the ECP is real and is not just something that helps us solve our little puzzle. But what exactly is the ECP and what is it due to? In this section we will address both questions, starting with the former.

2.5.1 The ECP concerns Quantifiers and Their Traces

We have seen that epistemic modals create some sort of intervention effect between a quantifier and the trace of that quantifier. In fact, the ECP affects only quantifier-trace relationships and not just any quantifier-variable relationship. That is, a quantifier can bind a pronoun across an epistemic modal:

- (45) Every student_i is convinced that I think that the dean may well expel him_i.
- (46) Every man in the room_i was asked to come here because he_i may well have seen the accident.
- (47) a. Every student_i thinks that he_i may well be a genius.
b. Every student_i thinks that Mary may/must like him_i the most.

In other words, the ECP is correctly stated as being about the relationship between quantifiers and their traces at LF. Therefore, the ECP prohibits LF raising of a quantifier across an epistemic modal and forces reconstruction of quantifiers that have raised on the surface past an epistemic modal.

The next question is whether the ECP affects other types of A-bar movement. Let's look at *Wh*-movement in questions then. Overt *Wh*-movement happily crosses epistemic modals:¹⁵

- (48) Who must she have hired for that job?
- (49) Who did Bill say that Susan must have married?

¹⁵ *Why* has difficulty getting over an epistemic modal. The following sentence is grammatical but the prevalent reading is the higher construal of *why*, where the question asks for the reason of the deduction, not the reason of the leaving:

- (i) Why must Susan have left?

If this judgment is real, we still cannot conclude that the ECP affects overt *Wh*-movement, as *why* is notoriously hard to extract.

- (50) Who must Bill have said that Susan married?
- (51) Where_j did Bill say that Bill must have seen Susan t_j?
- (52) Where_j must Bill have said that Bill saw Susan t_j?
- (53) It didn't take me long to find out which workers the boss must have reprimanded.

What about covert *Wh*-movement? In English, covert *Wh*-movement has been proposed for multiple questions in e.g.:

- (54) Who thinks that Susan talked with who?

What happens when an epistemic modal is inserted in the path between the two *Wh*-phrases?¹⁶

- (55) Who said that Susan must have talked with who?

Most speakers we have consulted find no contrast between (54) and (55). If indeed there is no contrast and if the most embedded *wh*-word must move to the highest COMP in order to yield the multiple reading, then (55) would show that the ECP does not affect covert *Wh*-movement. However there are several proposals about how to derive the multiple question reading that do not involve covert movement of the *wh*-phrase in situ (Baker 1970, Reinhart 1994, Tsai 1994, Pesetsky 2000). Since we do not have a favorite syntactic theory of multiple questions, we are somewhat at a loss as to what to conclude from the potential acceptability of (55). We could conclude that the ECP does not affect covert *Wh*-movement. Alternatively, we could use the absence of ECP effects in (55) to exclude those theories that postulate LF-movement of the embedded *wh*-word. We will not be so bold, though. We will remain agnostic about the relationship between covert *wh*-movement and the ECP and return to quantifiers.¹⁷

¹⁶ Andy Barss (p.c.) prompted us to consider such cases.

¹⁷ The ECP might be reminiscent of some recently discovered effects concerning covert movements of *wh*-elements. Beck (1996b) discusses a variety of *wh*-related movement constructions where there is a choice of leaving some material *in situ* at s-structure. One kind of example (cited from Pesetsky 2000):

- (i) Who + among DP
 - a. No separation, no intervener

[Wen von den Musikern] hat Hans ___ getroffen?
 whom of the musicians has Hans ___ met
 'Who among the musicians has Hans met?'

2.5.2 ACD and the ECP

No discussion about QR is complete without a digression into the forest of Antecedent Contained Deletion (ACD), the reader must be thinking. ACD has repeatedly been seen as a good argument for the existence of the LF-movement of quantifiers (Sag 1976, Williams 1977, May 1985, Fiengo & May 1994). We will assume that indeed resolution of ACD involves QR. The problem for us is that the QR that is involved in ACD appears to violate the ECP. We say "appears to" because the judgments are notoriously hard and we have found it very difficult to make sure that

b. Separation, no intervener

Wen hat Hans [__ von den Musikern] getroffen?
whom has Hans __ of the musicians met

c. No separation, intervener

[Wen von den Musikern] hat keine Studentin getroffen?
whom of the musicians has no student met
'Who among the musicians has no student met?'

d. Separation, intervener

??Wen hat keine Studentin [__ von den Musikern] getroffen?
whom has no student __ of the musicians met

As the examples in (a) and (b) show the German *wh*-word *wen* can be separated from the rest of the noun phrase it belongs to by moving just it and not the whole phrase. The choice between (a) and (b) is entirely optional. But when a quantifier like *keine Studentin* intervenes between the source position of the phrase and its movement target, the whole phrase has to move: (c) is OK, while (d) is not. Beck suggests that at LF the leftover material *von den Musikern* has to move to join the *wh*-word. This LF-movement, she argues, cannot cross an intervening quantifier. There is no intervener blocking the LF-*rendezvous* between the two partners in (b), but there is one in (d).

We do not think that the ECP can be reduced to the effect that Beck discusses. Epistemic modals do not appear to act as blocking interveners in the structures Beck discusses:

- (ii) Wen müßte Maria behauptet haben [[__ von den Musikern] getroffen
who must Maria claimed have of the musicians met
zu haben]?
to have

'Who must Mary have claimed to have met of the musicians?'

Here, we have the epistemic modal *müßte* on the path between the fronted *wh*-word and the rest of its phrase. Nevertheless, the separation does not make the sentence unacceptable, in contrast to the (d) case in (i).

