MIGHT
Evidence and argument from negation and conjunction for anepistemic modality and its logical structure

by

Robert Hollander

A dissertation submitted to the Graduate Faculty in Linguistics in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

1999

UMI Number: 9946178

UMI
300 North Zeeb Road
Ann Arbor, MI 48103

This manuscript has been read and accepted for the Graduate Faculty in Linguistics in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

Sept. 21, 1999 Edward H. Bendix

Date Edward Bendix, Chair of Examining Committee

Sept 21, 1999 Charles E. Cairns

Date Charles Cairns, Executive Officer

Ricardo Otheguy

William Stewart

Supervisory Committee

THE CITY UNIVERSITY OF NEW YORK

Acknowledgments

For their long, persistent support, I am indebted to the members of my dissertation committee, Ed Bendix, Ricardo Otheguy, and Bill Stewart, each of whom contributed uniquely to the content and execution of this project. Without Ricardo's probing foundational questions and stubborn demands, reflective both of his intellectual curiosity and academic integrity, this dissertation would have had a much less satisfactory form. Few incentives motivated me to rethink and rewrite as Ricardo's relentless skepticism of the content and presentation alike. Bill Stewart's help and humor were equally indispensable. Observing unexpected clues in the trivial or undermining the seemingly self-evident, this mercurial, irreverent, and original mind provided conversation that was never less than an education in itself besides being a pleasure.

I owe most to the person who first introduced me to the study of linguistics, Ed Bendix. As an undergraduate, I was looking around for some engaging area of study that would satisfy an inclination to philosophical abstractness, but supply some real empirical content as well. Ed Bendix, far from being unnerved or threatened by questions as so many others are, always welcomed mine as an opportunity to open the floodgates of his knowledge. I was impressed, not only with the seemingly endless current of information, but also with the smart, elegant theories riding atop it. What pleasure I take in linguistics was sparked by his graduate and undergraduate courses at Hunter College and the Graduate Center, an abiding influence, though I doubt I have succeeded in measuring up to his model. I am lucky to be among the many who have thrived by virtue of the nourishment and discipline of his guidance.

I always benefited from conversations with Takaki Hashimoto, that rare bird in our increasingly specialized field, the linguist who takes a deep, obsessive interest not only in his own, but in all areas of linguistic research. No subject was ever too arcane or too technical for his careful and serious, sharp and detailed review.

A word of thanks to all my friends in the Doctoral Students' Council and the Graduate Center newspaper, *The Advocate*, who provided a political education while gratifying my need both to serve usefully and indulge Quixotic fantasies of improving the world. Apologies to Mark and Michael who have waited so impatiently so long.

table of contents

Chapter 1 Modalities

1.1.0 Introduction

This dissertation addresses a variety of puzzles concerning the word *might*, the solution to which points to some conclusions about its underlying logical structure and, more generally, the role of perspicuity in semantic, syntactic and morphological patterns. The first puzzle has been described by Laurence Horn in his book *A Natural History of Negation* (Horn 1989). There he observes that although the negative particle in natural English follows the modal auxiliary, the negative takes into its scope those modals expressing possibility, but excludes from its scope modals expressing necessity. *Must not leave* never means that it is not necessary to leave -- the negation is never interpreted as negating *must*. Yet *can not leave* usually does mean that it is not possible to leave -- the negative marker negates the modal *can*, despite its position following *can*. Stress on the negative marker can induce an interpretation of the marker in place, excluding *can* from its scope. But even this interpretive possibility disappears when the negative marker is contracted. *Can't* never, ever means 'possibly not'.

This peculiar pattern of negation poses more than just a strange puzzle. It is a challenge to any theory of syntax and semantics that requires a regular, rule-governed relationship between the parts of sentences, their combination and their aggregate meaning. Such a theory of the relationship between syntax and semantics is indispensable if it is true that a language can generate an infinite variety of sentences and that the mind has the capacity to interpret any such well formed sentence. For the mind is surely finite, and cannot hold an infinite number of meanings. It can hold a finite number of parts and a finite number of rules to generate a variety of meanings and, if any of those rules is recursive, any number of meanings. But such rules cannot be whimsically applied for we would not know why or when to apply them without losing the benefit of a finite, economical system. Any apparent departure from regularity in the syntax-semantics relationship requires, therefore, some explanation with general application, not just for reasons of scientific economy or elegance, but to meet the practical constraints of human limitations.

The puzzle of the irregular scope of negation is further complicated by an exception to the pattern of irregularity. *Might not leave* does not mean that leaving is not possible, although *might* clearly expresses possibility, not necessity. So there is not only a wayward pattern to explain, but an exception to the waywardness as well.

This is not just a trivial lexical peculiarity about the word *might* either. The most striking fact about the puzzle of negative interpretation over modals is that *may*, when it is used to mean *might*, is excluded from the scope of negation, just as if it were *might.* Yet when *may* is used to express mere permission, deontic possibility, its negation exhibits the same scope reversal as all the other modals of possibility. The *may not* of *She may not testify* when spoken by the chair of a hearing as a denial of permission means *not possibly.* When spoken by an observer of the hearings, interchangeably with *She might not testify*, it means *possibly not.* The scope reversal is a robust *semantic,* not lexical, fact of English.

Exceptions often prove the rule. The exceptionality of *might* is the focus of this investigation because it sheds light on the wayward pattern of negative scope over the modals.

The first step towards an explanation of the exceptionality of *might* is to deny that it is a modal of possibility. If *might* does not actually belong to the category, but only superficially appears to belong to it, then there is little reason to expect it to fall into the pattern of a category in which it has been mistakenly included.

In determining the category to which *might* actually belongs it is useful to recall Aristotle's distinction between contingency and simple possibility. Contingent events or things are those that may possibly be *and* may possibly not be. Contingencies cannot be necessary; contingency and necessity are contradictories. But necessary things or events must also be possible, even though they cannot possibly not be. So simple possibility is consistent with necessity and does not necessarily imply contingency. Things that can be, are possible; things that might be are contingent.

The contingent nature of *might* leads us to a partial solution to its exceptionality under negation. If *might* expresses a contingency, then its logical structure must be a conjunction of possibly *and* possibly not. The negation of a conjunction is true in any of three cases: when either conjunct is false or when both are false. Were negation to take *might* into its scope, the result would be ambiguous. *Might not leave,* assigned the meaning of 'not (might leave)' would deny *might leave* because leaving is necessary, or because not leaving is necessary. It is easy to test this speculation by observing the meaning of sentences in which the wide scope of negation is forced as in, "It is not true that I might go, I'm going" and "It is not true that I might go, I'm not going."

Why should the ambiguity of wide scope negation over *might* cause *might* to behave differently from the other modals of possibility? The answer to this question, if true, explains why the modals of possibility induce wide scope negation in the first place. Ambiguous and vague expressions are less perspicuous, less useful, carry less relevant information, serve communication less well than univocal, perspicuous, unambiguous expressions. *Not might* is ambiguous. Similarly, *possibly not* is less perspicuous than *not possibly* since *not possibly* indicates for all possibilities, which obtain, while *possibly not* indicates only that the negative is possible, and is completely silent on whether the positive is possible, necessary, or impossible. The *not possible* interpretation of *cannot* is useful in communication and has been instituted in the language despite the fixed syntactic position of the negative marker.

This phenomenon is not unique to the modals. As Horn points out, there is a general tendency for languages to avoid various forms that express *possibly not* (or equivalently, *not necessarily*) and *not all* (equivalent to *sometimes not)*, the O corner of Aristotle's square of oppositions (see chapter 5:129ff below). In English this tendency is observed in the absence of any lexical quantifier meaning *not all.* English has *all, none, some* but not *nall.* The movement of negative scope can be observed in so-called negative transportation, sentences in which a negation marker placed in the matrix clause is interpreted in the subordinate clause. A person saying *I don't think this will fly* does not intend the listener to come away thinking that the speaker doesn't have any thoughts on whether "this will fly," although, judging from the placement of the negative marker, that's exactly what the sentence should mean. Instead, the sentence is readily interpreted as meaning *I think this will not fly.* It should be as readily apparent how much more informationally relevant the latter interpretation is than the former.

One source of evidence for the difference between *might* and modals of mere possibility are sentences in which a modal clause is conjoined with a clause which contains the realization of what was considered under the modality: "I can leave and I will," "I might leave and I will." These sentences are particularly useful in showing distinctions in modal interpretations. In the case of *might* they also show that the lack of perspicuity of O interpretations does not suffice to explain the meaning of *might* since either or both conjuncts in the meaning of *might* should be consistent with either the realization or the negation of the realization. Possibilities can be realized with consistency as in "I can leave and I will," and impossibilities too: "I can't leave and I won't." But both of "I might leave and I will" and " I might not leave and I won't" are strange.

One initially attractive solution to rule out immediately is the Grice-Horn account of metalinguistic negation. It might at first seem that both *will* and *won't* may be denials of *might* for the same reason that conversational principles allow us to reject assertions of possibility with assertions of actuality or denials of actuality. But such an account should hold equally of *can* and *could* as of *might.* The solution lies elsewhere.

The only satisfactory answer seems to be that *might* expresses not just contingency, but uncertainty, an essentially epistemic state, a state of mind, not just a mode of reality indicating the more or less real, but a mode of reflection on reality. This is the final conclusion presented here.

The rest of the present chapter concerns a general exploration of notions of modality, including possibility, contingency, and probability considered from its linguistic form entailing uncertainty. There follows a section devoted to the historical development of the notion of modality and the place of possible worlds in the model theoretic treatment of it. A fuller description of the outline presented here concludes the first chapter. The second chapter sets out a contemporary formal framework for modality in Kratzer's situation-based theory. Chapters three and four are concerned with interpreting the conjunctions *and* and *but* which provide the crucial data pointing to the underlying logical structure of *might.* Chapter five introduces the relevant conundra about negation, solved in chapter six, which develops my conclusions about the meaning of *might.*

1.1.1 Modality in English

Among the many notions expressible in English, the notions of necessity, possibility, impossibility, certainty, uncertainty or degrees of probability, obligation, futurity, and conditionality occupy a special place. Like the verbs that express transitive relations, the verbal elements that express these meanings are incomplete alone; they are dependent. Unlike transitive verbs, which depend on a substantive object, these verbal elements are dependent on other verbs. *Mohammad can* must be elliptical for *Mohammad can* something -- can read, can write, can think, can be. One thing Mohammad cannot do -- no matter how clever he is -- Mohammad cannot just *can.* And this is no mere human limitation of his. Mohammad cannot just *can't* either. Adding *can* to *Mohammad read* doesn't change what he read, how fast or how well he read it, or how he liked reading it. It changes the reailty of his reading. To say *Mohammad can't read* is to deny all reality to it. Say he can, and you've allowed him a possibility of really reading. Saying he will means that, whether he is now or not, in the future his reading will be real. Whatever it is that one might want to say Mohammad does, saying that he *can, will, should, must, might,could,* or *would* do it is to say something about how it is that he does what he does with respect to the *fact* and *reality* of what it is he does.

There are many ways to express these verb-dependent notions. The nouns I used in the first sentence and their adjectival and adverbial counterparts, necessary and necessarily, possible and possibly, certain and certainly or definite and definitely, probable and probably, obligatory and obligatorily, as well as such phrases as *in the future*, *under the condition that* -- these are just some ways in which sentences can be modulated according to these verb-dependent notions regarding the reality of the sentence contents. Not only what is, but also what must be, what could be, what could not be, what one is convinced of and what one doubts, what will be and what would be or would have been, are all commonly expressed by English speakers using just such words as *must*, *can*, *might*, *will*, *should*, *could* and *would*.

Whether these words are verbs, as they might be, or whatever they are, they form a closed class known as 'modal auxiliaries' with a distinct syntax: Like regular inflected verbs, they usually appear in assertions following the noun phrase, but they do not inflect; in questions, they appear initially. The verb that follows them appears without inflection but preceded by *to*, suggesting that the modal has taken on the inflectional function. The negative particle *not*, when present, always follows the modal.

Not all such reality modifiers belong to this class. We've already mentioned some nouns, adjectives, adverbs and phrases that serve to express these same meanings. There are even some English verbs that express such meanings but do not belong to the closed class of verb-dependent words. Verbs like *know, believe, want, try, consider,* and *ought* express notions akin to those in the closed class without sharing the syntax of the closed class of modal auxiliaries. But more interesting is the bald fact that all the words in this closed class do express such notions, and only such notions. In other words, English has a syntactic category reserved exclusively for one semantic function which function can be fulfilled outside that category as well. It is necessary, but not sufficient, that the word express modality to belong to that category.

1.1.2 Modals and negation

While there exists in English a closed class of words syntactically distinguished not only by their position but also by their close relation to the verb system and verbal inflection, and semantically distinguished by the exclusively modal notions they contribute to sentence meaning, modal notions do not have to be expressed this way, or by words at all. In some languages, Romance languages, for example, many of the notions expressed in these English modal auxiliaries are in fact expressed on the verb as inflections. And even in English, as noted, many modal notions can be expressed using means other than modal auxiliaries. But English has this broad collection of modal auxiliaries providing interesting and surprising patterns of syntactic and semantic interaction.

One such pattern is the interaction with the English negative particle *not* . Whether *not* negates the modal or the verb on which the modal depends is determined not by the temporal location of *not* in the stream of speech, but by the semantics of the modal. The location of *not* with respect to the modal is invariable; *not* follows the modal and precedes the verb. The negative particle negates the verb -- semantically attaches to the verb or takes the verb into its scope -- if the modal expresses necessity. If the modal expresses possibility, the negative particle negates the modal -- semantically attaches to the modal or takes the modal in its scope. For any directional grammar, especially one based on context free expansions, such a pattern poses problems. Is the negative particle sister to the verb or the modal? Does it dominate one or both? It would appear that no mere context free rule could accommodate both directions of scope or semantic attachment unless the rule were sensitive to the semantics of possibility and necessity.

The present research attempts to elucidate this syntactic context sensitivity of negative scope over modal auxiliaries in English by a close examination of the exception to the rule, the interaction of negation with the modal auxiliary *might*. This modal, as it turns out, is, among modals, semantically exceptional as well as syntactically exceptional in the negative scope pattern. It is therefore the thesis of the current project that the scope of negation is dependent on certain specific semantic distinctions among modal notions, semantic distinctions made evident by the exceptional semantics of *might*. Much of the groundwork for understanding these distinctions has already been laid by Laurence Horn. My contribution concerns the semantics of *might*, and the unique modality it expresses.

