



Volume 3

Issue 2 *Papers from the 20th Annual Penn Linguistics
Colloquium*

Article 3

1-1-1996

Epistemic:Root::Particular:General

Virginia Brennan

Epistemic:Root::Particular:General

Epistemic:Root::Particular:General

Virginia Brennan

1. Introduction

Very often, when we talk about situations in the world, we talk about particular situations. Also frequently, we talk about kinds of situations or classes of situations. For example, given a context of utterance, 1 is probably only about one situation, whereas 2 might well describe a number of different situations.

1. I lit that match.
2. A dog barked.

In a discourse, 2 *can* be used to say something about a particular situation, but it can be used in other ways as well. Like an indefinite NP, its interpretation swings from the specific to the general, propelled by various other features of the discourse. 1, in contrast, is like a name, pointing to a particular situation in much the same way as a name points to a particular individual. 3 is even more tightly tied to a particular situation than 1. (It is tied in a different way, too: in 1, the real world facts about matches tell us that 'I lit that match' must be true only in virtue of one situation. For 3, it is the temporal and locative adverbs that tie it to one situation.)

3. I lit a match at 10 a.m. on Feb. 1 1996 in Nashville.

Sentences such as 2 are, in the unmarked case, more open to variable interpretation than are sentences such as 1 or 3. Notice that it is quite easy to quantify over situations described by 2, harder to quantify over situations described by 1, and not possible to quantify over situations described by sentences such as 3:

4. Every time a dog barked, I jumped.
5. ?Every time I lit that match, I burned my finger.
6. #Every time I lit a match at the stroke of 10 a.m. on Feb. 1 1996 in Nashville, I burned my finger.

The contrast between 4 and 6 is a contrast between two poles on a continuum: at one pole are vague sentences and at the other are specific sentences, in the sense of being vague about what situation they describe, on the one hand, or of describing only one specific situation, on the other. Vague sentences can always be made specific by additional information, and sentences may be made specific to various degrees.

I will apply these ideas to the analysis of a series of contrasts between modal

sentences with root interpretations and modal sentences with epistemic interpretations. My basic idea is that epistemic modal sentences tend to be about particular situations whereas root modal sentences tend to be about a whole class of situations. By 'be about' I mean that the necessity or possibility which is asserted is held to be true, in epistemic cases, only of a particular situation whereas the necessity or possibility holds good across a class of situations in the root cases.

Why should this be so? The reason is that it is the nature of laws, regulations, dispositions and abilities to be relevant in a class of situations, whereas we tend to reason epistemically about the situation which is of immediate concern to us. A freak of nature is exactly the sort of thing that is not the product of 'natural laws', colloquially understood, and reaching beyond one's potential on a single occasion (propelled by a rush of adrenaline, for example) is to do on a single occasion something that never occurs in the class of normal situations representing one's abilities.¹

To build this into the semantics, I'll argue that the restrictions on epistemic modals differ from those on root modals: the conversational backgrounds restricting epistemic modals are typically situation-specific whereas those restricting root modals are typically situation-indefinite, in a sense to be spelled out below.

2. Specificity and the Interpretation of Modal Sentences

2.1. Root vs. Epistemic Modality

Consider the modal sentences in 7-10. (The most likely sort of interpretation is marked for each one.)

7. EPISTEMIC
 Considering the way the zookeeper harassed him, that tiger may bite you.
8. EPISTEMIC
 Given the condition of the floor in the belltower, Will may have killed the stranger.
9. DEONTIC
 According to Maine law, dogs may run free.

¹Palmer 1977 and Kratzer 1981, 1991 are important antecedents for the approach I take here in the sense that they both appeal to the idea that different kinds of modal reasoning underlie different types of modality. I would also like to thank Jack Brennan for discussion of these ideas.

10. DYNAMIC

Since she works out, Brenda can lift 100 pounds.

In each case, the adjunct indicates the sort of conversational background (in the sense of Kratzer 1981, 1991) restricting the modal. I'm interested in the fact that in epistemic 7 and 8, the adjunct directs our attention to a here and now kind of situation whereas the adjunct in deontic 9 directs us to all the situations where Maine law is enforced, and the adjunct in dynamic 10 directs our attention to all the situations where Brenda has the property of working out regularly.²

These cases are representative of a systematic pragmatic difference between root interpretations, on the one hand, and epistemic interpretations, on the other. A variety of secondary interpretive phenomena suggest that the topic of an epistemic modal sentence is usually a particular situation whereas the topic of a root modal sentence is usually a class of situations.