Sigrid Beck (pc) provided us with a further demonstration that the ECP is not subsumed by her intervention effects. In her dissertation (Beck 1996a), she showed that partially reconstructed readings of *how many*-questions are not available across the kind of barriers she had identified. But again, epistemic modals do not disrupt such readings:

- (iii) Wieviele Bücher müßte er der Maria versprochen haben mitzubringen?
How-many books must he the Mary promised have with-bring

'How many books must he have promised Mary to bring with him?'

Possible Answer: He must have promised her to bring six books.

the epistemic modal is indeed included in the composition of the interpretation. However, we will at least stare the worst case scenario squarely in the face for a bit and assume that sentences like the following are indeed possible on the relevant reading, indicating a violation of the ECP:

- (56) John thinks that Sarah must have played on every piano that we had predicted he would.

For ACD to be resolved the QP [*every piano that we had predicted he would e*] must LF-move over the modal *must* into the higher clause.

Is this a big problem for us? What should we conclude from the fact that ACD seems to be allowed to ignore the ECP? Well, actually, even if we accept that ACD uncontroversially proves the existence of QR, the fact is that ACD-resolving QR (henceforth "ACD-QR") has some different properties from non-ACD-resolving QR (henceforth "Scope-QR"). (i) ACD-QR can move a QP out of a tensed clause, which Scope-QR cannot:

- (57) John said that (they wrote that) Mary played on every piano that we predicted he would.

- (58) A different / Some student said that Mary likes every boy.
(*every > a different/some)

(ii) ACD-QR bleeds Condition C while Scope-QR does not (Fiengo & May 1994, Fox 2000):

- (59) a. ??I reported him_i to [every cop that John_j was afraid of].
b. I reported him_i to [every cop that John_j was afraid I would].

(iii) ACD-QR can cross negation, Scope-QR cannot. Imagine John, who for years has been accusing Mary of being a racist. Now there is an exam coming up and we predict that John will take this opportunity to make the same point; that is, we predict that he will say that Mary will fail women and minority students. In this scenario, the following sentence seems fine:

- (60) John said that Mary will not pass every student that we predicted he would.

In other words, the QP [*every student that we predicted he would e*] raises out of the embedded clause over sentential negation. On the other hand, Scope-QR cannot easily cross sentential negation:¹⁸

¹⁸ The movement of PPI *some* across negation, as used for example in section 2.3, is therefore not simply an instance of QR but more like ACD.

(61) John didn't touch every dessert. (*?every > not)

The same holds for movement over negative quantifiers. Imagine that John, who took part in a dessert competition, is always negative about certain rival cooks. We predict that he will say that people don't like the desserts made by these cooks. In this scenario, the following seems fine:

(62) John said that nobody will touch every dessert that we predicted he would.

On the other hand, Scope-QR cannot easily get over a negative quantifier:

(63) Nobody touched every dessert. (*?every > nobody)

Clearly, the differences between ACD-QR and Scope-QR are not negligible. In this context, the fact that ACD-QR and Scope-QR also differ in their sensitivity to the ECP does not appear all that surprising. In fact, across all these facts we find Scope-QR subject to constraints that ACD-QR appears to be able to violate.

We could then adopt the attitude that the fact that ACD behaves differently from normal scoping is a problem for everyone and hence not for us. In the end, that will be the tactical decision we will take. But we would like to point out an alternative perspective as well.

2.5.3 Cinque/Beghelli & Stowell

The facts about ACD-QR being able to cross epistemic modals might suggest that the way we have formulated the ECP so far is incorrect. If the ACD facts are as we fear they are, quantifiers can bind their traces across an epistemic modal. Could we reformulate the ECP to make space for what ACD seems to be capable of doing?

One could adopt from Cinque (1999) the idea of a very rigid articulated functional hierarchy in the architecture of sentences, and in particular the commonly held notion that epistemic modality is located very high in the clause. One could then combine this with the idea associated with Beghelli & Stowell (1997) that quantifier movement targets particular positions in the sentence (rather than being an adjunction process that can target many kinds of projection). If all the quantifier targets are below the high position for epistemic modals, we get essentially the same generalization that we designed the ECP to capture, in particular for Scope-QR. We could say that ACD-QR does not care about specific Beghelli-Stowell targets but moves anywhere it needs to move to resolve ACD.

The question of why Scope-QR obeys the ECP would then reduce to two questions: (i) Why can Scope-QR not go into a higher clause to check features there? The answer is locality for feature-checking: under the assumption that all clauses have the relevant features, quantifiers will not be allowed to check the features in a higher clause. (ii) Why should the epistemic modal be higher than all the positions in which quantifiers can check their features? Cinque gives an intuitive answer, which is related to ideas in Iatridou (1990) and Kratzer (1999). He says that epistemic modals need to apply to whole propositions and therefore are higher in the tree than most if not all functional categories. However this intuition is already disproven by the facts we presented earlier of *wh*-movement easily applying across epistemic modals.

2.5.4 What is the ECP?

As hinted above, for simplicity sake, we will continue to work with a formulation of the ECP as ruling out LF-configurations where an epistemic modal intervenes between a quantifier and its trace.

What is the ECP due to? Under the Cinque/Beghelli-Stowell perspective, it is an unexplained fact about clause architecture. Under our formulation, it is an LF-intervention effect (which does not reduce to the effects discussed by Beck, see Footnote 17). Pending further research, we will treat the ECP as an LF-constraint *sui generis*.