1.1.3 What is modality?

Modality has been variously described in terms both narrowly specific and almost indefinably broad. The basic modern text for modal logic gives this wishfully simple, but depressingly limited, specific list which has the one advantage of being concretely linguistic

> Modal logic can be described briefly as the logic of necessity and possibility, of "must be" and "may be".
>
> (Hughes and Cresswell 1968:ix)

and the disadvantage of being too narrow, since it fails to include on the list other similar expressions like *possibly, probably, likely, maybe* or to give a general criterion for their inclusion. But this uninspiring view has definitive historical precedent. It is Aristotle's own view of the matter, and he invented the study, so far as anyone can tell. Here is Kneale & Kneale interpreting Aristotle's view of modality

> syllogisms constructed from them, Aristotle elaborated a theory of modal statements and modal syllogisms. A modal statement is one containing the word 'necessary' or the word 'possible' or some equivalent of one of these, and a modal syllogism is one in which at least one of the premisses is a modal statement.
>
> (Kneale&Kneale 1962:81-2)

The authors are placing him into a modern context: Aristotle was writing before there was any such notion as modality to explain. Aristotle gives even less thought, if that is possible, to what modality is, launching into the consideration of the possible and the necessary without hesitating to consider, metatheoretically, where these notions belong in a theory of logic or language

> Having made the foregoing distinctions we must prove the relations subsisting between affirmations and denials affirming or denying the possible [δυνατον], contingent, impossible [μη δυνατον], necessary [αναγκιον] -- a question not wanting in difficulty.
>
> (Aristotle 1938:157)

Contrast these unenlightening specific, extensional, linguistic descriptions, with the psychological treatment from the larger perspective of Ducrot & Todorov

> Logiciens et linguistes ont souvent estimé nécessaire de distinguer, dans un acte d'énonciation, un contenu représentatif, appelé parfois **dictum** (la mise en rapport d'un prédicat avec un sujet), et une attitude prise par le sujet parlant à l'égard de ce contenu (c'est le **modus**, ou la **modalité**). Ainsi les énoncés (1) <<Pierre viendra>>, (2) <<Que Pierre veinne!>>, (3) <<Il est possible que Pierre vienne>>, <<Pierre doit venir>> semblent avoir le même dictum, et différer seulement par le modus.
>
> (Ducrot & Todorov 1972:393)

Why "contenu représentatif" does not include "attitude" requires some further elucidation, but at least here is a beginning of a general description with some explanatory force. More troubling is the reduction of modality to "attitude". Not every modal is so psychological. To say something is impossible is not always to put it at a psychological distance, but sometimes only to remark on its distance from reality. "Il est possible que Pierre vienne" is a case in point.

A similar objection applies to Jespersen's "certain attitudes of mind of the speaker towards the contents of the sentence" (Jespersen, 1924:313). Palmer approaches a more ecumenical view with "the degree of the commitment by the speaker to what he says" (Palmer 1986:51) still a subjective view, though not specifically psychological. The sentences

XiaoMei can read
Kudzu can destroy entire forests

simply assert something about XiaoMei's skills and the bio-ecological consequences of a vine's growth, abilities and consequences which rely in no way on the speaker's attitude or commitment toward them. XiaoMei might not actually be reading -- in fact, it would be unlikely for someone to assert that she can read while she is actually reading -- but her skill may be a fact. While it is probably true that a speaker who asserts *XiaoMei can read* will also be able to imagine XiaoMei reading, it is not necessarily the case that a speaker who asserts the contrary -- that XiaoMei cannot read -- would be unable to imagine XiaoMei reading. It would be a mistake, then, to think that all assertions of modality are psychological.

It was the psychological, subjective aspect of modality that bothered Frege enough to exclude modality from his logic: "If I term a proposition 'necessary' then I am giving a hint as to my grounds for judgment. But this does not affect the conceptual content of the judgment..." (Frege 1972:114). Fitting and Mendelsohn (1998) object to Frege's dismissal on the grounds that modal notions do affect conceptual content. They give as an example: if the proposition p is true, then it must be possible for p to be true; yet the converse is false, that it is possible for p to be true in no way implies that p is in fact true. So the two propositions, <p> and <possibly p>, having different implications, must be conceptually distinct.

Though Fitting and Mendelsohn appear to be right about the conceptual content of modality, their defense of modality from psychologism may not be necessary if not all conceptions of modality are confined to the psychological. Contrasting with the psychological is a broader, more comprehensive, and simpler, almost enigmatic, view from the *Kleine Brockhaus*

> Modalität: die Art und Wiese, wie etwas ist oder gedacht wird.
> (*Kleine Brockhaus*, "Modalite")

an admirably succinct, but entirely non-linguistic, metaphysical and epistemological consideration consonant with the metaphysical treatment of modality by the German originator of the theory of it, Leibniz, who first brought us the appeal to alternative worlds which has since become a staple in the explanation of the meaning of modal statements.

Do modal notions have such teutonic metaphysical and epistemic implications as the *Brockhaus* implies? Describing how a situation *could* or *would* be suggests that one can at least imagine the world in a way different from the way it happens to be. When XiaoMei's friend Mohammad says that XiaoMei *can't* read, he is ascribing a limit to the ways in which reality, according to him, is -- whatever ways the world may be, Mohammad seems to be saying, pick any such way, XiaoMei still doesn't read. If you see XiaoMei reading, well, you must be dreaming. When Mohammad says *XiaoMei can smile*, he is admitting that a reality in which XiaoMei smiles is a reality that he won't disbelieve in or think is a dream simply because she is smiling in it.

But if XiaoMei is not in fact smiling, what sort of reality are we contemplating when we evaluate *XiaoMei can smile*? Is Mohammad committed to maintaining that the reality in which XiaoMei is smiling is more real than your dream in which she is reading? Are modal notions an invitation to recognizing alternate realities with levels of realness? Where are these possible worlds? What are they? How can we know what is true in them, what laws hold for them, what notions of similarity and difference apply to them and how?

Despite their potential of carrying metaphysical and epistemological baggage, possible worlds have played a major role in the logical formalization of modal notions. As an analogy, they are the clearest means of understanding a whole range of modal phenomena. If an assertion describes reality, a modal assertion can be defined as a function from the real world to the set of alternate worlds in which the assertion is true. To say that XiaoMei is happy is to describe a reality. To say that it is impossible for XiaoMei to be happy is to say that there is no possible world in which "XiaoMei is happy" is true, that the value of the function to possible worlds is the empty set.

What about moral and epistemic modes? Possible worlds can accommodate these modalities as well. When Mohammad says, *XiaoMei should go to bed*, we can interpret him to mean that in all possible worlds where things are as they ought to be, XiaoMei is gone to bed in them.

The notion of possible worlds gives a clear and well defined picture of modality and a more comprehensive view of it than the psychological picture of Ducrot and Todorov or Palmer. What the possible worlds picture shows is aptly described -- without reference to possible worlds -- by Frawley

> The notional content of modality highlights its association with entire statements. Modality concerns the *factual status* of information; it signals the relative *actuality*, *validity*, *believability* of the content of an expression. Modality affects the overall *assertability* of an expression and thus takes the entire proposition within its scope. As such modality evokes not only

> objective measures of facual status, but also subjective attitudes and orientations toward the content of an expression by its utterer.
> (Frawley 1992:387)

Factual status, actuality, validity, believability, and assertability are exactly those notions possible worlds can elucidate. These notions all have in common an amenability to a possible worlds analogy or explanation. While it is debatable whether modality requires possible worlds, and in the next chapter arguments against a simple possible worlds treatment will be given, it does seem that whatever it is that defines modality also motivates possible worlds.

It is a remarkable coincidence that English modals adhere strictly to notions amenable to possible worlds analysis. The future, which belongs to the modal categories of possibility, probability and necessity -- it is *possible* that the sun will rise tomorrow, indeed *probable*, and it is *necessary* that the laws of mathematics will hold tomorrow -- the future marker *will* belongs among the closed class of modal markers, the modal auxiliaries. But the past, which is not a modal category -- the past is not a world removed from the actual or real but a fixed part of the real, actual world -- the past marker is not among the modals but is expressed as an inflection on the verb. English has an extraordinarily clean, neat analytic division of linguistic labor. Both past and future are tenses, but only the tense which motivates description by possible worlds is expressed with a modal auxiliary.

One answer, then, to "what is modality?" is: Modality is what motivates us to contemplate alternative worlds, worlds less real, worlds of varying degrees of probability, including worlds of conjecture, future worlds, and best worlds.

1.1.4 Types of modality among English modals

One question to ask is: which of all the possible notions of realness are expressed within the class? The standard answer has always been: various flavors of possibility and necessity, as well as futurity and conditionality. First, the basic chocolate and vanilla flavors of possible and necessary, *can* and *must* in their core senses, are standardly called *alethic* modes as they modify the truth of the sentence contents, possibly true versus necessarily true. Other flavors are mixed into these basic ones. Add to necessity the flavor of morality -- moral necessity -- and you have the *deontic* mode expressed by *should.* Add morality to possibility and you get one use of *may,* moral permission. Add one's knowledge of reality, the evidence one brings to bear on the contents of one's sentences, and you get an *epistemic* mode. These epistemic modes happen to be expressed by the same words as express alethic modes, underscoring the derivative nature of the epistemic mode: *it must be raining* has necessity written all over it, but necessity with respect to what one knows -- given the evidence, the conclusion that it is raining is necessary. Similarly, *that sound could be rain* draws on evidence towards a possible, but not necessary, conclusion. Even futurity and conditionality have these two basic flavors. The future contains what may possibly happen as well as what must and will happen. The conditional includes both what would happen (necessarily) were certain conditions met and what could happen (possibly) were those conditions met. Under the assumption that *possible* and *necessary* underlie all the other modals, all this is very satisfyingly symmetrical.

But for *might.* This member of the closed class seems at first glance to be about possibility, but it isn't, not exactly. It's about something in important respects very different. It's about probability. Of course, probability is related to possibility. This should come as no surprise. Even necessity is related to possibility: something is only necessary if it is not possible for it not to be so. Possibility is the interchangeable reverse image in the mirror of negation -- the *dual* -- of necessity. But probability is even more distinct. It may not be simply reducible to possibility/necessity or their negations.

Linguistically -- in natural conversation -- probability does seem to include or entail possibility. If something is known to be impossible, it would be odd to say it had a degree of probability when it clearly has no degree of probability at all. One might get away with calling it, jokingly, improbable, or very highly improbable, because it is completely improbable, but one can't seriously ascribe any quantity of probability to it. It seems that, at least in the way we casually converse, if something has a degree of probability greater than none, it cannot be impossible and must be possible. Linguistic probability appears to entail possibility.

1.1.5 Possibility distinct from probability?

Is the converse also true, does possibility entail probability? Supposing something is possible, does it thereby have a degree of probability -- is everything that is possible, in some degree probable? If probables are possible and possibles probable, maybe probability just is possibility and nothing more. Or is probability some special property of all and only possible things?

There seem to be possibilities that are completely improbable. Certainly it is possible to imagine completely improbable situations. I can imagine the past to have been different than it was. I can imagine that Malcolm might not have been assassinated even though I know he was assassinated. The proposition that he might not have been assassinated has no degree of probability, yet I can imagine, not only the circumstances of that proposition, but the way the whole world might be different if Malcolm had lived, still knowing that the past and present cannot be changed. A world in which Elvis still lives is possible even though, in my estimation, it has zero degree of probability. I can imagine the possibility of the factually false, even though I afford it no probability at all.

So something may be known to be actually, factually false yet still be imagined possible, in some peculiar sense. It's a peculiar sense because the facts of the past and the present are unalterable. It is impossible for the past to be different than it is, though apparently, it is possible for the past to have been different than it was. I can know for certain that Malcolm died, and still consider the *possibility* of circumstances having been otherwise. This makes it seem as if possibility is essentially epistemic. But if I consider the *probability* of the imagined past, it is either nil or it just doesn't make sense to think of the probability of imaginings. Why?

It seems that probability is in the first place a cognition of possibilities with respect to the known. It is not about certainties or impossibilities. Whereas one can easily consider possibilities contrary to certain reality, probability is a consideration, an imagining, of the likelihood of possibilities with respect to reality. If the possibilities are known to be contrary to reality, they are known to the considerer and the consideration of the probability of something contrary to fact will always be nil.

Considered this way, probability requires some degree of ignorance. I can only consider the probabilities of things that I am unsure of. Louis Farrakhan may have ordered Malcolm's assassination, but I don't know for sure. I can consider the probability that he did. I cannot consider the probability that Malcolm was killed, since I know he was.

This is not the same as considering the probability of events from an historical perspective, for example, in which one imagines what one might have deemed probable had one been ignorant at the time. Malcolm's death might have seemed at the time a probable event to observers who were aware of how threatened Elijah Mohammad felt. It was then a merely probable event because on the one hand, it seemed a possible future reality, and on the other, it seemed possible that it not be a future reality.

On the other hand, possibilities contrary to fact do seem to bear varying degrees of improbability beyond their known improbability. It is more likely that Malcolm would have lived if he had stayed abroad than not. It is more probable that Elvis has been alive all this time than that he has been alive all this time *and* performing in Las Vegas and on national television. There appears to be a dual standard of probability parallel with a dual standard of possibility. The past is fixed yet can be other than it was; those possibilities are completely improbable, yet have varying degrees of probability. The conceptual conundrum seems without answer.

1.1.6 Possible or contingent?

If something is necessary, then surely it must be possible. If it is necessary that twice two is four, then it must be possible too. For if it were not possible, then it would be impossible, and it would be strange if the same thing were both impossible and necessary at once, for it would both necessarily be so and necessarily not be so, and these are contraries. If it is necessary that twice two is four, and twice two is in fact four, then it cannot be impossible that twice two is four, so it must therefore be possible.[1]

But if something is possible, then is it possible that it not be? If it is possible for XiaoMei to be at home, isn't it possible for her to be not at home?

Logic and language diverge on the meaning of *possible.* Considered logically, if necessarily p implies possibly p, then possibly p cannot imply possibly not p. Yet in language it's just the other way around. Although we seem to accept that necessities entail possibility, we exclude necessity when we talk about possibilities. If Mohammed says that XiaoMei might be at home, he means that it is not necessarily the case that she is at home, but *only* possibly true. If it turned out that XiaoMei was home-bound, we'd think that Mohammad got it wrong or misled us. He should have said that XiaoMei must be at home. We do not allow that the possible might or could be necessary. Rather, we imply that what is possible could possibly be otherwise, that the possible is *merely* possible, and not necessary. What's going on?

Aristotle troubled over this question of the difference between the possible and the *contingent.* A contingent truth is one which can be represented as the conjunction: <possibly p and possibly not p>. A contingent truth clearly excludes necessity -- <possibly not p> and <necessarily p> are contradictory -- and a necessary truth cannot be contingent. When Mohammad says that XiaoMei may be at home, he is using *may* to express a contingency, not a mere possibility.

---

[1] Unless two or four or multiplication did not exist, in which case the contraries would both be false. Logically, necessity only entails possibility; necessity need not entail actuality in all modal systems.

All merely probable events are contingencies. They must be possibly real, otherwise they would have no probability, and it must be possible for them not to be real, otherwise they would be certainties, not probabilities. Probability is a consideration of a contingency, an evaluation of it. For something to have probability, it must be considered a contingency, not known to be either true or false.