One such secondary interpretive phenomenon is temporal interpretation. The temporal interpretation of the sentence under the scope of the modal generally differs depending on whether the modal gets an epistemic or a root interpretation: epistemic interpretations of the modal generally lead to very particular temporal interpretations of the sentence under the scope of the modal, while this is not true of root interpretations. In 11 and 12, the available temporal interpretations for the sentence under the scope of an epistemic modal coincide with the temporal interpretations generally available for the present tense. Specifically, stative sentences get 'now' interpretations (11) and non-statives get habitual interpretations (12). Sentences under root modals, in contrast, tend to be temporally underdetermined. (See the deontic readings of 11-12.)

11. Bill must be on time.

Epistemic reading: It must be the case that Bill is on time (now).

Deontic reading: It is required that Bill be on time/Bill is obliged to be on time (on whatever occasions the conversational background makes relevant.)

² It is fairly easy to come up with examples illustrating the opposite, i.e. examples in which an epistemic modal is restricted by a general sort of conversational background, or ones where root modals are restricted by a conversational background which is about a single situation only:

i. epistemic:

Given that dogs like to chew things up, it may well be that Scout is the one who chewed up your shoes.

ii. deontic:

Given the regulations concerning the Queen's activities on New Year's Day in the year 2,000, we must not plan a meeting for that date.

iii. dynamic:

Because he has the flu, John cannot lift that box.

These examples are in keeping with the claims made in the text. They are simply atypical examples of modal sentences from their respective interpretive classes.

12. Assistant professors may take semester-long sabbaticals.
 Epistemic reading: It is possible that assistant professors take semester-long sabbaticals (whenever they take sabbaticals).
 Deontic reading: It is allowed that assistant professors take semester-long sabbaticals. / Assistant professors have the right to take a semester-long sabbatical.

Specific temporal interpretations are not associated with modal sentences expressing regulations, regularities, rights, obligations, abilities and dispositions, unless the temporal information is explicitly given in the modal sentence (as in 13).

13. Sam must appear in court of Feb. 15th 1996 at 2 p.m. in Nashville.

The specific/general divide between epistemic modality on the one hand and root modality on the other, extends into the realm of nominal interpretation as well. It is noticeable that the interpretation of the subject NP in 14 is influenced by the interpretative class of the modal, as is indicated in the glosses given here.

14. The District Attorney may be a Canadian.
 Epistemic reading: It is possible that the person who is the District Attorney (in the relevant context) is in fact a Canadian.
 Deontic reading: It is allowed that the District Attorney (whoever it is at any given time) be a Canadian.

It often happens that type/token NPs, such as *the District Attorney* in this example, get token interpretations in epistemic sentences but get either sort of an interpretation in a root modal sentence. Note: The facts here are not simple. What sort of predicate (15) as well as pragmatic factors (16) affect the interpretation of type-token NPs markedly, regardless of how the modal is interpreted.

15. The District Attorney must run three miles every day.
 Epistemic reading: It is a certainty that (this particular) DA runs three miles a day.
 Deontic reading a: (This particular) DA is required to run three miles a day.
 Deontic reading b: DAs in this district are required to run three miles a day.
16. The District Attorney may be responsible for custody cases.
 Epistemic reading: It is possible that the DA (whoever it is) is responsible for custody cases.
 Deontic reading: (?) It is allowed that the DA (whoever it is) be responsible for custody cases. ['(?)' = 'if available']

It does seem to be the case, however, that if, in a given sentence, an NP can get a token reading when the modal gets a root reading, then the token reading will also be there when the modal is read epistemically. The converse is not always true; an epistemic reading of a given sentence may co-incide with a token interpretation of an NP in that sentence, while the token interpretation is not available given a root reading of the modal. This is what happens in 14, the case of immediate concern to me. It is with this understanding in mind that I claim that epistemic modals are associated more strongly with token readings of NPs than root modals are.

2.2. Conversational Backgrounds

The foregoing facts are unsurprising if we assume that in the epistemic cases the conversational background has already provided information about time and the identity of the District Attorney, and that the conversational background relevant for root readings has not provided such information. It is my idea that epistemic modal reasoning typically does rest on information of just this kind, i.e. on information which is particular to a given situation, and that reasoning which concerns the root modalities typically rests on much more general information. (In fact, this tendency is so strong that even when the modal sentences are presented *out of context* (as 11, 12, and 14 were here), native speakers supply appropriately specific or general conversational backgrounds for epistemic and root readings respectively.) This section is devoted to a more detailed discussion of 'conversational backgrounds', with pointers to some partially analogous devices found in the semantics and pragmatics literature, followed by a more precise statement of the proposed analysis of 11, 12, and 14.