2.6 Scoping Mechanisms without Movement

We said that the ECP constrains the relation between a quantifier and its trace. We therefore predict that if there are scoping mechanisms that do not involve movement, they should be able to apply across epistemic domains. Recent work in the syntax/semantic interface has indeed discussed a number of such mechanisms. Let us look at two prominent kinds of cases: (i) pseudo-scope indefinites and (ii) generic indefinites.

2.6.1 Pseudo-Scope Indefinites

Here are two examples of indefinites that can be read with wide scope for the indefinite even though the indefinite appears in what is otherwise assumed to be a domain out of which scope-affecting quantifier movement is impossible:

- (64) Everyone reported that John had insulted Max and some lady.

(65) Each teacher overheard the rumor that the dean had summoned a student of hers.

A much explored approach to this phenomenon employs choice-functions in the interpretation of such indefinites.¹⁹ One assumes representations roughly like these:

(66) $\exists f$: everybody reported that John had insulted Max and $f(\text{lady})$

(67) each teacher λx . $\exists f$: x overheard the rumor that the dean had summoned $f(\text{student of } x)$

Now, as hinted above, since this choice-function mechanism does not involve long distance quantifier movement of the indefinite, we expect it to be able to apply across epistemic modals.

(68) Everyone reported that John may have insulted Max and some lady.

$\exists f$: everybody reported that may $\left[\text{John have insulted Max and } f(\text{lady}) \right]$

The sentence (68) is correctly predicted to have a reading equivalent to “there is some lady such that everybody reported that it may be the case that John insulted Max and her”. But it achieves that reading without moving *some lady* (or *Max and some lady*) across the epistemic modal and out of the embedded clause. And therefore this is not a counter-example to the ECP. The same applies to a variant of (65):

(69) Each teacher overheard the rumor that the dean may have summoned a student of hers.

each teacher λx . $\exists f$: x overheard the rumor that
may $\left[\text{the dean have summoned } f(\text{student of } x) \right]$

The power of the choice-function mechanism should of course also apply in simpler examples. So, we expect a pseudo-wide-scope reading of the indefinite even in examples where the indefinite is not buried in some lower clause:

(70) John may have invited two friends of his from Texas.

$\exists f$: may $\left[\text{John have invited } f(\text{two friends of John's}) \right]$

¹⁹ See Reinhart (1997a,b), Winter (1997), Kratzer (1998) among others.

This will be interpreted as follows: “there is a way f of choosing elements from sets such that it may be the case that John invited the element that f chooses from the set of pluralities which are two friends of John’s”. This reduces to: “there is a particular plurality of two friends of John’s such that it may be the case that John invited this plurality”.

It is quite crucial that the reading that the choice-function mechanism produces for (70) is a wide-scope collective reading of *two friends of John’s*. The mechanism cannot produce a distributive wide-scope reading. Such a reading could only be produced by treating *two friends of John’s* as a distributive quantifier and moving it across the modal, which is ruled out by the ECP. Hence the badness of our example (34), repeated here:

- (34) #Two friends of John’s from Texas may have come to visit him this weekend, but they can’t both have come (because they hate each other).

2.6.2 Generic Indefinites

We would like to mention one other kind of scoping mechanism that does not involve quantifier movement. We assume that generic readings of indefinites are produced by having a covert generic operator bind the variable introduced by an indefinite.²⁰ The indefinite itself is not a quantifier. So, even if the indefinite needs to move to ensure that it ends up in the restrictor of the generic operator (which is for example part of the analysis of such sentences in Heim 1982), this will not result in a configuration where a quantifier binds its trace across an epistemic modal. We therefore expect generic indefinites to be able to have scope over epistemic modals:

- (71) A dog may well be asleep when his eyes are open.
Dogs may well be asleep when their eyes are open.

Gen [λx . dog x & his _{x} eyes are open] [λx . may [x be asleep]]

Our expectation seems to be borne out.²¹

²⁰ This analysis is found in Heim 1982 and much work after. It is of course controversial, so we will need to investigate whether our view of the ECP is an argument for this approach against one that builds the generic quantificational force into the meaning of the indefinite NP itself. For now, we will simply assume that the story involving a covert generic operator is correct.

²¹ Note that we can also have examples where generic claims are in the scope of an epistemic modal operator:

- (i) Q: Why is Chaucer so grumpy?
A: I don't know much about dogs.
a. Maybe dogs do not like it when you blow in their faces.
b. Dogs may not like it when you blow in their faces.

This possibility offers us another way of approximating in a grammatical way the meaning that (12) tries to express but can't:

(72) A/Any student whose light is on must be home.

Gen [λx . student x & x 's light is on] [λx . must [x be home]]

Here as well, the generic quantifier binds the variable introduced by the indefinite *a student* or the "free choice" indefinite *any student*.²² No quantifier has moved across the epistemic modal. The sentence is acceptable and expresses something very close to the intended meaning of (12). What is different is that this is a generic quantification and not the merely universal quantification that (12) wants to express.

2.7 Conclusion

We needed the ECP to explain the fact we observed about (12). If our suspicion about the ECP is right, we expect that the following ways of expressing the intended content of our puzzle sentence (12) should be acceptable, since they involve variable binding across the modal but not quantifier movement:

(73) Every student (in this dorm) is such that he must be home if his light is on.

(74) I know of every student (in this dorm) that he must be home if his light is on.

(75) ?Every student (in this dorm) is so reliable that he must be home if his light is on.

Our prediction appears to be correct: these examples are somewhat stilted but are acceptable.

²² Treating free-choice *any* as a Heimian indefinite caught by a covert generic operator is again not uncontroversial. For now we will assume it without further exploration. The analysis is found for example in Kadmon & Landman (1993).