The distinctions between necessity, possibility and probability are crucial to understanding the words that express them in English, and to explaining the differences in the behavior of those words. One way to summarize the results of the research to follow is this: probability, unlike possibility, is a mode of uncertainty, and, like possibility, is a basic modal flavor. Probability is neither a kind of possibility nor necessity nor even futurity. Although it is epistemic -- bringing one's knowledge into the mix -- it doesn't get its epistemic modality from some addition to a basic flavor of possibility or necessity. It possesses that epistemic mode intrinsically. Unlike the epistemic modal expressions dependent on possibility and necessity, the probabilistic mode of uncertainty is essentially epistemic at its core.

One expression in English for probability is the modal *might.* This word is never without epistemic mode. Unsurprisingly, it has syntactic-semantic properties of its own that distinguish it from the other modals. It doesn't fit some of the syntactic and semantic patterns of the other modal verb-dependent words although it does clearly belong to the closed class. The third, fourth and fifth chapters below are concerned with the ways in which this word departs from the patterns of its cohort in the closed class, semantic departures in the third and fourth, and a kind of syntactic-semantic difference in the fifth chapter. These differences provide support for viewing *might* as expressing a fundamentally different basic mode, and this fact that *might* is in a different mode in turn explains its exceptional behavior. The last chapter provides some possible analyses of the logical structure of the word. Chapter two sets up a framework, which informs the entire research, of recent advances in the study of modality.

1.1.7 The significance of modal distinctions

Much hangs on the exact nature of the difference between probable and possible modalities. For those who maintain that all notions of modality are psychological or represent an attitude, let's call them the Fregean camp, any epistemic difference between possibility and probability collapses, and what linguists call "epistemic modality" becomes just a peculiar subtype of the more general epsitemic nature of modality itself.

I have drawn attention to two kinds of reasons to reject the Fregean view, one logical, the other linguistic. On the logical side, it seems there are some things which are possible without being probable. I gave the example of known past events and possible alternatives to them which have zero probability. On the linguistic side, there are two curious facts, one of which I have already mentioned, that the past is not included among the class of modals. When stipulating possible alternative pasts, we use modals like *could have* and *would have*. This linguistic fact lends support, of a kind, to the view that the past is in itself nonmodal and without probability. A third bit of support comes from the semantic anomaly of sentences of the form:

> [*noun phrase*] might [*verb phrase*] and [*anaphoric pronoun*] will
> [*noun phrase*] might have [*verb phrase*] and [*anaphoric pronoun*] did
>
> Mohammad might graduate and he will*
> XiaoMei might have graduated and she did*

If *might* is an expression of probability, then the anomaly of these sentences is most easily attributable to the discord between *uncertainty* in the antecedent conjunct and *certainty* over the same matter in the consequent. The other alternative would be to consider the probability expressed by *might* as merely a contingency -- as expressing in these examples

possibly [graduate] & possibly not [graduate]

A contingency is not inconsistent with actuality, though. The actual must be possible but could possibly not have been. A contingency is only inconsistent with necessity. So an account which attributes the unaccceptability of these sentences to the inconsistency between a contingency and something else, would require that the something else be a necessity. That would entail that actuality be interpreted as not merely actual but as necessary.

A simpler thesis is that such sentences indicate that probability is irreducibly epistemic. The same cannot be maintained of minimal pairs constructed from modals which express possibility

Mohammad can graduate and he will
XiaoMei could graduate and she did.

There are easily available contexts under which these sentences would be not only nonanomalous, but true. These sentences indicate that possibility is consistent with actuality.

Pursuing this paradigm further down the path, we can show that the actual and the merely contingent are not inconsistent,

It could have been that XiaoMei had not graduated, although she actually did and that, therefore, the actual cannot be treated as necessary.

Yet it may still seem puzzling that the past could be nonmodal yet still subject to possibilities. Why shouldn't we just consider the known as necessary? Under such an interpretation, possibilities would remain consistent with the past, and contingencies would be inconsistent.

The actual has a special place in modality. The formula

> Lp --> p
> *whatever is necessary is actual*

is not always included in modal systems. There are logically consistent modal (though perhaps not provably complete) systems in which this is neither an axiom nor a theorem deducible from the axioms nor is it required semantically. Mendelsohn and Fitting use the example of the notion of futurity. What is necessary in all future worlds need not be true today. The accessibility relationship between the actual present and possible future worlds is not reflexive.

The past may be fixed as part of the actual without being necessary. Under this view, we may be able to distinguish between the necessary and the certain. The actual is certain -- not a probability -- but it is not necessary, it could have been otherwise, though the probability of it's being otherwise is nil. Necessity is a syntactically logical and semantically metaphysical notion; certainty and its alternate, probability, are epistemic.

The argument that *probability* is essentially epistemic but *possibility* need not be, is hard to develop on philosophical grounds alone. There does not appear to be anything intrinsically wrong with viewing probability as the gradient between the necessary and the impossible. On one view *Malcolm's death was completely probable* is strange, since his death is certain. But a similar objection of strangeness holds for *possible*. It is also strange to say *Malcolm's death was possible*, for the very same reason -- his death is certain. Conversely, if I maintain that Malcolm's death is a certainty and therefore not a probability, can't I likewise claim that his death was not a possibility, because it was a certainty? It seems that possibility and probability can both be viewed epistemically and both viewed alethically.

The linguistic facts are all the more interesting, then, since they very clearly suggest one unequivocal answer to this question otherwise difficult to decide. The facts of English suggest that probability is about uncertainty, and is therefore epistemic. Probability is also inconsistent with the known, and therefore I will call it, among epistemic modalities, *anepsitemic*, while possibility may be consistent with the known and need not be anepistemic.

There is a sense in which all utterances are epistemic -- any assertive utterance can be preceded with "I think" without changing the meaning expressed. Setting this trivial modality aside, there is no compelling linguistic reason to view possibility as epsitemic, whereas there are very good reasons to view probability as essentially anepistemic.

1.1.8 Summary of modalities

The basic types of modality in language include necessity, contingency, conditionality (about which more later), futurity, possibility and anepistemic probability. Pure nonepistemic probability (where certainties *have* complete probability and impossibilities *have* a probability of degree zero), though logical, is not represented among the modals. It is questionable whether it is expressible at all. Compare these dialogues

A: It is possible that hydrangeas grow here.
B: Oh look! There's one right there!!
A: You see, it *IS* possible that hydrangeas grow here!

A: It is probable that hydrangeas grow here.
B: Oh look! There's one right there!!
A: You see, it *IS* probable that hydrangeas grow here!

The second dialogue is odd, even though it would be perfectly normal for A to have said instead

You see? I was right!

and in fact, changing the tense makes A's response much more acceptable

You see? It *WAS* probable that Hydrangeas grow here!

which points even more clearly to the unacceptablility of the present tense version: It is odd to claim probability for what one knows as a certainty. The case is even starker for modal *might*

A: Hydrangeas can grow here.
B: Oh look! There's one right there!!
A: You see, hydrangeas *CAN* grow here!

A: Hydrangeas might grow here.
B: Oh look! There's one right there!!
A: You see, hydrangeas *MIGHT* grow here!

This last dialogue is completely unacceptable unless the second *might* indicates uncertainty about still other hydrangeas. The modality of possibility or contingency (can) is consistent with certainty (epistemic necessity). But the anepistemic modal clashes with certainty or actuality. Whether it is actuality or certainty that clashes is moot -- facts are transformed into certainty through the medium of the speaker's awareness. Speakers assert factuality as knowledge. It is the nature of the speech situation that excludes anepstemic probability from factual assertions.

Here is a table of possible attributes of the basic modalities, excepting conditionality:

	~Possible~	Possible	Possible~	~Possible	Actual
Necessary	√	√	x	x	√/x
Actual	√/x	√	?	x	√
Contingent	x	√	√	x	√/x
Possible	√/x	√	√/x	x	√/x
Probable non epistemic	√	√	√	√	√
Anepistemic	x	√	√	x	x
Future	√/x	√	√/x	x	x

The necessary cannot possibly not be, must be possible, must not possibly not be, must not be impossible, and usually is actual. The contingent can possibly not be, must be possible, cannot be impossible, and may be actual. The possible is sometimes also necessary, sometimes may not be, but cannot be impossible, and may be actual. The nonepistemically probable assigns a probability to everything, from the completely probable to the completely improbable. The anepistemic probable assigns probability only to the nonactual contingent -- what is possible or what may possibly not be. The future may be necessary, or just possible, but not impossible and not actual.

1.2 Contemporary notions of modality

1.2.1 C.I.Lewis and strict implication

With the advent of Frege's quatificational calculus, the turn of the century saw an outpouring of formalizations of logical programs, among them, Russell and Whitehead's *Principia Mathematica*. One of the logical sentential connectives they used was the "material implication" commonly expressed as "if, then" and defined as "~x or y" (~x v y). If x is true, then y must be -- if x is true and y isn't, then the whole disjunction is false. In every other case, the disjunction is true: if x is false, then the first disjunct is true, and the truth of one disjunct suffices for the truth of the whole. If y is true, then again, one disjunct is true and so is the whole. A proposition "if p then q" is false if the proposition p is true but q is false. Otherwise the proposition is true. The truth table for *or* (v) and for material implication (-->) shows their equivalence

x	y	~x	v	y
t	t	f	T	t
t	f	f	F	f
f	t	t	T	t
f	f	t	T	f

x	y	x --> y
t	t	T
t	f	F
f	t	T
f	f	T

The upper case letters show the truth of the connected sentences depending on the truth of the sentences connected. The truth of <~x v y> and the truth of <x-->y> are identical for the same values of x and y.

This material conditional produces some unpleasant paradoxes. Any true proposition will imply a conditional consisting of that proposition as consequent and any proposition at all as antecedent.

q --> (p --> q)

is a tautology, it is always true. Similarly, every false proposition implies the truth of a conditional consisting of any proposition as consequent and the false proposition as antecedent.

$$\sim p \dashrightarrow (p \dashrightarrow q)$$

And for any conditional, either it or its converse are true

$$(p \dashrightarrow q) \vee (q \dashrightarrow p)$$

So *If Mohammed is Anglican, then XiaoMei is Chinese* will be true just in case Mohammed is not an Anglican, and *If Mohammed is Anglican, then XiaoMei is Chinese* will also be true just in case XiaoMei is Chinese. If the sentence is false, it is false because Mohammed is Anglican but XiaoMei is not Chinese, and in that case the sentence *If XiaoMei is Chinese then Mohammed is not Anglican* will be true because both clauses are false.

What seems strange about these paradoxes is that we don't usually assert conditionals where we have so little reason to connect the truth of antecedent to consequent. We simply wouldn't assert a conditional about two people's ethnicity or religion unless we felt they were connected causally as in *If Mohammad is Anglican then his son is Anglican too.* Without the connection, the results are odd.

C.I. Lewis, troubled by the inadequacy of material implication, introduced a new connective, *strict implication*, which he defined modally: *necessarily implies*, or in terms of possible worlds, *implies in all possible worlds.* So, in addition to the standard connectives *and* (&), *or* (v), *material implication* (-->) and *not* (~), Lewis introduced a symbol for strict implication (⥽) and a modal operator "L" for necessity, defining "⥽"as p ⥽ q = df L(p --> q)

The properties of the new modal operator depend on the axioms introduced for it, and for each added consistent axiom not deducible from the previously given ones, each new consequence of the operator, a new modal logic results. Since the purpose of introducing the modal logic was to accommodate a more natural notion of implication, axioms may be added to capture various intuitions about the natural or cognitive world, for example, the modal notion of futurity mentioned above. Necessity in the future would mean *true in all future times* or *true in all future worlds.* For such a notion of necessity, Lp *does not* imply p -- that p is necessary (true forever in the future) does not mean that p must be true now. But a stronger notion of necessity, for example, necessary for all time, would require the added axiom

Lp --> p

which is a characteristic of the system known as S5. In this way the modal symbols can accommodate various intuitions about the way the world is, defining the logical *syntax* (definitions purely in terms of the symbols used) to accommodate the desired *semantics* (the way we understand things in the world to be).

1.2.2 Quine's critique

No discussion of contemporary notions of modality can ignore the controversy Quine has introduced regarding them. On the semantic side, Quine finds that there is no non-circular definition of necessity. Why are bachelors *necessarily* unmarried? The answer that *bachelor* is synonymous with *unmarried man* begs the question, In virtue of what are they synonymous? Appeal to possible worlds has the same question begging consequence, In virtue of what are only those worlds possible in which all bachelors are unmarried men? All such relations are justified by the definition

bachelor = unmarried man

which is simply stipulative. So for Quine, the notion of necessity can only be justified on axiomatic grounds. He can accept that logic is necessary, but not that contentful semantic relations are.

Quine's argument is at heart just a radically skeptical empiricism. Suppose a non English speaker were to try to determine the meaning of English *bachelor* only by looking at the way English speakers use the word *bachelor.* She sees them apply it to individuals, all of whom we can take to be members of the class *bachelor*, the *extension* of the word *bachelor.* Right away the observer is faced with an inductive problem, how can one judge from each extensional addition to the class whether the next will bear the same property. If the observer happens to be researching in a Hasidic community in Brooklyn, all the bachelors will be dressed in black and it will seem reasonable for her to include *dressed in black* in her definition. Quine's problem is deeper than the inductive quandary, though. Even if every instance of bachelor were available to the researcher trying to learn English, still there are fine grains of meaning that would elude grasp. Are bachelors just the unmarried men, or just the momentary appearances of unmarried men, or are they combined parts of unmarried men? These seem to Quine incorrigible indeterminacies that preclude what he calls *radical* translation, the kind of translation he thinks is necessary for the determination of meaning, the jump from extension -- the individuals who happen to be picked out by a word -- to intension -- the individuals the word picks out necessarily, in all possible worlds, by definition.

Not all views of semantics are so radically empirical. Katz (1984, 1990) argues against Quine on the grounds that semantic notions can be taken to be just like logical notions, stipulative. To know English is to know that *bachelor* is a synonym for unmarried man. Such relations of synonymy and antonymy are as constitutive of the language as its syntax, and as little dependent of extralinguistic facts. This view of language is as radically divorced from empirical questions of reference as Quine's is reliant on them. It may be because of the abstraction of Katz' platonic semantics that, Katz' arguments notwithstanding, Quine's critique of meaning remains widely accepted.

Quine's critique of meaning casts doubt on necessity as a clear, coherent and reliable semantic notion. But Quine also has qualms about the use of necessity in logic as well. If the number of planets is 9, and necessarily 9>7, it should be true that necessarily the number of planets >7. But this last statement is false, since the number of planets is not necessarily 9, but only contingently 9. There is no *logical* reason why there could not have been seven planets. The number of planets is a physical contingecy, not a logical necessity. It seems, then, that in modal contexts identities cannot be substituted without the risk of changing the truth value of the statement.

Quine sees a further problem with substitutability of variables. We know that everything is necessarily identical with itself. We know that Imamu Amiri Baraka is the adopted name of LeRoi Jones. So, since a thing is necessarily identical with itself

> (LeRoi Jones is the same as Amiri Baraka) & (necessarily LeRoi Jones is the same as LeRoi Jones).