The term 'conversational background' was coined by Angelika Kratzer to talk about the background information relevant for interpreting a modal expression, most fundamentally for setting up the accessibility relation in terms of which the modal is interpreted on a given occasion of use. The adjuncts in 7-10 are all suggestive of what might be included in the conversational background. In Kratzer's analysis of the semantics of modal words, conversational backgrounds are formal objects : conversational backgrounds are functions which assign to every member of W a subset of the power set of W (Kratzer, 1991, p. 641). This is summarized, first in prose form and then formally, in 17.

17. A *conversational background*, f , is a function mapping worlds onto sets of propositions.

If f is a conversational background, then for all worlds $w \in W$:

$f(w) \rightarrow A$, where $A \subseteq \rho(W)$

Kratzer goes on to show that modal worlds are doubly relative (to pragmatically supplied conversational backgrounds), depending on one conversational background to

determine the *modal base* and on a second to determine the *ordering source*; both the modal base and the ordering source relativize the interpretation of the modal to particular contextually determined concerns.

Although space precludes discussion of the motivation for and details of this analysis here, I must at least note that the modal base in Kratzer's semantics coincides with the set of accessible worlds in the semantics for modal logic of long-standing in philosophy. (See Hughes and Cresswell 1968 for an introduction to philosophical modal logic.) So, in this framework, the conversational background determines what worlds are accessible on a given occasion: a world w' is accessible from a world w iff all the propositions in $f(w)$ are true in w' (where ' f ' is the conversational background, as above.)

The structural role played by the conversational background determining the modal base (the 'mb-cb', hereafter) very closely resembles the structural role played by the restriction in any tripartite quantifier structure. Partee 1991 provides 18 as an illustration of operator-headed structure in its most general form. The schema in 19 makes explicit how modals fit onto this pattern. In what follows, I will frequently refer to the mb-cb as 'the restriction on the modal'.

18. Partee's (1991) Generalized Tripartite Structure

S

OPERATOR	RESTRICTOR	NUCLEAR SCOPE
V	'cases'	main clause
must	<i>if</i> -clause	assertion
not	subordinate clauses	focus
almost every	common noun phrase	consequent
always	topic	main predication
mostly	presuppositions	
GENERIC	domain	
	antecedent	
	context	

19. Modal_s [conversational background (s)] [scope (s)]

It is also worthwhile here to consider a somewhat less formal characterization of conversational backgrounds. Presumably, the conversational background that relativizes the interpretation of a modal on a given occasion consists of a set of propositions on a given topic, which the speakers and hearers in the discourse situation accept as true and of which they are, in some sense, aware. Viewed in this way, conversational backgrounds look a lot like presuppositional common grounds, as defined in Stalnaker 1979 and used in a great deal of subsequent work on discourse in formal semantics. As McConnell-Ginet and Chierchia 1990 point out, however, conversational backgrounds restricting

modals and the common ground of the discourse must be distinguished; in discourses such as 20, the first proposition is as a matter of course part of the common ground for evaluating the second, but it plainly must not be part of conversational background restricting the modal: if it were, the modal sentence would inevitably be false.

20. Loren didn't sing. But she could have.

Furthermore, the two conversational backgrounds that Kratzer employs are different from one another: one tells what worlds are accessible and the other ranks the accessible worlds according to how well they approximate some ideal. The moral of all of these cautionary notes is that the mass of *relevant information* available to speakers and hearers in a discourse is often drawn on selectively by various linguistic devices. One device (such as the record of presuppositions) may well pull out different information from what is pulled out by another (such as a dynamic conversational background.)

Finally, in future work, it will be worthwhile to explore how well conversational backgrounds match up with *topics*. These mechanisms resemble one another superficially at least, and to the extent that they can be viewed as the same thing we have a better chance of catching now elusive generalizations cutting across modal and non-modal data.

At any rate, conversational backgrounds are the device that I will use to explain the root/epistemic contrasts in 11, 12 and 14. For the definitions of the modals provided here (in 23 and 24), I have (in 22) adapted Kratzer's notion of conversational backgrounds for a semantic framework where sentences denote sets of situations (see 21.) I assume the semantic framework developed in Portner 1992, the major features of which are summarized in the appendix.