3. Exploring the MIH

With the ECP in place, we have successfully ruled out those LF-structures for our puzzle sentence in (12) that have the quantifier *every student* take scope over the epistemic modal (those are the structures we labeled A and C). If the quantifier is nevertheless meant to bind the pronoun in the *if*-clause, the *if*-clause must be located below the quantifier, which by transitivity means it has to be lower than the modal. Since we assume that *if*-clauses need to restrict some operator, we next need to consider the possibility that the *if*-clause is restricting the quantifier. This would be the structure that we labeled B:

B **must > every + if**

must [λw . every [λx . student_x if his_x light is_w on] [λx . x be_w home]]

What this would mean is: ‘it must be the case that every student whose light is on is home’. The *if*-clause would be semantically equivalent to a restrictive relative clause. Since our sentence is unacceptable, something must make this structure unavailable.

Our plan is to argue for a constraint that essentially prevents *if*-clauses from being synonymous with relative clauses:

(2) The Modal *If*-Hypothesis (MIH)

An *if*-clause can only restrict quantifiers over possible situations/worlds, not quantifiers over individuals.

For many readers, this idea will have no shock value whatsoever. After all, didn’t we always think that *if*-clauses are used to make conditional sentences and aren’t conditional sentences per se statements about possible situations/worlds? Well, no. As we mentioned in the introduction, there is a widely accepted theory of the semantics of *if*-clauses that locates the conditional/modal force of the constructions they appear in not in the meaning of *if* but in a separate conditional/modal operator. This operator may be overt or covert and in the latter case it may appear tempting to attribute the meaning of the construction to *if* itself. But work in this tradition has shown that a unified theory of *if* is only possible if one treats *if*-clauses as supplying restrictions to independent operators. Kratzer (1986/1991) summarizes this discovery as follows:

(76) Kratzer's Thesis

“The history of the conditional is the story of a syntactic mistake. There is no two-place *if...then* connective in the logical forms of natural languages. *If*-clauses are devices for restricting the domains of various operators.”

Kratzer's own work concerns *if*-clauses restricting modal/adverbial operators of various sorts. At least in print, she does not consider the possibility that *if*-clauses could restrict determiner-quantifiers over individuals. But many examples that call for just such an analysis have surfaced over the years (some are due to Kratzer and/or Heim). In von Stechow (1998), the somewhat fragmented discussion in the literature is surveyed and a number of relevant examples are given. We will display here the following three cases:

- (77) a. Every letter will be answered if it is less than 5 pages long.
b. Every letter that is less than 5 pages long will be answered.
- (78) a. Nobody will be admitted into the country if he doesn't have a valid visa.
b. Nobody who doesn't have a valid visa will be admitted into the country.
- (79) a. Most papers are rejected if they are longer than 50 pages.
b. Most papers that are longer than 50 pages are rejected.

In every one of these pairs, the a-sentence with an *if*-clause seems synonymous with the b-sentence which has a restrictive relative clause on the quantificational noun phrase. The conclusion von Stechow (1998) reaches is that an analysis that extends Kratzer's Thesis to these cases is called for.

We think that a more detailed look is necessary. It doesn't take much of an effort to find examples where *if*-clauses are not equivalent with restrictive relative clauses, in fact where they lead to quite spectacularly weird sentences:

- (80) a. I invited the woman who runs the store downstairs.
b. I invited the woman if she runs the store downstairs.
- (81) a. At the party, I met some woman who works for Clinton.
b. At the party, I met some woman if she works for Clinton.

In fact, we argue that (80) and (81) constitute the normal case: quantifiers over individuals simply cannot be restricted by *if*-clauses. In our view, *if*-clauses are not truly all purpose restrictors. This is what the MIH expresses.

Now, of course the sentences in (77)-(79) are the real problem. We will argue that they satisfy the MIH because the quantifier in them is a modal quantifier over individuals.

3.1 Generic Flavor

We detect a distinct flavor of genericity in (77)-(79). These examples make claims about lawlike connections: between a letter's length and whether it will be answered, between a person's visa status and whether they will be admitted into the country, and between a paper's length and whether it will be rejected. The examples do not simply make claims about accidental facts. We think this is true in general for examples where *if*-clauses seem to restrict a determiner. This can be brought out by some subtle manipulations. Consider this pair:

- (82) a. Every book that I needed for the seminar happened to be on the table.
b. #Every book happened to be on the table if I needed it for the seminar.

The (a) example reports on a lucky accident. We cannot replace the relative clause with an *if*-clause, even though *every* is one of the determiners that can apparently work together with an *if*-clause. The (b) example is odd.

Here is another such pair:

- (83) Yesterday afternoon we found ourselves with a lot of time on our hand and we sat down to deal with the mail. In the end,
a. every letter that was less than 5 pages long was answered.
b. #every letter was answered if it was less than 5 pages long.

The context here is meant to suggest a haphazard, time-killing afternoon about which it is unlikely that one could make lawful generalizations. Again, the (b) example with an *if*-clause is degraded compared to the perfectly normal relative clause case in (a).

One final exhibit:

- (84) a. No paper that is longer than 50 pages is on this table.
a'. No paper is on this table that is longer than 50 pages.
b. No paper is on this table if it is longer than 50 pages.

Consider the kinds of situations that could be truthfully described by these sentences. All three sentences could describe a policy of yours that says that you will not tolerate long papers on the

table pointed to. But only the relative clause examples in (a) and (a') can describe an accidental fact, perhaps preceded by "What a strange accident! ...".