We can generalize existentially that

> (A) There exists a someone who is the same as Amiri Baraka & necessarily that someone is the same as LeRoi Jones

But we also know that

> Amiri Baraka is the same as Amiri Baraka & it is not necessary that LeRoi Jones is the same as Amiri Baraka

from which we may generalized existentially

> (B) There exists a someone who is the same as Amiri Baraka & it is not necessary that that someone is the same as LeRoi Jones.

This last sentence taken with (A) entails that there exist two people, one who is the same as Amiri Baraka and is necessarily the same as LeRoi Jones and someone else who is the same as Amiri Baraka but is not necessarily the same as LeRoi Jones. If we introduced yet another designator for Mr. Baraka, "Mrs. Jones little baby boy", for example, Quine can claim that modal logicians would be committed to yet a third object in their universe, for, in Quine's famous words "to be is to be the value of a variable".

1.2.3 Responses to Quine

Various solutions to Quine's objections have been offered. Smullyan (1948) argued that Quine had misapplied the rule of substitution -- Leibniz' Law of the identity of indiscernibles, the rule according to which any two identical individuals must be identical in all their properties. According to Quine, the correct conclusion to reach from *necessarily 9>7* and *the number of planets = 9* is *the number of planets is such that it is necessarily greater than 7.* But that presumes too much from the nature of the identity statement. *The number of planets* is not a proper name for a number, it is the name of a property which happens to satisfy another property, that of being equal to 9. Smullyan interprets the scope of the necessity operator in a different position than does Quine. According to Smullyan, the application of Leibniz' Law yields

The number of planets is such that necessarily that number is greater than 7

a true statement.

Quine's second argument fails, according to Fitch (1949), if the names involved are taken seriously as proper names. Kripke's 1972 exploration of the relationship between naming and necessity supports such treatment. If names are not properties but refer directly, then

Amiri Baraka is necessarily the same as LeRoi Jones

is true, and Quine cannot set up his argument.

Fitting and Mendelsohn (1998) put the issue into a different perspective. For them, there is nothing disturbing about Quine's observations on non-substitutability, or as they view it, the lack of truth-functionality of modal operators.

> For it is not the truth of a claim alone that is relevant to necessity, but the quality of the truth. We are making discriminations in the quality of the truth, and this should certainly be reflected in the fact that the operators are non-truth-functional. Quine sometimes makes it look as though truth-functionality is, in and of itself, a vice. But this is hardly plausible -- unless one seeks not to make any distinctions in the quality of truth.
>
> (Fitting & Mendelsohn 1998:76)

Susan Haack (1978) had already pointed out that Quine's real gripe against modality is not its non-truth-functionality, but the lack of extensionality of quantified modal contexts, that is, Quine's second problem: the value of a variable must not depend on how it is picked out -- it must not depend on whether it is picked out by the name Baraka or Jones. Fitting and Mendelsohn respond that if the modal operators are non-truth-functional, all open sentences (sentences with variables not yet bound by a quantifier) in their scope will also be non-truth-functional, which is to say, there are no extensional modal contexts. In less technical terms, when we talk about possible and necessary properties of individuals, we are not just talking about those individuals in the actual world, we are talking about the properties individuals have in possible worlds and therefore we should not expect to be restrained by identities of the actual world. How we determine individuals' counterparts in possible worlds is a project of the semantics. The system of modality will depend on how that semantics is set up.

1.2.4 Kripke's possible worlds semantics

Kripke, in his 1959 and 1963 papers, greatly advanced the understanding and acceptance of modal logic by providing a formal semantics for quantified modal systems. He does so by juggling several elements to create models for modalities: the actual world (**G**) within a set of possible worlds (**K**), the relation of *accessibility* of these worlds to one another (***R***), the individuals who inhabit these worlds (a,b,c...) and variables which range over these individuals (x,y...), and the truth or falsity (T,F) of properties (P,Q...) that may be predicated of those individuals.

The intuitive idea is that each possible world is populated with named individuals who instantiate various predicates. Malcolm in the actual world was assassinated, so the predicate *is dead* is true of Malcolm in the actual world **G**, but may not be true in possible world **H**.

Recall our researcher on the meaning of *bachelor* who was confined to the Hasidic community in Brooklyn. For her, let's call her Hilda, the predicate *wears black* is true of all bachelors: *∀x bachelor x --> wears black x* is true since for every value of the individual variable *x* that satisfies *x is a bachelor*, that same individual satisfies *x wears black*. But outside the confines of her world, the value of *is a bachelor* will include individuals c, d, and e, who are non Hasids and who do not wear black. So while *∀x bachelor x --> wears black x* is true for Hilda at present, *L∀ x bachelor x --> wears black x* is not true because world **H** is accessible from Hilda's reality or imagination, and H is a world in which *∀ x bachelor x --> wears black x* is false, there being bachelors c,d, and e there who don't wear black.

The validity of theorems can be demonstrated with surprising clarity in Kripke's framework as can the additional model theoretic semantic constraints which can be added to make desirable theorems come out valid. In Kripke 1969, he uses an instructive counterexample to the Barcan formula

> ∀x L Px --> L ∀x Px
> *if all x's are such that they are necessarily P,*
> *then necessarily all x's are P*

Suppose in **G** the extension of the predicate P (those individuals which satisfy P, or which P is true of) is the set {a}, where *a* is the name of the only individual in **G**. The formula

> ∀x Px

is true in **G**, there being only one individual in it and that individual satisfies P. Suppose further that in a world **H** accessible from **G,** there are two individuals, a and b, and only a satisfies P. Assuming the accessibility relation ***R*** is reflexive -- that **G** is accessible from itself -- the formula

$\forall x\ L\ px$

is true since (x) is evaluated from **G** -- all the individuals in **G** satisfy P and *those individuals represented by x in* ***G*** also satisfy P in **H** too. However, the formula

$\forall x\ Px$

is false in **H**, since b in **H** does not satisfy P. If $\forall x\ Px$ is false in **H**, L $\forall x\ Px$ cannot be true in **G**, for **H** is accessible from **G**.

The Kripke model shows transparently what constraint on the semantics provides validity to the Barcan formula. If the individuals in **H** are a subset of the individuals in world **G**, the Barcan formula would hold between them. To generalize using a spatial analogy -- if the possible world you go to has no more corresponding individuals than the world from which you come, the Barcan formula will hold of the 'going to' relation between those worlds. If the individuals of the accessible world are a subset of those found in the world from which the accessible world is accessed, the Barcan formula will be true.

The semantics of modality can be adjusted not only by populating and depopulating possible worlds, but also by assigning various extensions to the predicates, and by modulating the properties of the accessibility relation. Kripke assumes an accessibility relation which is reflexive, symmetric and transitive. But the relation may have any combination of these properties, or none of them, depending on what intuitive facts one wants the modal system to reflect.

1.2.5 Questions about possible worlds

The notion of possible worlds is not uncontroversial. There are immediate questions about their metaphysical status, since they appear to introduce entities. As David Lewis puts it

> ...there are many ways things could have been besides the way they actually are. On the face of it, this sentence is an existential quantification. It says that there exist many entities of a certain description, to wit 'ways things could have been'.
>
> (Lewis 1973:84)

Lewis sees no way of avoiding realism about such modal quantification.

> We might take them as metalinguisitc predicates analyzable in terms of consistency: 'Possibly ϕ' means that ϕ is a consistent sentence. But what is consistency? If a consistent sentence is one that could be true, or one that is not necessarily false, then the theory is circular...
>
> (Lewis 1973:85)

Lewis prefers to accept the existence of possible worlds, demurring from Quine's objections to the messiness of "unactualized possibilities who lead double lives, lounging in the doorways of two worlds at once." Lewis avoids the mess by stipulating that the same individuals do not exist in different possible worlds, only their *counterparts* do. Otherwise, possible worlds are the same in kind as the actual world, except that we only inhabit the actual world.

Stalnaker 1976 tempers Lewis' sanguine realism with some careful hedges. He suggests that viewing the world in which we live as the way things really are, rather than as just another possible world distinguished only by our presence, is no compromise to the understanding of modal propositions, since in each possible world, the inhabitants will see reality and possibility from their own perspective, yet one can fairly assert that their perspectives are nonetheless fictional. They only *think* they are real, we think we are real and we *are* real.

> We can grant that fictional characters are as right, from their point of view, to affim their fullblooded reality as we are to affirm ours. But their point of view is fictional, and so what is right from it makes no difference as far as reality is concerned.
>
> (Stalnaker 1976:69)

Setting aside metaphysical qualms, more serious problems with possible worlds arise in conditional semantics and the analysis of counterfactuals. To validate a sentence like

> If this match had been scratched, it would have lighted

I may appeal to a possible world in which the match is scratched and lights. But on what grounds can I assume that every possible world in which the match is scratched is one in which it lights? What about the possible world in which it is raining and the match gets wet? Exactly how to constrain the *accessibility relation* for counterfactuals is a topic to which I return in some detail in the next chapter.

1.3 Modality in language

English modals have received attention from linguists at least since Jespersen (Philosophy of Grammar, 1924). Palmer (1986) and Perkins (1983) have written contemporary comprehensive studies, along with Warner's 1993 study of auxiliaries. Current research focuses on modality in discourse (Portner, 1995) including anaphora (Roberts, 1989) and on requirements for an adequate expression in logic (Kratzer 1977, 1989, 1991) as well as the historical development in the semantic fields of the modal auxiliaries (Bybee, Perkins & Pagliuca 1994).

Among descriptive studies, Palmer's 1986 book provides some interesting comparative data on how modalities are treated in a variety of languages, feeding metatheoretical and cross-linguistic considerations of how modality is encoded and grammaticalized. Perkins' interesting 1983 study attempts to discover the core meanings of the English modals, an attempt that fails since some of the core meanings he finds are shared by more than one modal and so do not adequately distinguish each of the modals from one another.

Already Jespersen observed a wide variety of types of modalities, specifying that the notion of mood is a syntactic category "if the attitude of mind is shown in the form of the verb." His list is long:

Containing an element of will

Jussive	go (command)
Compulsive	he has to go
Obligative	he ought to go/we should go
Advisory	you should go
Precative	go, please
Hortative	let us go
Permissive	you may go, if you like
Promissive	I will go/it shall be done
Optative (realizable)	maybe still be alive
Desidrative (unrealizable)	would he were still alive
Intentional	in order that he may go

Containing no element of will

Apodictive	twice two must be (is necessarily) four
Necessitative	he must be rich (of he could not spend so much)
Assertive	he is rich
Presumptive	he is probably rich/he would (will) know
Dubitative	he may be (is perhaps) rich
Potential	he can speak
Conditional	if he is rich
Hypothetical	if he were rich
Concessional	though he is rich

(Jespersen 1965:320-1)

Kratzer suggests that these may be multiplied infinitely. Three basic types are commonly recognised among both linguists and logicians (e.g., Allwood, Andersson & Dahl 1977, Chierchia & McConnell-Ginet 1990):

> alethic or circumstantial (possibility and necessity),
> deontic (moral, legal or social obligation),
> epistemic (implications drawn on evidence, certainty).

Preferential (implications drawn from one's desires) and dispositonal (probable implications of one's dispositions) are often included as well. Warner observes that the subjective epistemic mode is far more common than the objective alethic and that the common philosophical assumption that the alethic mode somehow corresponds to a core mode is ill advised. From the standpoint of use, his caveat is welcome. But when analysing and interpreting the meanings of the various types of modality, the notion of a core underlying the various uses brings us back to the simpler alethic modes for explanatory purposes.

Consider these examples

> "If I could've married her I would have."
> [quoted in the NYTimes]
> (alethic)
>
> "They should lock him up and throw away the key."
> [WNYC radio call-in]
> (deontic)
>
> "If you're arrested, you must've done something wrong."
> [personal communication, NYPD]
> (epistemic)

The first example above regards *circumstantial* obstacles that prevented the *possibility* of a desired marriage; the second asserts that for morality or justice to be served, nothing less than lifelong incarceration is *legally* or *morally necessary*, implying that a grave crime was committed; the last implies that the officer *believes* that NYPD actions *justify* and *entail necessary conclusions* about guilt.

Such examples as these suggest that each type of modality comes in two basic flavors, possibility and necessity.

> *alethic*
> I can continue without help
> Life must go on
>
> *deontic*
> You must/have to/ should reject their terms, no question about it.
> You may reject their terms, if they don't suit you.
>
> *epsitemic*
> It must be raining
> A: What's that noise? B: It might/could be rain.

Alethic *can* (possible) pairs with *must* (necessary); deontic *should*, *must* and *have to*, expressing various shades of obligation, are paired with the possible *may*; epistemic *must* pairs with *might* and *could*.

Modality may be expressed in a variety of syntactic categories. In this example from Frawley (1992)

> Apparently, Maria bought the cat

"apparently" expresses the epistemic slant of the proposition changing it from the assertion that Maria bought the cat to the assertion that Maria's buying the cat is implied by the speaker's evidence. Palmer cites a wide variety of forms in which modal notions are expressed cross-linguistically, including complement clauses *It is essential that they should come* , *I hope you come,* and conditionals *if you say that you are wrong*, and elements like evidentials, less perspicuous in English than in some of the other languages he considers.

The essental facts about modal verbs are familiar. In the English system this class of words includes *can, could, must, shall, should, will, would* (Warner, writing in British English, includes also *had (better), had (rather), would (rather)* among the modals), and in some instances *dare, need, ought.*

They are a subset of the auxiliary verbs, those words by means of which English speakers express facets of verbal meaning not expressed by tense or aspect inflections. But they are distinct among the auxiliaries because they do not inflect at all unless the 'preterite' forms *could, would,* and *should* are understood as inflected forms of *can, will* and *shall.* But since the former do not merely serve as past forms of the latter, the claim that they are inflected for tense while of historical significance, is of limited soundness or explanatory power.

Though the modals are further distinguished from the auxiliaries by their meaning, they share a similar syntax, appearing where a verb normally would, as other auxiliaries do.

> I mean it.
> S V O
>
> I write [for a living].
> S V
>
> A: Who writes for a living? B: I do [write for a living].
> S aux
>
> A: Who can take minutes? B: I can [take minutes].
> S modal

In their position they are syntactically like verbs. But morphologically the modals do not inflect for person as other auxiliaries and verbs in English generally do. As mentioned, something like tense seems to appear. The following pair seem to share a root:

I can turn cartwheels.
modal present

I could turn cartwheels when I was younger.
modal past

but since the inflection, if it is an inflection, does not always express the normal tense function:

I can draw accurately from life.
present

I could draw accurately from life if I wanted to.
conditional

the inflection cannot be strictly analogized to that of the verbs. One might think of the morphology as belonging to two etymologically related words rather than thinking of *can* and *could* as one word inflected variously.

Modals do not simply replace the verb. An uninflected verb may appear following one of these modals and some verbal predicate is always understood. In this sense they are unlike intransitive verbs which do not require a complement.