21. A *proposition* ϕ denotes the set of situations $s \in S$ s.t. $\phi(s) = 1$.
22. A *conversational background*, f , is a function from situations to the intersection of sets of sets of situations [i.e. from situations to (the intersection of) sets of propositions].
23. $[\text{must}(\alpha)(\beta)] = 1$ iff the set of situations in which α is true is a subset of the set of situations in which β is true.
24. $[\text{can}(\alpha)(\beta)] = 1$ iff the set of situations in which α is true intersects with the set of situations in which β is true.

In Section 2.1, it was shown that epistemic readings of a modal are associated with well-defined temporal and nominal interpretations of material under the scope of the modal, and we saw that this was not the case for root readings of the modals. It was also noted that while these associations tend to occur, this tendency may be overridden

(resulting in temporally determinate interpretations of sentences under the scope of root modals, for example.) I account for these facts by positing that epistemic modality is typically associated with conversational backgrounds that specify such things as time and the identity of individuals, whereas root modalities typically are associated with much more general conversational backgrounds. More to the point, for epistemic readings of 11, 12 and 14, speakers and hearers supply conversational backgrounds which specify the (a) value of the temporal parameter, and (b) the identity of the District Attorney in the context of utterance. For root readings of these sentences, speakers and hearers normally supply no such specific information.

Immediately below, I have provided explicit sample epistemic and deontic conversational backgrounds for the modal sentence in 11.

25. *Bill must be on time* (=11)

sample deontic conversational background:

- a. Bill is a subway conductor.
- b. Subway conductors work shifts that last precisely 8 hours, from 7a.m.-3p.m., 3p.m.-11p.m., or 11p.m.-7a.m.
- c. Subway conductors leave exactly when their shifts end.

Given a-c as the conversational background, α , [**must** [α] [**Bill be on time**]] = 1 iff the set of situations in which a-c hold is a subset of the set of situations in which Bill is on time.

26. *Bill must be on time* (=11)

sample epistemic conversational background:

- a. Bill is expected at 8p.m.
- b. It is now 7:59 p.m.
- c. Bill's car just pulled up in front of the house..

Given a-c as the conversational background, α , [**must** [α] [**Bill be on time**]] = 1 iff the set of situations in which a-c hold is a subset of the set of situations in which Bill is on time.

Because the conversational background in 26 explicitly makes reference to the utterance situation, in this case the conversational background is for all intents and purposes equivalent to the presuppositional common ground, discussed earlier. Root readings, in contrast, rarely arise when the relevant conversational background is the presuppositional common ground; root readings instead arise against conversational backgrounds setting

out what *would* be true if all the rules were followed, or what *could* be true if one exercised all of one's capacities, or what one would *like* to be true.

The reason the epistemic reading of 11 gives rise to such a specific temporal interpretation of 'Bill be on time' is that 'Bill be on time' inherits the value of the temporal parameter which is fixed in the conversational background. Because this is the time of utterance, 'Bill be on time' is interpreted in exactly the same way as the present tense sentence 'Bill is on time' is interpreted. A similar account can be given of the type/token NP difference seen in 14: by hypothesis, an epistemic conversational background will typically identify the actual District Attorney whereas a deontic conversational background does not. Taking the sentences out of context, we assume the modals are behaving in a normal way and so the intuitions about 14 are those described above.

2.3. Situation-Specific vs. Situation-Indefinite Propositions and Conversational Backgrounds

I have claimed that epistemic conversational backgrounds in effect *are* the presuppositional common ground, and more specifically that they often contain information that resolves temporal and nominal indeterminacy while root conversational backgrounds do not. While this suffices to explain the facts from Section 2.1 regarding 11, 12 and 14, I am going to make a stronger claim here: epistemic conversational backgrounds concern only one actual situation, whereas root conversational backgrounds concern more than one.³

The advantage in positing this fundamental difference between epistemic and root conversational backgrounds is that such a difference would (a) make sense out of the fact that epistemic modal sentences often seem to be more immediate and particular in meaning than root modal sentences (witness the facts in Section 2.1), and (b) make it possible to explain why epistemic modal sentences, unlike root modal sentences, don't serve as the scope to a wide scope adverb, as will be seen below.

The definitions of *situation-specific proposition* (28) and *situation-indefinite proposition* (29) immediately below will enable me to be more precise about the ideas just presented. These definitions presuppose a definition of *distinct*; it appears in 27.