3.2 *If*-Clauses Can Restrict only Determiners that (also) Quantify over Worlds

We argue that *if*-clauses can only restrict quantifiers over possible worlds/situations. The apparent counterexamples involve a special kind of determiner-quantification. We assume that at least some determiners are ambiguous between readings where they quantify only over individuals (and thus will make an accidental claim about actual individuals, unless there is a modal operator on top of them) and readings where they quantify simultaneously over individuals and worlds (making them modal/generic operators in their own right). This ambiguity, we suggest, lies behind the two readings of a sentence like the following:

(85) Every friend of John's is a socialist.

Reading A: $\text{every}_x [x \text{ friend of John's in } w_0] [x \text{ socialist in } w_0]$

Reading B: $\text{every}_{x,w} [x \text{ friend of John's in } w] [x \text{ socialist in } w]$

Reading A of (85) is the accidental generalization reading which reports that everyone of John's actual friends here and now are socialist, leaving it open whether this is by pure happenstance or whether there is some principle behind this. Reading B says that all pairs of an individual and a world such that the individual is a friend of John's in that world are such that the individual is a socialist in that world. Of course, the quantification over worlds will be contextually restricted in the usual way (presumably here it is confined to worlds that are compatible with John's actual principles about who he considers a friend).

Our claim is that only determiners that quantify over worlds can be restricted by *if*-clauses. A sample structure of a pertinent examples is this:

(86) Every letter will be answered if it is less than 5 pages long.

$\text{every}_{x,w} [x \text{ letter \& } x \text{ is less than 5 pages long in } w] [x \text{ is answered in } w]$

Since this sentence quantifies not just over actual letters here and now but expresses a policy, the determiner can be restricted by an *if*-clause.

3.3 Revisiting (12): Modal Determiners Cannot Be Epistemic

We started out by arguing that the ECP and the MIH together rule out all scopal combinations of (12), thereby leaving it with no possible interpretation. The MIH permits *if*-clauses to restrict determiners as long as the quantification is modal, i.e. (also) over worlds. We also saw that the determiner *every* is, in fact, one such modal determiner. But then we have painted ourselves into a corner. How can we appeal to the MIH to rule out (12)? Actually, things get worse.

Consider the following sentences. The (a) sentence in (87) can be understood as a lawlike claim. Thus, it comes as no surprise that we can restrict the determiner quantifier with an *if*-clause as the (b) sentence shows. And lastly, we can conclude from some piece of evidence that this generalization holds, so we can produce the (c) sentence.

- (87) a. Every student hates his advisor.
b. Every student hates his advisor if his dissertation is a failure.
c. Every student must hate his advisor if his dissertation is a failure.

What is the difference between (87c) and (12)? Let us set up the parallel sentences for (12):

- (88) a. Every student is home
b. *Every student is home if his light is on
c. *Every student must be home if his light is on.

We see that the difference between (87) and (88) already shows up in the (b) sentences. What goes wrong in the change from (88a) to (88b) is the addition of the *if*-clause. In other words, we can add an *if*-clause to (87a) to derive (87b) but not to (88a) to obtain (88b). This must mean one of two things: either there is a difference already present between (87a) and (88a) or, (87a) and (88a) are alike but there is a difference in the type of *if*-clause that we are adding in the two sentences. It seems that the second alternative may be the correct one. The *if*-clause in (87) gives the reason for which a student might hate his advisor. That is, it gives the reason for (87a) per individual assignment to the variables bound by the determiner. We will refer to this *if*-clause as causal. On the other hand, the *if*-clause in (88) does not give the reason that would keep each student home but the reason for which we would conclude that each student is home. We will call this *if*-clause epistemic as it attempts to restrict a modal that quantifies over epistemically accessible worlds. To test whether it is indeed the nature of the *if*-clause that makes (88b) run afoul, let us test (87a) with an epistemic *if*-clause. For example, we see a lot of students with

black sweaters on campus today. We conclude that it has something to do with the students' feelings about their advisors. We conclude that it must be the case that every student who is wearing a black sweater hates his advisor. Can we express this by (89a,b)?

- (89) a. *Every student_i hates his advisor if he_j is wearing a black sweater.
b. *Every student_i must hate his advisor if he_j is wearing a black sweater.

It seems to us that the sentences in (89) have exactly the status of (12). We conclude that at least part of the problem with (88b) (and the difference with (87b)) is the epistemic *if*-clause. From (87-89) we conclude that it is possible to have a causal *if*-clause but not an epistemic *if*-clause restrict the modal determiner *every*.

Why is this? We don't really know why, but we have a suspicion. Our suspicion is that although some determiners can function as modal operators, no determiner can function as an epistemic modal operator.

4. Conclusion

In this paper we argued for the existence of the following two constraints in language:

The Epistemic Containment Principle (ECP)

An epistemic modal cannot intervene between a quantifier and its trace.

The Modal *If* Hypothesis (MIH)

An *if*-clause can only restrict quantifiers over possible situations/worlds, not quantifiers over individuals.

There are plenty of data that provide independent support for the ECP. The MIH was harder to detect independently but we saw it in action in sentences where it blocked interpretations that were consistent with the ECP. We also argued for the existence of modal determiners, that is quantificational determiners that range over individuals as well as over worlds (though not epistemically accessible ones).

It should become obvious that for us, epistemic modals are a distinct class of operators with their own syntactic properties, which means that even if their semantics is simply a special case of Kratzer's general schema for modal elements, their syntax is idiosyncratic.

Appendix A: Iffiness

In the body of this paper, we developed a condition that needs to be satisfied to allow an *if*-clause to restrict a determiner-quantifier: the quantification needs to be modal. We think that there are further consequences of choosing an *if*-clause as a restrictor rather than a relative clause. The material in this section does not affect the main point, but is sufficiently interesting to warrant a page or two.