The verbal complement to the modal appears bare (without *to*), thus distinguishing the modals from other verbs that take verbal complements like *want* as in *I want to go*. *Need* and *dare* are exceptional in that they sometimes take *to V* as complement. This syntactic distinction has other reflexes which will figure importantly in Chapter Five. When present, the verb will always appear without inflection, as it were, tenseless, as if the modal had replaced whatever function tense would have served.

These modals, similar to, yet distinct from verbs, taking the place of verbal inflection for tense or aspect, also express something akin to yet distinct from tense and aspect. Tense, a verbal property expressed by inflection, adds a time specification to the assertion

> I wrote
> past
>
> I write
> present

and aspect, sometimes a verbal property expressed by inflection, sometimes a property of the entire verb phrase expressed by the interaction of verb and complement, says something about completion or continuity

> I write [for a living]
> timeless=Iam a writer
>
> I'm writing [and so can't answer the phone]
> continuity
>
> I was writing[when you called]
> countinuity relative to an event
>
> I wrote [all day]
> continuity over a period
>
> I wrote a novel.
> completion

The modals also express a relationship between the subject in the immediate discourse (the subject of the sentence) and a verbal predicate, a relationship that says something beyond the simple assertion of the predicate to the subject, as in *you write well*

> You can write well.
> You must write well.
> You should write well.
> You could write well.

The modals add to the assertion "*you write well*" some possibility (you can, i.e., have the ability to, write well), or some knowledge under the circumstances (you must write well [since you are a doctoral candidate]), or expectation (you should write well [since doctoral candidates write so much]), or possibility under certain conditions (you could write well [if only you were not an academic]).

The modals then seem to be part of the verb system, in some ways like verbs, in some ways like verbal inflections. They are a subset of auxiliaries, distinct both morphologically and semantically.

One peculiarity they share with other auxiliaries is the ability to combine with the verbal negative marker:

> I not went* I went not.? I wentn't.*
> I not want to go* I want not to go.? I wantn't to go.*
> I don't write.
> I can't write.

The interaction with negation, puzzling in itself, points to a further puzzle.

1.4 Negation

Some semantic functions are restricted to specific categories in English: tense to the verb, number to the noun, definiteness to the articles and demonstratives, for example. Other functions range over more than one category: aspect may be carried by the verb alone ("I wrote her"), by a prepositional phrase (or satellite, in Talmy's (1985) terminology designed to describe this kind of interaction) "I wrote for three hours" vs. "I wrote immediately", sometimes by implications from nominal properties, "I wrote a dissertation" ("dissertation" is a singular count noun) which implies a task completed vs. "I wrote commentary," ("commentary" denotes a mass) which does not indicate that I completed a task of writing a single commentary.

Negation ranges freely over almost any category from the morphological “un” in “unhappy” (meaning “sad”) which negates “happy” in a different way than the word level negations “non” in “non-happy” (meaning not happy but not necessarily sad); phrasal “Diedra is not happy to be leaving” which predicates a certain negative property about Diedra, who is assumed to exist, and the technically distinct denial at the sentential level “It is not the case that Diedra is happy to be leaving” which may be true if Diedra doesn’t exist. Denials can even be made demonstratively of whole chunks of discourse: “I deny that,” where “that” may include accusations of indeterminate length.

Interacting with the apparent freedom of denial/negation are the constraints of syntax and scope. To avoid every ambiguity of negation a language would not only need to allow negation markers to attach to any morpheme with a directional interpretation rule, but the language would also require a phrase marker to indicate how far the negation marker is meant to reach, otherwise it would be impossible to tell how much linguistic material is subject to the negation. English only meets these requirements part way. It has morphological markers which indicate whether negation occurs below the word level, at the word level or beyond it. There is an awkward method for sentential negation -- “it’s not (the case/true) that” -- which has the advantage of being unambiguous. But at the phrase level, English is hampered by having neither a phrase marker nor syntactic freedom, nor even a clear directional rule as will be shown below.

As a subset of auxiliary verbs, modals bear the fixed auxiliary-negation syntax. The word “not” always follows the modal. This syntactic rule is just about as strong as syntactic rules can be. It may be violated in some rare marked forms, like poetry, but always with an exotic or rhetorical effect.

"...whereof the ewe not eats.."
Tempest

"...ask not what you country can do for you..."
presidential inaugural address 1961

Negation of the verb phrase normally requires an auxiliary verb. This verb precedes the negation marker invariably, leading to a question (moot in the case of dummy auxiliaries like *do* which have little meaning in themselves): which is the negation marker negating, the verb of the auxiliary? In the case of the modal verbs, the answer to this question provides interesting insights.

In analyzing the meaning of negated modals, it has been pointed out by Horn (1998) that the meaning of the word *not* sometimes attaches to the modal and sometimes attaches to the following verb.

Consider the following two sentences:

I can not go
I must not go.

Both these sentences mean very roughly that going is out of the question for me. In the first sentence, going is ruled out by the negation of the possibility indicated by *can.* If *I can go* means *to go is possible for me*, *can not go* means *to go is not possible for me.* A tentative representation might be

~possible go(I)

The second sentence rules out going by affirming the necessity of *must* over not going. A tentative representation might be

necessarily ~go(I)

Notice that the negation sign shifts position. This is not a trivial difference. Suppose *can not go* were interpreted to mean *can not-go.* Then *I can not go* would mean *not to go is possible for me.* So I might answer the question *Do you absolutely have to go?* with *I can not go if I really don't want to.* In order to achieve this interpretation I would have to emphatically stress *not* in the sentence. Without emphasis the sentence is not a felicitous answer to the question. If I contract *can not* to *can't*, it is impossible to use the sentence to mean *can not-go.* On the other hand, *must not go*, when contracted to *mustn't go* still means *must not-go. Can not* and *can't* seem to mean ((NOT-CAN) (V)), while *must not* and *mustn't* seem to mean ((MUST) (NOT-V)).

Contraction can not be an indication of scope or direction of semantic attachment since it indicates narrow scope or attachment to the verb when *must* is the modal, wide scope or attachment to the modal when *can* is the modal. What accounts for the difference in scope?

The switch in scope is not random. All modals which express a flavor of necessity take narrow scope negation, all modals in the possiblity camp take wide scope:

must not go = must not-go
should not go = should not-go
ought not go = ought not-go

(even *shall* used deontically as in *thou shallt not kill* means *shall not-kill*; it does not mean *it is not the case that thou shallt kill* which would simply make killing non-required)

can not go = not-can go
could not go = not-could go

and the permissive sense

may not go = not-may go.

(Wide and narrow scope over *will* and *would* mean the same.)

Horn points out that the interpretations that English seems to prefer correspond to the E corner of the medieval quadrangle of modals based on Aristotle's *On Interpretation*

necessarily P (not possibly not P) A	necessarily not P (not possilbly P) E
I not necessarily not P (possibly P)	O not necessarily P (possibly not P)

O interpretations are dispreferred by English. Horn gives no complete explanation for this descriptive generalization. The present research suggests that English (perhaps other languages as well) prefers to lexify or in other ways calcify unequivocal explicit negation over vague or ambiguous negation.

One difference between E and O interpretations is that O forms -- *not necessarily P*, which is equivalent to *possibly not P* -- are vague with regard to whether on not P is true in a particular case. E forms -- *necessarily not*, which is equivalent to *not possible*, are quite explicit for all cases, namely, everywhere P will be false.

Something similar, familiarly called negative transportation in the syntactic literature, occurs in sentences with certain negated psychological predicates. The negation of the psychological predicate is transported into the complementary clause:

I don't think he's gone

seems to mean *I think he's not gone/I think he's here* (an E interpretation) rather than *I am not thinking the thought: he's gone*, the O interpretation. The first indicates a commitment to a thought about his presence, the second commits only to an absence on my state of mind and says nothing about the proposition *he's gone*. This second -- vague -- interpretation is far and away dispreferred among speakers, despite its syntactic transparency. Compare these with a psychological predicate which does not undergo negative transportation:

I don't know he's here

which has a strong O interpretation: it is consistent with my knowing he's not here, and my knowing nothing about the matter if, for example, I only surmise that he's here. Here again English appears to lack a rule for the directional attachment of negation.

The vagueness of not knowing may be less odious than the vagueness of not thinking something. In the context of the question of someone's presence, an assertion that I have no thought on that presence seems a strange evasion. There are normally only two alternatives, he's here or not here. In the context of knowing of someone's presence, certainty is highlighted, and it makes some sense to be able to defend oneself from liability, as it were, by asserting one's lack of certainty.

The odiousness of vagueness or ambiguity bears on both the problem of negative transportation and modal negation. Are negative transportation and modal negation related? Is there a rule which can cover both?

One problem for both the descriptive generalization that English disprefers O interpretations and for an explanation based on a preference for non-vague interpretations, indeed for any explanation, is the fact that *might* when negated does appear to have an O interpretation.

I might not go

does not mean

it is not the case that I might go
~might go(I)

to go is not possible for me
~possible go(I)

It seems to mean

might ~go(I)
not to go is possible for me
possibly ~go(I)

which is an O interpretation, vague as to whether going or not going is to be the case. Both going and not going remain options.

To explain this apparent departure from the pattern of negated modals of possibility, I propose that *might* is not at all a simple modality of possibility, but a combined modality of knowledge and possibility, a modality of probability, of ignorance and uncertainty.

The difference between *might* and other modals shows most clearly in contrastive *but* coordinations. *But* is usually felicitous when what follows it denies an expected or desired possibility suggested by the preceding clause (Bendix 1971, van Dijk 1977, Rieber 1996):

I can go but I won't

are felicitous because the antecedent clause *I can go* implies going as a possibility which is ruled out in the consequent, justifying the use of *but*. The but-clause is not felicitous either when no possibility is present in the antecedent or when what is denied is an assertion or entailment of the antecedent

I can't go but I won't*
I shall go but I won't*

In the case of *might*

I might go but I won't

is contradictory, apparently because when I say that I might go, I am not certain whether I shall or not, so I cannot then assert my intentions while claiming not to know them. I propose this tentative analysis of *might go*:

~know (go) & possibly (go)

If this is the representation of *might go* then it would follow that the narrow scope interpretation of *might not go* (might not-go) would be

~know (~go) & possibly (~go)

which works out to mean virtually the same as *might go* with only the technical difference that what I don't know in *might go* is whether I will go, and what is not known in *might not go* is whether I will not go. Pragmatically these turn out to be the same once the context of choice is established -- usually there are only two options, so if I don't know whether I will go, I also don't know whether I will not go; conversely, if I know I will go, I know I will not not go. As for the second, *possibility* conjuncts, these are equally vague as regards their negations. The technical differences account for the difference in emphasis which distinguishes *might* from *might not.*

> A: Come, you'll have fun. B: Really? Then I might go.
>
> A: Come, you'll have fun. B: Really? Then I might not go.*
> (Under the assumption that fun is desirable)
>
> A: Don't go, you'll be bored. B: Really? Then I might not go.
>
> A: Don't go, you'll be bored. B: Really? Then I might go.*
> (Under the assumption that boredom is to be avoided)[2]

The difference may just be whether going or not going is the topic. The implications of either *might* or *might not* are a balance of probability, and saying *but I might not* seems to add only a hesitation to *I might go* and *but I might* to *I might not go.*

> I might go, but I might not
> I might not go, but I might

The analysis of *might* as a modality of knowledge seems intuitively correct since

> I might not go but I won't

is just as contradictory as

> I might go but I won't

and

> I might not go but I will.

---

[2] The 'A' statements are there only to set up the expectation that going is expected in the first pair and not going in the second pair. These are entirely contextual assumptions. Imagine a rebellious and contrary teen who claims to hate fun, seeking it out to torture himself. Then the asterisked sentences will be felicitous and the unasterisked ones, infelicitous.

One can't assert one's ignorance of one's future choice of action and assert one's choice of action at the same time. It is clearer in the third person

She might go but she will*
She might go but she won't*
She might not go but she will*
She might not go but she won't*

The infelicity of all of these is predicted if *might* is a modality of knowledge. If *might* were a modality of possibility only, it would be expected to act as *can*

She can go but she won't
She can go but she will*

Now consider wide scope of negation in the above analysis. If the negation were given wide scope over *might not*

~(~know (go) & possibly (go))

the result would be ambiguous since what is in the main parenthesis is a conjunction, and the whole would then be false if any one conjunct were. The result would be ambiguous as to which conjunct is negated, reaffirming the observation that English avoids ambiguity in negation. If vagueness/ambiguity is the decisive factor, this analysis of *might* may have implications for negative transportation.

This solution may seem too neat, since it rests on what appears to be a technical detail of notation. But the notation here simply reflects the intuitive meaning of the word *might*.

Formalizing this interpretation of *might* raises two issues. Does the modality of knowledge expressed by *might* correspond to other epistemic modalities, and if not, how do they differ? And second, is the wide scope negative attachment to modals of possibility the same as or distinct from sentential negation?

Taking the last point first, in familiar formalizations of modal logic, the choices of scope are limited to negation of the predicate or the modal operator:

L~P(f)
~LP(f)
[L=necessity, P=a predicate, f=an individual constant]

In natural language, we need something like sentential negation as well:

I can NOT go (with stress on *not* meaning I can stay)
I can't go (meaning I must stay)
It is not the case that I can go (meaning *I can go* is false because I must stay or because I must go)

Following Horn's analysis, the last instance would be the case of so-called metalinguistic negation. If I say something is merely possible, I seem to imply, perhaps by a Gricean conversational principle of quantity, that the predicate is only possible and not actual or necessary. All the modals of possibility, including *might* behave similarly under sentential negation:

It is not the case that I can go -- I must/I am going.
It is not the case that I could go -- I must/ I'm going.
It is not the case that I might go -- I must/I'm going.

Under sentential negation, all modals of possibility are ambiguous. They all may mean either that the predicate is not possible or that asserting only the possibility of the predicate is misleading.

Another interpretation of the modals of possibility, going back to Aristotle, is that possibility attributed to a predicate by a modal in English means both the predicate is possibly true and possibly the predicate is false -- in other words, a contingency:

possibly Q = possibly Q & possibly ~Q

If Aristotle's analysis is correct, or if wide scope negation of modals of possibility is equivalent to sentential negation and Horn's metalinguistic analysis is correct, there would be an explanation for why, under certain circumstances all the modals of possibility are vague when negated under the wide scope of the operator. However, with that predictive strength, both analyses lose the power to explain the exceptionality of *might.*

The second question regards how *might* fits in with other epistemic modals. If my analysis of *might* is correct, it expresses a modality of knowledge quite distinct from the familiar epistemic modality. In the first place, it is really a modality of ignorance or uncertainty, not of information. Whereas epistemic modalities are concerned with probabilities based on positive information, *might* entails a lack of certainty, knowledge, and information. But it also differs in modal structure.

The structure of the meaning of the modal verbs in English has been explored by Kratzer (1977, 1991). She shows that modals presuppose a context of utterance. *It must be raining* actually means

In light of what I know it must be raining.