27. Two situations *s* and *s'* are *distinct* iff *s* is not part-of *s'* and *s'* is not part-of *s*.⁴

³The obvious difficulty with this claim lies in the phrase 'one situation': how do we measure situations in order to count them? Numerous authors have discussed this issue, and I will address it and von Stechow 1994's approach to it in the next section. For the time being, I will presuppose that there is a coherent way of measuring and counting situations available.

⁴For the definition of the *part-of* relation, as well as for the other definitions providing the semantic framework assumed here, see the appendix.

28. A (tenseless) proposition p is *situation-specific* iff for all situations s' in S and all world-situations $s-w$ in S , if $p(s') = 1$ and s' is part of $s-w$, then there is no s'' distinct from s' and s'' is part-of $s-w$ s.t. $p(s'') = 1$.
29. A (tenseless) proposition p is *situation-indefinite* iff for some $s-w$ there are two distinct situations s and s' , each of which is part-of $s-w$ s.t. $p(s) = 1$ and $p(s') = 1$.
30. A conversational background, f , is situation-specific when applied to a world w iff $\cap f(w)$ is a situation-specific proposition.

Notice that situation-specific propositions are true in at most one situation per world. This is guaranteed in part by the fact that, in the semantics assumed here, situations are structured by the part-of relation onto complete join semi-lattices, the maximal element of any such semi-lattice being a world. The point is spelled out in the theorems presented in 31 and 32.

31. The cardinality of the set of worlds containing situations where p is true is the same as the cardinality of the set of situations where p is true, if p is situation-specific.
32. The cardinality of the set of worlds containing situations where p is true is smaller than the cardinality of the set of situations where p is true, if p is situation-indefinite.

When a conversational background is situation-specific, then, the modal quantification over accessible situations reduces to traditional modal quantification over accessible worlds. This is not the case for 25, where the conversational background is not (in plausible models) situation-specific. Situation-specific conversational backgrounds come in to play later in explaining why adverbs of quantification don't take scope over modal sentences with epistemic interpretations.

The account of 11, 12 and 14 developed in the previous section carries over to this one; it is placed in a broader perspective here. It makes sense that situation-specific conversational backgrounds characteristically supply information that helps fix the temporal parameter and the identity of individuals described by NPs, among other things.

3. Measuring Situations

In quantifying over situations, one of the tricky jobs is getting the 'grain' right, a point discussed in Krifka 1989 and von Stechow 1994, *inter alia*. In a sentence such as 33, for example, it is important that we count each cabin-building once; we want to avoid

counting a situation in which John built one cabin and then another as a single cabin-building situation, for example -- it should count as two. (What if John used metal nails in the second cabin in such a case? The sentence should come out false, but it wouldn't.)

33. When John builds a cabin, he always uses wooden nails.
 sense: Every situation in which John builds a cabin is a situation in which he uses wooden nails.

von Fintel 1994 proposes the general semantic schema for adverbs of quantification given in 34 and the particular rule for *always* appearing in 35. It assigns the meaning represented by 36 to the sentence at hand.

34. von Fintel's schema for the semantics of quantificational adverbs
 [Q-Adverb- δ] $(\alpha)(\beta) = \{s: \delta * [\text{minimal}(\alpha \cap S(s_w)), \text{part-of}(\beta)]\}$
35. Semantic rule for *always* from von Fintel 1994
 [always] $(\alpha)(\beta) = \{s: \{s': \text{minimal}(\alpha \cap S(s'_w))\} \subseteq \{s': \exists s'' \text{ s.t. } s' \text{ is part-of } s'' \text{ and } s'' \in \beta\}\}$
36. [Always (John builds a cabin) (John uses wooden nails)] = 1 iff
 the set of minimal real-world situations in which John builds a cabin is a subset of the (set of parts of the) situations in which John uses wooden nails.

One feature of this definition to pay attention to is the use of 'minimal' in the specification of the first argument α .

In general with telic sentences, we count by the culmination point of the telic event. A problem arises, however, when the restriction on an adverb of quantification is atelic (i.e. a state or an activity) rather than telic (such as the accomplishment sentence used in 33.) In atelic cases, the grain at which situations are counted is more plainly a consequence of pragmatic factors. Consider the examples in 37-39.