We detect an element of "iffiness" in the relevant examples where an *if*-clause restricts a determiner-quantifier. This suggests that *if* is not merely a marker of quantifier restrictions (*pace* Kratzer's Thesis) but adds some meaning beyond that. To start getting a hint of what we mean, consider this pair found in Lewis (1975), the classic paper on restrictive *if*-clauses:

- (90) $\left\{ \begin{array}{l} \text{When} \\ \text{\#If} \end{array} \right\}$ Caesar woke up, he usually had tea.

While many times *if*-clauses restricting adverbial quantifiers like *usually* are interchangeable with *when*-clauses, this is not so in (90). Somehow, the *if*-variant suggests that there was a question for each day quantified over whether Caesar would wake up or not. Since people do wake up regularly, the iffiness contributed by *if* makes the sentence odd.

We think that there is iffiness contributed by *if* also in the examples where it seems to restrict determiners. Consider these variations on the letter-sentence:

- (91) Every letter will be answered if $\left\{ \begin{array}{l} \text{it less than 5 pages long} \\ \text{it is type – written} \\ \text{it criticizes Clinton somewhere} \\ \text{it is polite} \\ \text{the arguments are smart} \\ \text{it mentions the water shortage} \end{array} \right\}$

- (92) $\#$ Every letter will be answered if $\left\{ \begin{array}{l} \text{it is about the water shortage} \\ \text{it is from Europe} \end{array} \right\}$

To our ears (and those of our informants), the sentences in (92) are much less successful than the ones in (91). We conjecture that the reason is that choosing *if* signals, for example, that for every letter it is iffy whether it is polite or not. The author can choose to make it polite or not. But it is not the case that for a given letter it is iffy whether it is about the water shortage or not. If it is

not about the water shortage, then it can't be the same letter as if it is about the water shortage. We readily admit that this is a very nebulous intuition, but it does seem to correspond to quite robust judgments. Consider also this contrast:

- (93) a. Every congressman who is from Florida is a Republican.
b. #Every congressman is a Republican if he is from Florida.

The (a) sentence can be read as making a lawlike claim based on the voter population of Florida. But nevertheless the modal determiner-quantifier cannot be restricted by an *if*-clause, as (b) shows. The reason, we suspect, is that for a given congressman it is not iffy whether he is from Florida or not.

Appendix B: Lasersohn Conditionals

We have argued that an *if*-clause can restrict a determiner but only if the determiner is a modal operator. One might have wanted to pursue a different approach to derive what we wanted to derive (that the *if*-clause in the environments we have seen cannot restrict the determiner *every*). One might consider arguing, for example, that *if*-clauses cannot restrict determiners because they are syntactically unable to do so. That is, they are syntactically not part of the DP. We will refer to this as the “syntactic” approach, in contrast to the “semantic” approach proposed in the main text. With respect to the *if*-clauses discussed so far one could indeed reason that the syntactic approach is correct as these *if*-clauses are sentential adjuncts and therefore syntactically not in the right position to restrict the determiner. However, there are *if*-clauses that do appear to be part of the DP and even they do not restrict the determiner. Such cases are the focus of this appendix.

Consider the following sentences which contain what Lasersohn (1996) calls “adnominal conditionals”²³:

- (94) We all know the consequences if we fail

In (94) it is clear that the sentence does not mean *if we fail we know the consequences*. Instead the sentence “...asserts that we do actually now know the consequences. Which consequences? The ones which would result, if we were to fail.” (Lasersohn, p. 154)

Lasersohn argues that *the consequences if we fail* is an NP. One argument that he gives for this is that the *if*-clause can appear immediately adjacent to the subject as in (95), without the parenthetical intonation that we usually get in this position, as in (96).

- (95) a. The fine if you park in a handicapped spot is higher than the fine if your meter expires.
b. The price if you pay now is predictable; the price if you wait a year is not.
c. The outcome if John gets his way is sure to be unpleasant for the rest of us.
- (96) a. John, if you bother him long enough, will give you five dollars.
b. *John if you bother him long enough, will give you five dollars.

On the other hand, as Lasersohn points out, adnominal conditionals show a parenthetical intonation when they are separated from the subject:

- (97) a. The fine will, if you park in a handicapped spot, be higher than you want to pay.
b. *The fine will if you park in a handicapped spot, be higher than you want to pay.
- c. The price can, if you pay now, be predicted; the price cannot, if you wait a year, be predicted.
d. *The price can if you pay now, be predicted; the price cannot, if you wait a year, be predicted.
- e. The outcome will, if John gets his way, be unpleasant for the rest of us.
f. *The outcome will if John gets his way, be unpleasant for the rest of us.

Another piece of evidence that Lasersohn gives for the existence of adnominal *if*-clauses can be seen in the following sentence:

- (98) The location if it rains and the location if it doesn't rain are within five miles from each other.

In (98), "...neither *if*-clause takes scope over the rest of the sentence, but only over its own conjunct noun phrase. There seems no alternative in this construction to regarding the *if*-clauses as forming part of the noun phrases" (Lasersohn, p. 156).

²³ We should note that the only determiner that occurs in Lasersohn's examples is *the*. Once we try other determiners the sentences start becoming bad. Lasersohn does not discuss this nor does his proposal predict it in any obvious way

Lasersohn rejects several proposals for the adnominal *if*-clauses and finally settles on a semantics that would give paraphrases like the following:

- (99) a. The location if it rains and the location if it doesn't rain are within five miles from each other.
- b. The location in the worlds in which it rains and the location in the worlds in which it doesn't rain are within five miles from each other.