You mustn't make a fuss translates as

In light of the rules of good behavior you mustn't make a fuss.

But in the case of *might* it seems unnatural to view it as adding *in the light of X* since *in the light of X* implies some kind of knowledge. The lack of knowledge in the meaning of *might* suggests that either *might* does not conform to standard epistemic modality or that Kratzer's analysis is flawed.

My goals in what follows are

1. to explore the meaning of *might* using the contrastive clauses introduced above
2. by the same means explore the meaning of the modals of possibility
3. find a formalization adequate to express *might* and distinguish it from the other modals of possibility
4. explore the implications of this analysis for the peculiar behavior of negative attachment to modals.

Chapter Two updates theories of modality and possible worlds, showing that current theorizing fails to provide an explanation for, or even address, the issues raised here about the uniqueness of *might*. Chapters Three and Four explore the meaning and use of conjunctions to show that no current theory of conjunction is adequate to explain the behavior of *might* in conjoined structures. Chapter Five examines negative scope and its relation to modals, pointing the way to an adequate theory of *might*. Chapter Six presents three plausible theories of the meaning of *might*, only the third of which survives criticism.

Chapter 2 Kratzer's situation semantics for modals

This chapter is concerned with introducing the current linguistic analysis of modality, to provide the background for the discussion of modals to follow. The contemporary analysis given here turns out to be useful in Chapter Three's discussion of conjunctions also. The discussion in this chapter begins with some specific proposals that lead towards a notion of possible worlds modified by a version of situation semantics.

The most innovative proposals belong to Angelica Kratzer. Her treatment of modals first appears in her dissertation and 1977 article "What 'must' and 'can' must and can mean", and is developed in two later articles "Modality" (1991) and "An investigation into the lumps of thoughts" (1989).

Kratzer (1977) observes that the various types of modalities that have commonly been identified all have some kernel of meaning in common, and that since simple categorization into a handful of different types fails to accommodate the infinite variety of nuance among modals, defining what the types have in common will provide a simpler theory than any which depends on the identification of types.

To get at that kernel of meaning, Kratzer brings out the suppressed argument that distinguishes one modal type from another:

> Deontic must (refers to a duty)
>
> All Maori children must learn the names of their ancestors
> = *In view of what their tribal duties are,* all Maori children must learn the names of their ancestors

Epistemic must (refers to a piece of knowledge or information)

The ancestors of the Maoris must have arrived from Tahiti
= *In view of what is known*, the ancestors of the Maoris must have arrived from Tahiti

Dispositional must (refers to a personal disposition)

If you must sneeze, at least use your handkerchief
If -- *in view of what your dispositions are* -- you must sneeze, at least use your handkerchief

Preferential must (refers to preferences and wishes)

When Kahukura-nui died, the people of Kahungunu said: Rakaipaka must be our chief
= When Kahukura-nui died, the people of Kahungunu said*: In view of what is good for us*, Rakaipaka must be our chief

(after Kratzer 1977:340)

She translates these meanings into a possible worlds interpretation of propositional meanings. Limiting her concern to truth values alone, she takes a proposition to be identifiable as the possible worlds in which that proposition is true. A proposition, for this purpose, will be a function designating for each world whether the proposition is true or false in it, a function from worlds to truth values. Taking the epistemic modal as an example, she defines "what is known", interpreting it to mean *the propositions that hold of any given possible world.* "What is known" then, is a function which assigns to each possible world the set of propositions known in that world. It is a function from worlds into sets of propositions.

The meaning of *must* and *can* in Kratzer's account, is now built from some definitions of "logically follows from", "is consistent" and "is compatible". A proposition *p* follows logically from a set *A* of propositions just in case there is no possible world in which all of *A* are true but not *p*. This definition provides the function of epistemic *must* (= "must in view of"): *must in view of* assigns to the pair consisting of the function "what is known" and a proposition *p* (e.g., "the ancestors of the Maoris have arrived from Tahiti") all the possible worlds in which *p* follows logically from the function "what is known".

Kratzer defines *can* relying on both "is consistent" -- the requirement on a set of propositions that there be at least one world in which they are all true together -- and "is compatible" -- the requirement on a proposition *p* with respect to a set of propositions that there be a world in which they all are true together, i.e., consistent with one another. (Compatibility as I have just defined it does not rely on a prior definition of consistency, but consistency is the more basic concept, having more general application to worlds, and I assume that is the reason she introduces it.) She defines *can in view of* as the function which assigns to a pair consisting of the function "what is known" and the proposition p under consideration, those worlds in which *p* is compatible with what the function "what is known" assigns to those worlds -- *p can in view of what is known* means *p* is compatible with what is known.

Let p= some proposition, A=a set of propositions, w=some world, W=the set of all possible worlds, f,ζ= functions, U=union of individuals or sets, {}= a set of elements the members of which are listed between the brackets. These are her definitions exactly:

> DEFINITION 1. A proposition *p* is true in a world *w* of *W* if and only if *w* is a member of *p*. Otherwise *p* is false in *w*.
>
> DEFINITION 2. If *A* is a set of propositions and *p* is a proposition, then *p* follows (logically) from *A* if and only if there is no possible world where all members of *A* are true but *p* is false.
>
> DEFINITION 3. A set of propositions is consistent if and only if there is a possible world where all its members are true. Otherwise it is inconsistent.
>
> DEFINITION 4. A proposition *p* is compatible with a set of propositions *A* if and only if *A*U{*p*} is consistent.

DEFINITION 5. The meaning of 'must in view of' is that function ζ, which fulfils the following conditions:
(I) If *p* is a proposition and *f* a function which assigns a set of propositions to every $w \in W$, then $(f.p)$ is in the domain of ζ.
(ii) For any *f* and *p* such that (f,p) is in the domain of ζ, $\zeta(f,p)$ is that propostition which is true in exactlly those $w \in W$ for which the following holds: *p* follows (logically) from $f(w)$.

DEFINITION 6. The meaning of 'can in view of' is that function χ which fulfils the following conditions:
(I) As in Definition 5 with χ for ζ.
(ii) For any *f* and *p* such that (f,p) is in the domain of $\chi, \chi(f,p)$ is that proposition which is true in exactly those $w \in W$ for which the followoing holds: *p* is (logically) compatible with $f(w)$.

(Kratzer 1977:344-7)

Kratzer presents a problem for this theory. In real life, the set of propositions *A* is often inconsistent. Maoris may have rules that contradict one another. Legal decisions in one state of the union may contradict legal decisions in another state. It is a familiar fact of logic that any proposition follows from a contradiction

1 p&~p premise
(Suppose the contradiction p&~p is true)

2 p from 1 def.
(then p alone must also be true since by definition a conjunction is only true if both conjuncts are true)

3 pvq from 2, disjunctive addition
(if p alone is true then pvq -- where q is any *proposition at all you can think of -- is also true because a disjunction is true just in case one of its disjuncts is, and p is one of the disjuncts)*

4 ~p from 1 def.
(but we also know that ~p is true, since we have given p&~p)

5 q deduced from 3 and 4
(if pvq is true, and we can assert ~p, then pvq will only be true if q is the true member of the disjunction.)

E.g.:
1 If it's raining AND it's not raining, it must be that
2 it's raining.
3 It's raining so: it's either raining OR your mother is a monkey (or both).
4 Well, since according to 1 it's not raining
5 it must be that your mother is a monkey.

In any world where there are contradictory laws, dispositions, preferences or information, all propositions will follow logically and will be compatible; *must* and *can* will apply to everything.

To allow *must* and *can* to exclude some propositions and not others, Kratzer proposes that the definitions 5 and 6 be altered. Instead of consequence and compatibility being related in these definitions to a set *A* of propositions ('what we know') as a whole, these logical properties need to be related to the set in some way that is more restrictive. One candidate is to relate a proposition *p* to every consistent subset of this inconsistent set *A*. This case is too restrictive since some of the subsets will be the singletons of each of the propostions in *A*: no proposition will be consistent with all the subsets unless *A* consists of only one proposition.

Kratzer proposes that the relation should be between the proposition and the consistent subsets of *A* if each of those subsets has a consistent extension from which *p* follows. The propositions that will be excluded in this case will be those which are inconsistent with specific propositions contained in *A*. So, imagine the set *A* consisting simply of {p,q,~q}

p= murder is wrong
q= welfare is wrong [e.g., for individuals, as is often claimed]
~q= welfare is not wrong [e.g., for corporations, as is often claimed]

Our contradiction is q&~*q*. From this we want to avoid having to conclude

~p= murder is not wrong.

Listing all the consistent subsets of A we have

{{p}, {q}, {~q}, {p,q}, {p,~q}}

that is, all the subsets of *A* except those in which *q* and ~*q* appear together between the brackets. The proposition ~*p* cannot follow from all the members of this set, but neither can *p* -- *p* does not follow from {~q} or from {q}. But there is a consistent extension from every one of these consistent subsets of *A* from which *p* does follow and it is not the case that there is a consistent extension from every one of the consistent subsets of A from which ~p follows. So, for example, p follows from a consistent extension of {q}, namely the extension {p,q}. But there is no consistent extension of {p} from which ~p follows, since any set containing p and ~p is inconsistent.

So a world in which welfare is wrong can be extended to be a world in which murder is wrong too. And a world in which welfare is not wrong, can also be extended to be a world in which murder is still wrong. The world in which welfare is both wrong and not wrong is excluded because it is inconsistent. This is her solution to the problem of the inconsistency of the context of knowledge, practice, disposition or preference that modals base their force in relationship with. It is tacitly based on the idea that some circumstances go together naturally while others don't. It's this idea that she develops further in later papers.

Kratzer (1991) observes that the above theory translates directly into standard modal notions of accessibility relations if we take "what we know" to be a 'base', a set of worlds providing the background context. The notions of necessary consequence ("following from"), and compatibility and consistency can be treated as accessibility from all worlds in the base, or from some worlds in the base, respectively.

The modal base can be used to distinguish between

> Hydrangeas can grow here
> There might be hydrangeas growing here [Hydrangeas might be growing here]

The first has a purely circumstantial modal base consisting of facts about soil and hydrangeas. The second has an epistemic modal base consisting of all relevant evidence.

She presents further problems for the theory of modals. Logically, a conditional is true if its antecedent is false. So any conditional will be true that stipulates something denied in the base. Suppose *There shall be no murders* is a basic prohibition in our real world. *If a murder occurs, the murderer will be punished* will be true but so will *If a murder occurs, the murderer will be knighted.*

Graded notions of modality also cannot be accommodated by logical consistency or compatibility. Propositions are not more or less compatible, they either are or are not compatible. Yet we have such expressions as *barely possible, easily possible, more likely, less likely, more desirable, less desirable.*

Kratzer suggests that there are two backgrounds to every modal statement, the base -- "what we know", or "what our practice is", or "what is good", or "what we are disposed towards" -- and an ordering on possible worlds which corresponds to our assumptions about the normal course of events, how we expect things to be, running from the likely to the unlikely.

> Some worlds among the epistemically accessible worlds are more far-fetched than others....Far-fetched in which respect? With respect to what is actually the case in the real world? This doesn't seem right since, sometimes, things which are almost impossible turn out to be true. This is what usually

> happens in good detective stories. The most unlikely candidate turns out to be the murderer. If it is pretty far-fetched that someone from another continent or another planet has killed Girgl, then it is because such events don't correspond to the *normal course of events.*
>
> (Kratzer 1991:12, her emphasis)

She formulates this ordering source following Lewis (1981):

> For all w,w∈W, for any $A \subseteq \mathcal{P}(W)$:
> $w \leq_A w'$ iff $\{p: p \in A \text{ and } w' \in p\} \subseteq \{p: p \in A \text{ and } w \in p\}$
>
> A world w is at least as close to the ideal represented by A as a world w' iff all propositions of A which are true in w' are true in w as well.
>
> (Kratzer 1991:13)

A necessary proposition can then be defined as belonging to all worlds than which none is closer to the ideal given in the ordering source. Gradients of likelihood can then be easily defined relative to each other.

Recalling the earlier example of an inconsistent world, and using the ordering source in place of the simple power set of Kratzer (1977), a more natural looking solution obtains. Our true propositions are:

> p= murder is wrong
> q= welfare is wrong
> ~q= welfare is not wrong

And we can imagine three types of possible worlds

> Type 1 worlds in which murder is not wrong
> Type 2 worlds in which murder and welfare are wrong
> Type 3 worlds in which murder is wrong but not welfare
>
> (adapted from Kratzer 1991)

Types 2 and 3 are closer to the ideal of the ordering source than type 1. Murder is wrong in both these types of worlds. In the sense of Kratzer (1977), *that murder is* *wrong* follows from all these closest worlds. On the other hand, welfare may or may not be wrong since *that welfare is wrong* follows from only some of these closest worlds while *that welfare is not wrong* follows from others. These propositions regarding welfare are then possibly wrong, possibly right. This is just the result we want.

The problem of conditionals with false antecedents can also be resolved. Consider the world in which

> the whole content of what the law provides in w can be given by the following two sentences
>
> No murder occurs
> If a murder occurs, the jurors convene
>
> ... the proposition expressed by *If a murder occurs, the jurors convene* is predicted to be true in w just in case the jurors convene in all those worlds in which a murder occurs and which come closest to what the law provides in w. We are only allowed to consider worlds in which a murder occurs. Hence we have to drop the part of the law requiring that no murder occur.
>
> (Kratzer 1991:26)

The theory provides a rational means of distinguishing which worlds or propositions are relevant to the assessment of conditions and likelihoods on which we base our modal judgments.

In "An investigation into the lumps of thought" Kratzer takes her theory of modality one step further by fine-tuning possible worlds into situations which "lump" other situations together. Worlds are too crude for fine -- but common -- distinctions. If I paint a still life of apples and bananas, Kratzer points out, it is true of the real world that I have painted apples, that I have painted bananas, and also that I have painted a still life of apples and bananas. Asks Kratzer, must I then concede that I have engaged in three actions, painting a still life and painting apples and painting bananas?

> Painting apples and painting bananas was part of her painting a still life, like my arms and legs are part of me. Whrerever I go, my arms and legs will come along. Is it true, then, that I can never be alone? I think not. Somehow, when I talk about myself, my parts have no independent existence, their presence doesn't count. Likewise, on that memorable evening, a very special relationship between three propositions was established: It was true that Paula painted a still life. And it was also true that she painted apples and that she painted bananas. But once we consider the first proposition a fact of this world(at the time in question), we are not entitled any longer to consider the latter two propositions as *separate* facts
>
> ...Let us say that the proposition that Paula painted a still life *lumps* the proposition that she painted apples in the actual world.
>
> (Kratzer 89:608-9)

What is the relation of lumping? It cannot be logical implication

> Paula's painting a still life doesn't logically imply her painting apples and bananas. Material implication isn't a better candidate. In the actual world at the time considered, Paula's painting a still life materially implies [whatever else she did while she was painting the still life, including] her making herself a cup of tea, for example....But the propostition that Paula is making herself a cup of tea is not part of the 'lump of facts' whose properties we are trying to capture.
>
> (Kratzer 1989:610-11)

Lumps depend on aspects, or parts of worlds, or, in more familiar terms, *situations*

> The parts of a world are its situations. Since worlds are parts of themselves, they are also situations. They are maximal situations, situations that are not part of other situations. Given all of this, consider the following definition of the *lumping relationship*
>
> *Lumping*
>
> A proposition *p* lumps a proposition *q* in a world *w* if and only if (i) and (ii) both hold:
> (I) *p* is true in *w*
> (ii) Whenever a situation *s* is part of *w* and *p* is true in *s*, then q is true in s as well
>
> (Kratzer 1989:611)

This will seem unsatisfactory to those who view aspects of possible worlds as space-time slices or chunks. Kratzer uses the example of being tired and hungry at the same time. In every time-space slice, she will be tired and hungry together, yet these are not the same facts about her. Situations cannot therefore be space-time slices or chunks.