37. Whenever a child is taller than the teacher, there's trouble. [Likely grain of situations: one classroom over the course of a schoolyear.]
38. Sometimes, if I'm happy, I forget my troubles.
 [Likely grain of situations: stretches of time of a length determined by the speaker: possibly he has in mind years of his life, possibly he has in mind sub-intervals of single days]

⁵ von Fintel makes it clear that he is aware of difficulties with counting by 'minimal situations'; the issues raised here are not his central concern.

39. He is never quiet at night.

[Likely grain of situations: Periods of time long enough for someone to notice that he is being quiet.]

In cases where the restriction is atelic, the size of the situation that must be counted varies widely from sentence to sentence, depending on extra-grammatical factors. In 37, for example, the fact that one is talking about classrooms, students and teachers presumably brings to mind the notion of school-year-size situations; in 38, the immediate concerns of the speaker determine the size of the situations that are counted; for 39, what the pronoun *he* refers to will affect what size situations are to be counted (very small if *he* refers to a baby, for example, but bigger if *he* refers to an adult, or a pet.)

In order to reflect this dependence on the context, I'll assume that there's a set of measure functions which map propositions onto propositions in such a way that the output propositions denote a set of situations of the appropriate grain. The definition for these functions appears in 40.

40. For any ϕ , ι and f :

size_f is a function mapping propositions ϕ onto propositions ι in such a way that $\iota \subseteq \phi$, and for all $s \in \iota$, s has the dimensions specified by f . [Dimensions may be spatio-temporal or other.]

Given 40, I'll assume the revised general schema for quantificational adverb semantics appearing in 41.

41. [Q-Adverb- δ] (α)(β) = { s : δ * [$\text{size}_f(\alpha) \cap S(s_w)$], ($\exists s'$ s.t. s' is part-of s and $s' \in \beta$) }

In the case of telic restrictions, $\text{size}(\alpha)$ will normally yield the spatio-temporally minimal situations in which α is true, and the semantics will turn out just as in von Stechow's analysis. In the case of atelic restrictions, the size that counts will vary widely from sentence to sentence.

4. A Puzzle⁶

In each of 42-44, a modal sentence is embedded under an adverb.

⁶ See Iatridou 1990 for some related observations.

42. Usually, students may use the copy machine on the first floor.
 Gloss: Usually, it is allowed that students use the copy machine on the first floor.
 Not available: Usually, it is possible that student use the copy machine on the first floor.
43. While working for Unisys, Bob must wear a suit.
 Gloss: Throughout the time Bob works at Unisys, he is required to wear a suit.
 Not available: Throughout the time Bob works at Unisys, it is a certainty that he wears a suit.
44. At high altitudes, Brenda can run a 6 minute mile.
 Gloss: At high altitudes, Brenda has the capacity to run a 6 minute mile.
 Not available: At high altitudes, it is possible that Brenda runs/will run a 6 min. mile.

In each of these examples, an adverb taking wide-scope over the modal affects the range of interpretation associated with that modal. More specifically, epistemic readings of a modal sentence are, in the unmarked case, lost when the modal sentence is under the scope of an adverb of quantification (42), a durative temporal adverb (43), or an indefinite locative adverb interpreted generically (44). The root readings remain in the presence of these adverbs. The remainder of this paper is devoted to explaining these facts.

5. A-Quantification

In the semantics adopted here, both modals and adverbs of quantification range over situations; the difference is that the adverbs only range over actual situations, whereas the modals range over the whole class of situations, whether actual or not. The similarity between modals and adverbs is brought out by the semantic schemata in 45-46.

45.[=19] Modal_s [conversational background (s)] [scope (s)]

46. Adverb of quantification_s [restriction(s)][scope (s)]

Partee 1991, discussing different types of quantification found in natural language, discusses a fundamental divide between quantification in nouns phrases ('D-quantification') and quantification by verbal and adverbial expressions ('A-quantification'). A-quantifiers tend to rely much more centrally on contextually supplied

information for their restrictions whereas the central restriction on a D-quantifier is fixed by the syntax.

5.1. Nested A-Quantifiers Share Restrictions

In each of the sentences in 42-44, one A-quantifier is nested inside another. The puzzling fact is that when a modal is nested under an extensional A-quantifier, epistemic readings are lost. A new observation about A-quantifiers is critical to solving this puzzle: it appears to be the case that when one A-quantifier is nested inside another, the two share many (if not all) restrictions. Consider 47.