- (100) a. We all know the consequences if we fail
- b. We all know the consequences in the worlds in which we fail

If Lasersohn is right, the *if*-clauses in adnominal conditionals do not restrict the determiner, or in different words, the *if*-clause does not intersect with what is the restrictor of the determiner even when it is not a sentential adjunct but part of the relevant DP. This would lead to the conclusion that the semantic approach is to be preferred over the syntactic one.

However, one might hesitate to accept this conclusion and still hold out for the syntactic approach by arguing that even if Lasersohn's examples show that the adnominal conditional and the DP form a constituent, they do not show that the *if*-clause is sufficiently low to restrict the determiner. It could, for example, be that the adnominal conditional is an adjunct of the DP at or higher than the determiner. In such a case, the syntactic approach could still be the right one, as the *if*-clause would be too high to restrict the determiner. In fact, all of Lasersohn's examples are consistent with this possibility, except the following:

- (101) The consequences if we fail that he mentioned are not nearly as bad as the consequences if we fail that he did not mention.

If the intonation is as indicated, that is, no intonation associated with extraposition, the relative clauses *that he mentioned* and *that he didn't mention* come to the right of the adnominal conditional. This would place the *if*-clause safely in a position where it could restrict the determiner, given that material both before and after it restrict the determiner. We have to conclude, then, that the syntactic approach considered in this appendix is not the right path to take.

References

- Aoun, Joseph, and Li, Yen-Hui Audrey. 1993. *The Syntax of Scope*. Cambridge: MIT Press.
- Baker, C.L. 1970. Notes on the description of English Questions: The Role of an Abstract Question Morpheme. *Foundations of Language* 6, 197-219.
- Barker, Stephen. 1997. Material Implication and General Indicative Conditionals. *The Philosophical Quarterly* 47:195-211.
- Beck, Sigrid. 1996a. *Wh-Constructions and Transparent Logical Form*. PhD Dissertation. Universität Tübingen.
- Beck, Sigrid. 1996b. Quantified Structures as Barriers for LF Movement. *Natural Language Semantics* 4:1-56.
- Beghelli, Filippo, and Stowell, Tim. 1997. Distributivity and Negation: The Syntax of *Each* and *Every*. In *Ways of Scope Taking*, ed. Anna Szabolcsi, 71-107. Dordrecht: Kluwer.
- Belnap, Nuel. 1973. Restricted Quantification and Conditional Assertion. In *Truth, Syntax and Modality: Proceedings of the Temple University Conference on Alternative Semantics*, ed. Hugues Leblanc, 48-75. Amsterdam: North-Holland.
- Bhatt, Rajesh. 1997. Obligation and Possession. In *Papers from the UPenn/MIT Roundtable on Argument Structure and Aspect*, ed. Heidi Harley. Cambridge, MA: MIT Working Papers in Linguistics.
- Bosch, Peter. 1983. *Agreement and Anaphora: A Study of the Role of Pronouns in Syntax and Discourse*. New York: Academic Press.
- Brennan, Ginny. 1993. Root and Epistemic Modal Auxiliary Verbs, Graduate Student Linguistics Association (GLSA), University of Massachusetts at Amherst.
- Carlson, Greg. 1989. On the Semantic Composition of English Generic Sentences. In *Properties, Types and Meaning. Volume II: Semantic Issues*, eds. Gennaro Chierchia, Barbara Partee and Raymond Turner, 167-192. Dordrecht: Kluwer.
- Chomsky, Noam. 1995. Categories and Transformations. In *The Minimalist Program*, 219-394. Cambridge, MA: MIT Press.
- Chomsky, Noam. 2001. Derivation by Phase. In *A Life in Language: A Festschrift for Ken Hale*, ed. Michael Kenstowicz. MIT Press.

- Cinque, Guglielmo. 1999. *Adverbs and Functional Heads: A Cross-Linguistic Perspective*. Oxford: Oxford University Press.
- Dahl, Östen. 1975. On Generics. In *Formal Semantics of Natural Language*, ed. Edward Keenan, 99-111. Cambridge: Cambridge University Press.
- Diesing, Molly. 1992. *Indefinites*. Cambridge, MA: MIT Press.
- Farkas, Donka. 1981. Quantifier Scope and Syntactic Islands. *Chicago Linguistics Society* 17:59-66.
- Farkas, Donka, and Sugioka, Yoko. 1983. Restrictive *If/When*-Clauses. *Linguistics and Philosophy* 6:225-258.
- Fiengo, Robert, and May, Robert. 1994. *Indices and Identity*. MIT Press.
- von Stechow, Kai. 1994. Restrictions on Quantifier Domains, Graduate Student Linguistics Association (GLSA), University of Massachusetts, Amherst.
- von Stechow, Kai. 1998. Quantifiers and *If*-Clauses. *The Philosophical Quarterly* 48:209-214.
- Fox, Danny. 1999. Reconstruction, Binding Theory, and the Interpretation of Chains. *Linguistic Inquiry* 30:157-196.
- Fox, Danny. 2000. *Economy and Semantic Interpretation*, Cambridge, MA: MIT Press.
- Heim, Irene. 1982. *The Semantics of Definite and Indefinite Noun Phrases*, University of Massachusetts at Amherst.
- Heim, Irene. 2000. Degree Operators and Scope. *Semantics and Linguistic Theory* 10.
- Higginbotham, James. 1986. Linguistic Theory and Davidson's Program in Semantics. In *Truth and Interpretation: Perspectives on the Philosophy of Donald Davidson*, ed. Ernest LePore, 29-48. Oxford: Blackwell.
- Hornstein, Norbert. 1995. *Logical Form. From GB to Minimalism*. Oxford: Blackwell.
- Hornstein, Norbert. 1999. Minimalism and Quantifier Raising. In *Working Minimalism*, eds. Samuel David Epstein and Norbert Hornstein, 45-75. Cambridge, MA: MIT Press.
- Iatridou, Sabine. 1990. The Past, the Possible, and the Evident. *Linguistic Inquiry* 21:123-129.
- Ioup, Georgette. 1975. *The Treatment of Quantifier Scope in a Transformational Grammar*. PhD Dissertation. CUNY.