> What we seem to need is a way of distinguishing between an individual per se and those aspects of the world that make it true that the individual has properties like the ones just mentioned.
>
> (Kratzer 1989:613)

Lumping requires that situations divorce the individuals in them from the properties they bear with them. To find a way of treating individuals divested of their many properties, Kratzer appeals to Armstrong's notion of 'thick and thin particulars', particulars with and without their properties. Having a property, in this construct, will be a possible state of affairs in a situation.

> There may or may not be a universal corresponding to the property of being hungry. Suppose there is. Then there willl be a state of affairs (and hence a situation) consisting of the relevant thin slice of me and that universal. Suppose further that there is a universal corresponding to the property of being tired. Again there will be a state of affairs and a situation consisting of the relevant thin slice of me and that universal. The two situations both contain the same thin particular. But they contain different universals. Hence they are different.
>
> (Kratzer 1989:614)

Situations present a logical problem since they do not always appear to be *persistent.* That is, a fact which is true in one situation may not be true of the world of which that situation is a part. Imagine the proposition that all dissertations are interesting, patently false in the real world. Yet there might be some situation in which all the dissertations in that situation are interesting, say, syntax dissertations in a room full of syntacticians. The proposition that all the dissertations are interesting lacks persistence. It's true in the room, but a soon as you leave that room, it's false, as nearly anyone will attest.

Against Landman, Veltman, and Barwise and Perry, who accept that situational propositions will not be persistent, Kratzer follows Cushing (1976) and McCawley

(1981) in including the context as a restriction on quantification thereby allowing her situations to be persistent. So the context of the room is included in the interpretation of the utterance of "All the dissertations are interesting," just as McCawley advocates for restricting the quantification of "everyone left" to every individual in the discourse context, and not to every individual in the world. We have already reviewed the role of context -- modal base and ordering source -- she provides in her modal semantics. On the other hand, she defines notions of validity, consistency, compatibility, logical consequence and logical equivalence in terms of possible worlds, rather than situations, in order to remain within classical semantics.

Lumping provides some startling results for counterfactual reasoning. In a counterfactual like *If XiaoMei hadn't rejected Mohammad's flimsy paper, he wouldn't be victimizing her now*, the antecedent, *If XiaoMei hadn't rejected Mohammad's flimsy paper,* is always false, but we don't want to conclude that all counterfactuals are therefore true simply because material implication always holds for a false antecedent. Stalnaker (1968) suggests that we evaluate counterfactuals by adding the antecedent to our stock of beliefs and then see if the consequent follows. But that strategy leads to some difficult problems. Unless the consequent follows logically, it will very likely depend on a variety of circumstances in the world in addition to the antecedent. So who's to say that the world in which XiaoMei didn't reject Mohammad's paper, isn't also a world in which she infuriated him in some other way? And it is certainly true that a world in which XiaoMei read but didn't reject his flimsy paper, is a world in which she couldn't have the intellectual integrity for which she is famous. The addition of this antecedent seems to be inconsistent with other assumptions of the real world. If the world in which the antecedent is true departs too much from the real world, we are likely to lose those circumstances from which *he wouldn't be victimizing her now* would follow.

Which facts must be taken into account in evaluating the truth of a counterfactual is a puzzle that has long exercised philosophers. Stalnaker (1968) and Lewis (1973) have tried to approximate the additional premises that bear on counterfactual evaluation. Lewis employs a notion of closeness to the real world. *If I were looking into a mirror, I would see a face with brown eyes* is true just in case the world in which the speaker sees brown eyes is closer to the real world than one in which he doesn't see brown eyes.

Kratzer poses a problem. A zebra escapes from the zoo as a result of a negligent keeper. If we accept Lewis' closeness explanation, *If another animal had escaped, it would have been a zebra too* must be true, since the world in which another zebra escapes is closest to the real world. But is there any reason to think that only zebras want their freedom? Lewis has failed to indicate exactly what qualifies for closeness among worlds. Similarly, *If another animal had escaped, it might have been a gazelle* would be false, according to Lewis.

Why shouldn't the zebra's zebra properties matter in the assessment of closeness? Kratzer has an alternate means of handling counterfactuals that explains, along with lumping, why these properties don't matter.

> *'Would' counterfactuals*
> A 'would'-counterfactual is true in a world *w* if and only if every way of adding propositions which are true in *w* to the antecedent while preserving consistencey reaches a point where the resulting set of propositions logically implies the consequent.
>
> *'Might'-counterfactuals*
> A 'might'-counterfactual is true in a world *w* if and only if not every way of adding propositions which are true in *w* to the antecedent while preserving consistency reaches a point where adding the consequent would result in an inconsistent set.
>
> (Kratzer 1989:626)

Because every situation in which an animal with the zebra's properties escapes is a situation in which the real zebra escaped, it would be impossible to add the set of propositions refering to the zebra's properties to a counterfactual in which the antecedent is *If the animal that escaped were not that zebra...*

It is not clear to me how this analysis would handle the counterfactual *If two animals had escaped from the zoo, the second would have been a zebra, too.* This sentence should not be true, but lumping doesn't seem to prevent it from being so, since the sentence allows that the zebra which escaped in the real world also escapes in the counterfactual antecedent. Hence, the lumped propositions do not create an inconsistent set with the antecedent. Perhaps in this case, all these propositions will be lumped by *only one animal escaped* which is inconsistent with the antecedent. However, excluding every lumped proposition might exclude too much.

Kratzer has a more convincing solution to a problem adapted from Goodman (1947). Suppose Paula and Otto are painters and they are the only two people in the room. Then *Everyone in the room is a painter* is true. But what about *If Clara were also in the room she would be a painter*? The first sentence may be true, but surely Clara doesn't become a painter as soon as she enters the room.

The situation in which everyone in the room is a painter lumps the situation in which exactly two persons are in the room. The proposition *exactly two persons are in the room* cannot be consistently added to the antecedent of *if Clara were also in the room.* Therefore, *all the persons in the room are painters,* because it lumps propositions inconsistent with the counterfactual, cannot pressure the evaluation of the truth of that counterfactual.

Lumps solve another conundrum for the possible worlds view of counterfactuals, this one having to do with disjunctive addition. If *Mohammad is defending* is true, then the disjunction *Mohammad is defending or 2+2=5* is also true. What about *If Mohammad isn't defending, then 2+2 would equal 5* ? Since the antecedent fails, the counterfactual will hold true. Lumping offers a different result. *Mohammad is defending or 2+2=5* lumps *Mohammad is defending.* Using Kratzer's evaluations for 'would'-counterfactuals, *Mohammad is defending or 2+2=5* cannot be added to the antecedent without inconsistency.

Kratzer's theory is challenged in Rohrbaugh 1997. Rohrbaugh is concerned with solving conundra which stymie possible worlds analyses of deontic utterances. The puzzles are found in the work of Lewis (1979) and Kamp (1973, 1987) and Merin (1991).

Lewis presents the "spurious permission" problem. Suppose that when one utters a statement of permission -- allowing someone in the appropriate authority relation to act according to your words -- suppose that such statements are interpreted as directives allowing access to certain possible worlds in which the actions permitted occur. So *XiaoMei, you may defend your thesis* means that those worlds in which XiaoMei defends her thesis are added to those worlds to which XiaoMei has access. But worlds are large, and many things happen in them. Who's to say that in one of the worlds in which XiaoMei defends her thesis is not also a world in which she insults the department chair? According to the coarse grain of a possible worlds analysis, when you gave her permission to defend her thesis, you have given her permission to insult the department chair as well. And while this may have been your intent, yet it is conceivable that it may not have been. What's needed is some way of choosing among worlds that allow just the right actions.

Lewis entertains a variety of attempted solutions all of which fail: restricting the worlds to the one which best satisfies the permission is too restrictive. We want XiaoMei to be allowed to choose how to defend her thesis, how to respond to questions, when to take a drink of water, when to nod, smile, breathe, sigh. To prescribe one possible world would be to dictate all these things. Nor will choosing the world closest to the current world solve the puzzle. XiaoMei currently is uncertain of the outcome of her experiment. Should she continue to be uncertain at her defense? Yet certainty would be further from the current world. Suppose your boss gives you permission to take the afternoon off. You would not then take that only as permission to spend you free time working, yet the world in which you do so is closest to the current world. Closeness is no better than exactness as a solution.

Following a suggestion from Stalnaker, Lewis entertains a "reprehensibility" ordering of possible worlds. But this too fails.

> Kamp (1978:258ff) discussed the problematic (for Stalnaker) case in which *eating an apple* and *eating a pear* are both disallowed, but eating a pear is worse, since apples grow in the garden and pears must be bought. In such a case Stalnaker's proposal predicts that the permission in (12.a)
>
> 12a. You may eat an apple or a pear
> 12b. You may eat an apple
>
> will only add *apple eating* worlds, (since they are the least reprehensible worlds in which *you eat an apple or a pear*), rendering it equivalent to (12.b). But clearly the permission in (a) is different from that in (b); the (a) permission should add some *pear eating* instances to the option set of the addressee.
> (Rohrbaugh 1998:17-18)

Rohrbaugh applies this problem to Kratzer's situations and finds that situations are plagued with the exact same problem.

> In which situations *s* is it true that Paula painted an apple? Obviously it is ture in the minimal situation where Paula truly did nothing more than paint the apple. But it is also true in the larger situation in which Paula painted the still life. So both of these situations must be included in the set added to OPT [the set of permissible worlds] by the permission *Paula may paint an apple.* In fact every larger situation that has as a part that Paula painted an apple must be added by the permission *Paula may paint an apple.* But these larger situations will be situations in which Paula paints an apple and steals the landlord's money or Paula paints an apple and drinks her roommates's wine. Thus the situation based approach does not solve the spurious permission problem.

The problem for situations is even wider.

> A permission like *You may eat three cookies* should add to OPT all those situations in which the addressee eats three cookies, along with situations in which he eats one or two cookies. The situation semantics framework instead wrongly adds situations in which he eats three or four or five, etc., since all of these situations support the truth of the proposition *you eat three cookies.*
> (Rohrbaugh 1998:90)

Rohrbaugh's critique is specifically concerned with dynamic facts of deontic modality. More relevant here, and setting aside Rohrbaugh's complaints, Kratzer's ingenious distinctions among and within possible worlds also fail to explain the following contrast at the heart of our investigation:

> Hydrangeas couldn't grow around here
> = In view of what I know, Hydrangeas not could (must not) be able to grow around here

> Hydrangeas might not grow around here
> = In view of what I know, it might be that Hydrangeas cannot grow around here.

It is this phenomenon -- specifically the reversal of negative scope -- that we would like to explain.

Chapter 3 *and*

3.0 Introduction

In this world,who can do a thing will not;
And who would do it, cannot....

This chapter, introducing the crucial data of conjoined sentences which distinguish the relevant meanings of modal auxiliaries, is specifically concerned with interpreting the conjunction *and* to determine the conditions of its use. After considering the significance of these sentences for the meaning of *might,* an account is given of previous treatments of *and* including Grice's elegant theory which allows various uses to be accommodated to a simple, single meaning equivalent to the logical function *&*, simple logical addition. Instances from the literature as well as some original evidence is produced to show that the Gricean theory is inadequate; *and* is not a logical function but a relation; it excludes entailed information and causal inferences. These facts point towards an adequate theory of the conventional implicature that defines the special conditions of the use of *and.* The conclusion brings together Kratzer's lumps of thought and the directional implication of *and,* suggesting a means of interpreting realization conjunctions.

3.1 The significance of realization conjunctions

What is immediately striking about *might* is its resistance to what I will be calling *realization conjunctions.*

1. She can go and she will.
2. She can go but she won't.

In each of the above sentences, the first clause introduces not an action, but the possibility of an action. In their second conjuncts, the assertion is stronger than merely the possibility of the same action; the action is unequivocally asserted or denied as a fact (to be) realized in the future.

3. She might go and she will*
4. She might go and she won't*
5. She might go but she will*
6. She might go but she won't*

(3-6) are not acceptable in the way that (1) and (2) seem to be.

The possibility expressed by the first conjuncts of (1) and (2) is not inconsistent with the factual assertions about the future added in their second conjuncts. The possible and the actual do not conflict so the possibility of p is no argument against the actuality of ~p. Associating *can* with simple possibility suffices to explain the acceptability of the realization conjunctions of (1) and (2), since the actual must, and the non-actual may, be possible, and a possible event may or may not occur.

If *might* expresses possibility, as *can* seems to by the above evidence, the unacceptability of (3-6) remains unexplained. The factual assertions added by the second conjuncts in (3-6) conflict with the uncertainty expressed by the first conjunct. The association of *might* with possibility does not suffice, then, to explain the conflict between these conjuncts.There must be another kind of modality involved than the mere expression of possibility.

If *might* expresses *uncertainty*, the speaker's lack of knowledge, then the unacceptability of (3) could be explained if the assumption is added that asserting a proposition (as opposed to questioning it, demanding it be so, stipulating it in a conditional, or citing it as someone else's assertion) is equivalent to claiming to know its truth. Grice (1967) has provided pragmatic grounds for accepting this premise (see a full discussion below): Were it not accepted, the exchange of information in conversation would be undermined -- the addressee would never be clear as to what assertions were intended to be taken seriously -- and it would be difficult, if not impossible, for participants to understand one another. The assumption is doubly relevant to the use of modals, since without it there would be no reasonable motive for speakers to use any modals which indicate possibility or uncertainty to their addressees.

With the added premise, the explanation would proceed straightforwardly as follows: Let *she will go*$=\phi$,*might*$=\sim K$ (uncertainty; not knowing). The first conjunct of (3) asserts $\sim K\phi$ (the speaker asserts that she does not know whether she will go), the second conjuct asserts ϕ (she will go) with the repeated verb *go* deleted. Asserting $\phi = K\phi$ (by our added assumption that we only assert what we claim to know). Conjoined together $\sim K\phi$ and $K\phi$ yield the contradictory $\sim K\phi$ & $K\phi$.