47. Mostly, when the semester is over and a book is overdue, it must be returned to the main library.

Let's assume that 47 is spoken in a University Z context. The implicit restrictions available from the context are that the only situations one is to consider are those where University Z's regulations are followed. The explicit restrictions are that the semester be over and a book be overdue. Given the definition of *mostly* in 48, the truth condition for 47 is 49.

48. [**mostly** (α)(β)] = 1 iff $|\{s: s \in \text{size}_f(\alpha)\} \cap \{s: s \in \beta\}| \geq 2/3 |\{s: s \in \alpha\}|$

49. [**mostly** (the semester is over and a book i is overdue and the situation is at University Z) (**must**(cb)(a book i be returned to the main library))] = 1
iff $|\{s: s \in \text{size}_f(\text{the semester is over and a book } i \text{ is overdue and the situation is at University Z}) \cap \{s: s \in \text{must}(\text{cb})(\text{a book } i \text{ be returned to the main library})\}| \geq 2/3 |\{s: s \in \text{the semester is over and a book } i \text{ is overdue and the situation is at University Z}\}|$

short form: at least 2/3 of the relevant situations are ones where the book in question must be returned to the main library.

Asking now what the content of the cb restricting *must* is in this example, it appears that it must be restricted at least by the same information restricting the adverb of quantification. Thus, the only accessible situations for the modal sentence will be those where the regulations of University Z are observed and a book is overdue after the semester is over. Failing to include these restrictions on the modal, or alternatively failing to include them as part of the restriction on the adverb gives unintuitive truth conditions, where for example, 2/3 of the situations where a book is overdue after the

semester is over at some library are ones where the book must be returned at the main library at University Z.

On the basis of this discussion, I'll assume 50.

50. **Restrictions on A-Quantifiers:** Given two A-quantifiers in one sentence, one taking scope over the other, the implicit restrictions on either of the two quantifiers also restrict the other.

For extensive discussion of data connected to determining the domain restrictions on A-quantifiers, see Roberts 1994.

5.2. Vacuous Quantification

A number of authors have pointed out that quantifiers are anomalous in sentences such as 51-53. Kratzer (1995) called this vacuous quantification and stipulated that quantification when there are no variables free is prohibited. For her, the problem with 51 is that there are no free variables to be bound by the quantifier, *always*.

51. John is always tall.

Noticeably, however, this kind of anomaly persists, even when the syntax of the logical form would not violate the prohibition on vacuous quantification. This fact is illustrated by 52.

52. Every/Some/One/No day that I was born was snowy.

52 is true iff $\{x: \text{day that I was born } x\} \subseteq \{x: \text{snowy } x\}$

Similarly in the adverbial case in 53:

53. It was always cold at 5 p.m. on February 1st 1996 in Nashville.

On the view taken here, vacuous quantification is quantification over an impoverished domain (i.e. a domain with only one member); such quantification is always infelicitous. The reason for the infelicity is probably that using quantification (a complex structure in comparison with the simple first-order function-argument application called for in the case of simple predication) to predicate something of an individual violates principles of conversational cooperation enjoining speakers to say what they have to say as simply as they can.

The difficulty in getting adverbs of quantification to take scope over epistemic modals is fundamentally a difficulty of this kind: as we will see below, the epistemic

conversational background ends up being so specific to a particular situation that quantification over a class of situations by a wider scope adverbial operator becomes impossible.

5.3 Explaining the Loss of Epistemic Readings in 42-44

With this understanding of -quantification in mind, the puzzle posed by 42-44 resolves itself. The readings of those sentences which are of interest here all involve an extensional A-quantifier (the adverb) taking scope over an intensional A-quantifier (the modal). Given the premise that these operators share restrictions, it is critical that the restriction be situation-indefinite. Situation-specific restrictions only work on intensional operators (as the quantification is vacuous otherwise).

Thus, epistemic interpretations are successful as long as the modal sentence isn't embedded under an extensional A-quantifier. Once embedded under such a quantifier, however, any reading which depends upon a situation-specific conversational background will disappear. This is what happens in 42-44. The reason is that the wide-scope extensional adverb demands a situation-indefinite restriction. Root readings, typically, arise when the modal is supplied with a situation-indefinite restriction. Therefore, these readings remain in the presence of a wide-scope adverb.

6. Conclusion

Situation-specific restrictions have a variety of effects on A-Quantification. At a minimum, they reduce modal quantification over situations to quantification over worlds, fix the reference of context-dependent NPs (such as *the District Attorney*), and fix temporal interpretation.