- Kadmon, Nirit, and Landman, Fred. 1993. *Any*. *Linguistics and Philosophy* 16:353-422.
- Kennedy, Christopher. 1997. Antecedent-Contained Deletion and the Syntax of Quantification. *Linguistic Inquiry* 28:662-688.
- Kitahara, Hisatsugu. 1996. Raising Quantifiers and Quantifier Raising. In *Minimal Ideas*, eds. Werner Abraham, Samuel David Epstein, Höskuldur Thráinsson and C. Jan-Wouter Zwart.
- Kratzer, Angelika. 1978. *Semantik der Rede: Kontexttheorie - Modalwörter - Konditionalsätze*. Königstein/Taunus: Scriptor.
- Kratzer, Angelika. 1986. Conditionals. *Chicago Linguistics Society* 22:1-15.
- Kratzer, Angelika. 1998. Scope or Pseudoscope? Are there Wide-Scope Indefinites? In *Events and Grammar*, ed. Susan Rothstein, 163-196. Dordrecht: Kluwer.
- Kratzer, Angelika. 1999. Beyond *Ouch* and *Oops*. How Descriptive and Expressive Meaning Interact. Cornell Context-Dependency Conference, Cornell University.
- Lasnik, Peter. 1996. Adnominal Conditionals. *Semantics and Linguistic Theory* 6:154-166.
- Lasnik, Howard. 1999. Chains of Arguments. In *Working Minimalism*, eds. Samuel David Epstein and Norbert Hornstein, 189-215. Cambridge, MA: MIT Press.
- Lebeaux, David. 1994. Where Does the Binding Theory Apply? ms.
- Lewis, David. 1975. Adverbs of Quantification. In *Formal Semantics of Natural Language*, ed. Edward Keenan, 3-15. Cambridge: Cambridge University Press.
- May, Robert. 1977. *The Grammar of Quantification*, Massachusetts Institute of Technology: PhD Thesis.
- May, Robert. 1985. *Logical Form: Its Structure and Derivation*. Cambridge: MIT Press.
- Musan, Renate. 1997. *On the Temporal Interpretation of Noun Phrases*. New York: Garland. [Outstanding Dissertations in Linguistics. Revision of 1995 PhD Thesis from MIT]
- Partee, Barbara. 1971. On the Requirement that Transformations Preserve Meaning. In *Studies in Linguistic Semantics*, ed. Charles Fillmore and Terence Langendoen, 1-21. New York: Holt, Rinehart, and Winston.
- Pelletier, F. J. 1994. The Principle of Semantic Compositionality. *Topoi* 13: 11-24.

- Pelletier, F. J. 1993. On an Argument Against Semantic Compositionality. In *Logic, Methodology, and Philosophy of Science*, ed. Dag Westerståhl. Dordrecht, Kluwer.
- Pesetsky, David. 2000. *Phrasal Movement and Its Kin*. Cambridge: MIT Press.
- Read, Stephen. 1992. Conditionals Are Not Truth-Functional - an Argument From Peirce. *Analysis* 52:5-12.
- Reinhart, Tanya. 1997a. *Wh-in-Situ* in the Framework of the Minimalist Program. *Natural Language Semantics* 6.1:29-56.
- Reinhart, Tanya. 1997b. Quantifier Scopepe - How Labor is Divided between QR and Choice Functions. *Linguistics and Philosophy* 20:335-397.
- Rodman, R. 1976. Scope Phenomena, Movement "Transformations", and Relative Clauses. In *Montague Grammar*, ed. Barbara Partee. Academic Press, New York.
- Romero, Maribel. 1997. The Correlation between Scope Reconstruction and Connectivity Effects. *WCCFL* 16:351-366.
- Sag, Ivan. 1976. *Deletion and Logical Form*. PhD Dissertation, MIT.
- Sauerland, Uli. 1999. Total Reconstruction, PF-Movement, and Derivational Order. Ms. to appear in *Linguistic Inquiry* in a revised form. <http://www2.sfs.nphil.uni-tuebingen.de/uli/new.html>
- Szabolcsi, Anna ed. 1997. *Ways of Scope Taking*. Dordrecht: Kluwer.
- Tsai, Dylan W.-T. 1994. *On Economizing the Theory of A-Bar Dependencies*. PhD Thesis. Massachusetts Institute of Technology.
- Williams, Edwin. 1977. Discourse and Logical Form. *Linguistic Inquiry* 8.1:101-139.
- Winter, Yoad. 1997. Choice Functions and the Scopal Semantics of Indefinites. *Linguistics and Philosophy* 20:399-467.
- Wurmbrand, Susi. 1999. Modal Verbs Must Be Raising Verbs. *WCCFL* 18:599-612.
- Wurmbrand, Susi, and Bobaljik, Jonathan David. 1999. Modals, Raising and A-Reconstruction. Ms. Paper presented at Leiden University (Oct 1999). <http://web.mit.edu/susi/www/Leiden.pdf>