I claim here that epistemic conversational backgrounds are the same as the presuppositional common ground of the discourse. More generally it was shown that modal sentences which concern deduction from the speaker's knowledge tend to be about specific situations. In the semantics/pragmatics, this means that the restrictions on epistemic modals tend to be situation-specific, with all of the consequences laid out above. In contrast, when we talk about regulations, regularities, rights, obligations, dispositions and abilities, of necessity we are talking about classes of situations and hence the conversational backgrounds restricting root modals are by their nature situation-indefinite.

These generalizations about which interpretive classes get situation-specific restrictions and which get situation-indefinite restrictions spring from the nature of human reasoning and from the nature of laws, regulations and abilities, and not from any structural distinctions between the types of modal expressions in the language.

References

- Bach, Emmon 1986 The Algebra of Events in *L&P* 9.5-16.
- von Stechow, Kai 1994 *Restrictions on Quantifier Domains* UMass doctoral dissertation (GLSA: Amherst, MA).
- Hofmann, Thomas R. 1979 On Modality in English and Other Languages in *Papers in Linguistics* 12.1.1-37.
- Hughes, G. and M. Cresswell 1968 *An Introduction to Modal Logic* (Methuen: London).
- Iatridou, S. 1990 The Past, the Possible and the Evident in *LI* 21.1.123-129.
- Kaplan, David 1978 Dthat in *Syntax and Semantics vol 9 Pragmatics*, P. Cole, ed. (Academic Press: NY).
- Krifka, M. 1989 "Nominal Reference, Temporal Constitution and Quantification in Event Semantics", in R. Bartsch *et al*, eds. *Semantics and Contextual Expression* (Foris: Dordrecht).
- Kratzer, Angelika 1981 The Notional Category of Modality in *Words, Worlds and Contexts*, HJ Eikmeyer and H. Rieser, eds. (De Gruyter: Berlin).
- _____ 1995 Stage-Level and Individual-Level Predicates, appears in *The Generic Book*, G. Carlson and F. Pelletier, eds. (UChicago Press: Chicago).
- _____ 1991 Modality in *Semantics: An International Handbook*, A. Von Stechow and D. Wunderlich, eds. (De Gruyter: Berlin).
- McConnell-Ginet, S. and G. Chierchia 1990 *Meaning and Grammar* (MIT Press: Cambridge, MA).
- Palmer, F.R. 1977 Modals and Actuality, in *J. of Linguistics* 13.1-23.
- Partee, Barbara 1991 Adverbial Quantification and Event Structures in *BLS* 17.439-456.
- _____ 1994 Focus, Quantification, and Semantics-Pragmatics Issues, Preliminary Version to appear in *Issues in Natural Language Processing vol. 2 (?)* (IBM: Heidelberg).
- _____, E. Bach and A. Kratzer 1987 "Quantification: A Cross-Linguistic Perspective," NSF Proposal, UMass, Amherst.
- Portner, Paul 1992 *Situation Theory and the Semantics of Propositional Expressions* UMass doctoral dissertation (GLSA: Amherst, MA).
- Roberts, C. 1994 "If and when: The semantics of conditional and temporal subordinating conjunctions", ms. The Ohio State University.
- Stalnaker, R. 1979 Assertion in *Syntax and Semantics* 9, P. Cole, ed. (Academic Press: NY).

Appendix

The structure of the **models** and the basics of **interpretation** assumed here are adopted directly from Portner 1992.

Models

- i. A **model** is a 5-tuple consisting of a set of individuals (I), a set of situations (S), a counterpart relation on I, a part-of relation $<$ on I, and a temporal ordering on S. S is a subset of I.

Interpretation

- ii. Expressions are interpreted w.r.t. a model, M, a situation of utterance u, a reference situation r, a context of utterance C, a variable assignment function g, and a situation $s \in S$.
 - iii. **Situation of utterance**, u, includes at least: specification of time, speaker, addressee, location of utterance.
 - iv. **Context of utterance**, C, is set of pairs consisting of a situation and an assignment function.

Definitions

- v. The **intension** of an expression is a function from situations to the extension of the expression in that situation.
- vi. The **part-of** relation between situations induces a structuring of S. Given any two situations s, s' such that $s < s'$ [read: s is part-of s'], s and s' are on a complete join semi-lattice; the maximal element on this semi-lattice is the **world** of s and s'. Situations which are worlds will be designated by variables bearing a w subscript (e.g. s_w .) [See among others Bach 1986.]