Example 4 requires the additional assumption that one cannot be a consistent speaker and claim both to not know that ϕ and know that $\sim\phi$ all at the same time: $\sim K\phi \leftrightarrow \sim K\sim\phi$ is an equivalence that holds for speakers' beliefs at any given moment of awareness. Example (4) then states (1) below and entails the contradictory (6),

1 $\sim K\phi \& \sim\phi$

2 $\sim K\phi$ (conjunction reduction from 1)

3 $\sim K\sim\phi$ (by 2 and the speakers' equivalence just mentioned)

4 $\sim\phi$ (conjunction reduction from 1)

5 $K\sim\phi$ (4 plus the assumption that we only assert what we claim to know)

6 $\sim K\sim\phi \& K\sim\phi$.

The assumptions about the logic of belief for these conjunctions turn out to be the same assumptions mentioned in chapter 1 that explain the lack of not-contraction for *might.* The same facts about the meaning of *might* explain both phenomena.

Setting aside the justification for both the assumptions and the formalism, as well as the import of these facts for the theory of scalar implicatures, all which will be discussed below (see chapter 5), the explanatory power of this hypothesis depends on correlating two facts: first, *might* (and *may* when it means *might*) is the only modal (more particularly, the only modal of possibility) that does not prefer wide scope of negation and second, *might* is the only modal that resists realization conjunction. Is it in fact true that all other modals of possibility accept realization conjunction?

(7-10) pose a problem for this hypothesis if they seem less acceptable than the *can* versions ((11-14) are included to show that negation does not affect acceptability):

7. She could go, and she will.
   She can go, and she will.
8. We could watch TV all night, and we will.
   We can watch TV all night, and we will.
9. They could ask for more time, and they will.
   They can ask for more time, and they will
10. I could send it to you by e-mail, and I will.
    I can send it to you by e-mail, and I will.
11. She could go, and she won't
12. We could watch TV tonight, and we won't.
13. They could ask for more time, and they won't.
14. I could send it by e-mail and I won't.

If *could* is used as just a slightly less assertive version of *can,* these sentences seem just as acceptable as they would were *could* replaced by *can* in each of them. That *could* and *can* freely alternate this way is shown by

15. We could watch TV all night if we wanted to.
16. We could watch TV all night if we want.
17. We can watch TV all night if we want.
18. We can watch TV all night if we wanted to.?

There is fine difference of mood between (16) and (17). Suppose Jane is reporting to her sister that her parents have given them permission to watch TV all night. (17) but not (16) would be appropriate. Here the focus is on the ability opened up by parental permission, not the possible future contingent on wishing ('if we want'). The permission having been given, the possibility is not contingent, and the conditional *could* is not used. The circumstances in which (16) is appropriate seem to be a subset of those in which (17) can be used.

Despite what might be pedantically considered a mismatch of standard English moods or tenses in (16) ('subjunctive' or past *could* followed by present indicative *want*), (16) and (17) seem to be free variants of the same expression for my informants in those cases where they can both be used. They may differ in politeness -- *can* is stronger than *could.* Some speakers, perhaps for this reason, or perhaps for more dialectal reasons (some Brooklyn speakers seem to rely in many constructions on *could* where other native speakers would choose *can*), or a combination of both reasons -- Brooklyn speakers might prefer to avoid the confrontational implications of more direct and stronger forms -- will use (16) for (17).

The two clauses of (18), however, seem to be less acceptably mismatched. *Can*, expressing a possibility of the here and now, makes the contingency of the second clause irrelevant.

The order in which actuality is introduced may also be at work in (15-18), since *can* and *could* not only contribute different distances from actuality, but interact with the tense of the *if* clauses as well, and because possibility must precede actuality, it might be that speakers prefer conditionals in which the prior conditions precede their consequences temporally. It would be a mistake, however, to interpret the *if* clauses as causal conditions for the content of the first clauses. (17) does not mean that the possibility of our watching TV causally depends on our wanting to. (17) means that we have the ability to watch all night and are therefore free to do so, and our *actual watching* depends causally on our wanting to. These, and similar differences between English conditionals and logical implication are the subject of ongoing debate and will be discussed in the next chapter.

To the extent that *can* and *could* differ in meaning, each of (7-14) might seem slightly strange, as if the perspective of the speaker had shifted. The strangeness may be clearer in (19-20)

19. We could/can watch TV all night if we want to and we do.
20. We could watch TV all night if we wanted to and we do.?

It is not my contention that (7-14) are in fact unacceptable. But even the slightest doubt of the acceptability of these requires some explanation since such doubt would indicate that *could* also resists realization conjunction with *and.* If there were one reason for the resistance of both *could* and *might* the data of (1-6) would fail to support the hypothesis that distinguishes *might* from *could* in not-contractions.

But notice that *could* and *might* behave quite distinctly in realization conjunctions with *but*

21. She could go but she won't
22. We could watch TV all night if we wanted to, but we don't.
4. She might go but she won't*

If *could* resists realization conjunctions, it resists *and* realizations only. It is reasonable to suppose that the resistance of *could* and the resistance of *might* cannot be subsumed under one cause. However, unless the resistance of *could* can be explained, realization conjunctions offer only weak support for an explanation of the lack of not-contraction with *might*.

The goal of this chapter is to tease out the acceptability conditions of these realization conjunctions in an effort to discover the relevant meaning of the modals in their antecedent clauses and then show that if *could* resists *and* realizations it does so for reasons unrelated to not-contraction. This will feed the strongest argument for the *uncertainty* analysis of *might* against a possibility analysis of *might*.

3.2 *and* and *but*

If there were known contexts into which to plug the modals to evaluate them for comparison, the current project would be quite simple. However, the lack of uniformity in the meaning of *and* and *but* from context to context complicates matters. To take the more straightforward case of *and* first

1. If the old king has died of a heart attack, and a republic has been declared, then Tom will be quite content (Cohen 1971).
2. If a republic has been declared, and the old king has died of a heart attack, then Tom will be quite content. (Cohen 1971).[3]
3. You cannot have your cake and eat it too.
4. You cannot eat your cake and have it too.

There is agreement that (1) and (2) have distinct truth conditions (Cohen 1971, Gazdar 1979). In (1), the order of conjuncts suggests a smooth and peaceful political transition, the old king's natural demise causing a republic to be declared. Tom's satisfaction then depends on the truth of this causal relation between the conjuncts joined by *and.* In (2), the order suggests a less benign scenario. A republic has been declared while the king still lives, resulting in the king's premature death. Tom's contentment, now schadenfreude, depends on this causal sequence. It seems that

[3] Posner's 1980 example is more perspicuous: If Annie has married and had a baby, grandfather will be happy. I use Cohen's example above because it has entered the literature.

and must mean “and then” or “and therefore” in this context.[4]

If *and* meant “and then” we would have no explanation for why (3) seems to be a truism, since it is quite natural to have a cake and then eat it too. The adage would have to be expressed as (4). But, of course, no one ever says (4), and (3) is quite common. It seems that in this context *and* means exactly *&* (logical conjunction) and nothing more.

In the case of *but* there is wide agreement (Grice 1967, Gazdar 1979, R.Lakoff 1971, Dascal&Katriel 1977, van Dijk 1977, Levinson 1983, Blakemore 1989, Rieber 1997 among others) that it can only be used where the second conjunct poses a contrast with the first or with some contextual implication (presupposition, implicature or expectation) of the first.

5. Sal’s a cop, but he’s gentle.

But is acceptable because being gentle contrasts with our assumptions about being a cop. There is no such contrast in (6)

6. Rob would be going out tonight, but he has to work on his dissertation.

The modal of the first clause already indicates that Rob will not be going out tonight. The second conjunct does not so much contrast with the first as explain it. Notice that such explanation cannot be accomplished either by simple juxtaposition of the second conjunct as a separate sentence (without any conjunction) or using *and.*

---

[4] The example serves an expository purpose here. Gazdar 1979 rejects Cohen’s claim on the grounds that the evaluation of the truth of a conditional depends on assuming the truth, not of the antecedent, but of the context as altered by the antecedent. The antecedent becomes truth determining because of this peculiar semantics of the conditional. By adding the simple disclaimer “but the latter did not cause the former” the implicature assumed true for the evaluation of the conditional can be cancelled.

7. Rob would be going out tonight. He has to finish his dissertation.
≠ Rob would be going out tonight but he has to finish his dissertation.
8. Rob would be going out tonight, and he has to finish his dissertation.
≠ Rob would be going out tonight, but he has to finish his dissertation.

Juxtaposition can be used to introduce supporting evidence as in (9) and (10)

9. Rob would be going out tonight. He has to finish his dissertation. (He usually writes in the library because he can't accomplish anything at home. But he has the flu, so he won't be going anywhere for a while.)
10. Rob is getting a Ph.D. and has to write a dissertation.
= Rob is getting a Ph.D. and so has to write a dissertation

but not, in this context, an explanation. *And* can be used to introduce a consequence, but not a cause. It is *but,* and *but* alone, that flags the explanatory relation of the second conjunct. Yet in a non-modal context, cause is not flagged by *but* except when the context includes an assumption contrary to the assertion introduced by it:

11. Max didn't go to school today. He got sick. (Bar-Lev&Palacas 1979)
= Max didn't go to school today because he got sick.
12. Max didn't go to school today, but he got sick.
≠Max didn't go to school today because he got sick.
13. John has been truant before. John didn't go to school today, but he's sick.

The apparent explanatory force of *but* in (13) may be attributed to the presence of an explanation already in the context (John has been truant before). *But he's sick* contrasts with the easiest explanation available in the context for John's absence. It is the context that brings into play explanatory force, not *but,* which simply introduces the contrast with that explanation.

Both *and* and *but*, then, seem to vary in the meaning they contribute to utterances. The following sections will address first the variance according to context and then the question of whether these are semantic differences of meaning or pragmatic differences of use.

The literature shows that linguists have reason to dissociate *and* from logical *&* (logical conjunction). There are pragmatic theories of the use of *and* according to which lexical simplicity is served by identifying *and* with *&*, bringing in discourse elements to explain any variation in the interpretation of *and* (Grice 1967, Gazdar 1979, Levinson 1983). This theory has been contested by Bar-Lev & Palacas who provide compelling evidence that *and* and *&* cannot be identified with one another. But even where the non-identity has been accepted, *&* is still used interchangeably with *and* as the metalanguage interpretation of the object language *and* as well as of other conjunctions in the object language (e.g., R. Lakoff 1971, Blakemore 1989, Rieber 1997). Yet if *and* is not identical to *&*, there is no reason to expect it to be the basis for the definition of other conjunctions or to assume that *and* is the simpler conjunction, no reason to use *and* in the metalanguage as if *and* were, for linguistic purposes still equivalent to *&*.

But, for example, is usually defined as *and* plus something else, or as a special case of *&:* <&+contrast>, the element of contrast being taken to be a conventional part of *but*'s meaning. As recently as 1997, Rieber defines "but" as <"and"+ a performative ("I suggest that this contrasts")>. The use of *and* in the definition seems to be taken for granted, beyond criticism and below the level of question.

One justification for this bias is truth conditional. Sentences conjoined with *and* or *but* are usually considered to have the same truth conditions as they would have were the *and* or *but* replaced with *&*. However, the truth conditions of the conjuncts taken independently are also the same as the truth conditions of the two sentences conjoined with *&*

Roses are red and/but violets are blue

has the same truth conditions as

Roses are red. Violets are blue.

Using *&* in the determination of the truth conditions of sentences conjoined with either *and* or *but* does not require *&* at all.

3.3 The Gricean theory of *and=&*

The bias against *but* has its root in the bias towards *and* that *and* is equivalent to a logical truth function *&*, a view first made palatable to linguists by H. P. Grice. In *Logic and conversation* (1975, 1989) Grice offers a theory distinguishing what is *said*, the conventional and truth conditional meaning of the sentences uttered, from what is merely *implicated*, either through non truth conditional, conventional meanings of words or by their use within discourse independently of their conventional meaning. He hypothesizes a mechanism by which speakers can exploit the mutually accepted conditions of discourse to generate meanings beyond those conventionally associated with the words they use. Such a mechanism simplifies the lexicon, which no longer must account for the variety of meanings which words assume in different contexts. That burden is taken up by the context of discourse.

> Our talk exchanges do not normally consist of a succession of disconnected remarks, and would not be rational if they did. They are characteristically, to some degree at least, cooperative efforts; and each participant recognizes in them, to some extent, a common purpose or set of purposes, or at least a mutually accepted direction. . . We might then formulate a rough general principle which participants will be expected (ceteris paribus) to observe, namely: Make your conversational contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged. One might label this the Cooperative Principle.
>
> (Grice 1989:26)

Grice formulates this principle as a set of maxims, following Kant's moral theory, falling into categories of quantity, quality, manner and relation, following Kant's epistemology. Under quantity fall the maxims

> 1. Make your contribution as informative as is required (for the current purposes of the exchange).
> 2. Do not make your contribution more informative than is required.

under quality fall

> Try to make your contribution one that is true:
> 1. Do not say what you believe to be false.
> 2. Do not say that for which you lack adequate evidence.

under relation the single maxim

> Be relevant

falls and under manner

> Be perspicuous:
> 1. Avoid obscurity of expression.
> 2. Avoid ambiguity
> 3. Be brief (avoid unnecessary prolixity).
> 4. Be orderly.

These rules form the rational background speakers assume in the goal oriented action of conversing for the exchange of information. Mutually assuming these rules of conversation affords participants an enriched context in which they may use these rules as well as the conventional meanings of their words to carry forward their conversational goals, including the generation and transmission of information. Given an utterance in conversation, the speaker can assume the hearing addressee understands that, where nothing to the contrary has been indicated, the rules are being followed, and that the addressee is to fill in what has not been explicitly *said* with what it would make sense for the speaker to intend under the circumstances.

By such means, the mutual acceptance in conversation of the last maxim of manner, “Be orderly!”, may explain why *and* sometimes means *and then.* Where the speaker has not indicated otherwise, it may be assumed that the temporal order of conjuncts in discourse is the temporal order of the events they describe. Any other interpretation would require the assumption that the speaker is not being orderly and therefore not trying to move the conversation towards its goals in a rational manner. The intended description of the order of events is *calculable* based on what conversational participants can reasonably expect of one another's contributions to the discourse. Since such calculations are not explicitly stated (*said*) and are not entailed by what has been *said*, they are characteristically *defeasible* -- they may be cancelled easily by expressions like *but I do not mean to imply that ...* or, particularly in the case of the temporal sequencing of sentences conjoined with *and,* an expression like *but not in that order*.

Characteristically, the meanings generated by conversational rules are not truth conditional and are not entailments. They share this with certain properties of words which have meanings beyond what they contribute to truth conditions. Maintaining neutrality as to the exact logical status of each of such meaning contributions, and needing to distinguish them from both entailments and implications, both of which are truth-condition determining, Grice uses *implicature* to denote such meanings.

Conversational implicatures are not the only kinds of non truth conditional meanings, according to Grice. *But* does not add anything to the truth conditions of the sentences it conjoins, yet it contributes to the meaning conditions of use: where no sense of contrast is meant, *but* is out of place. *But* contributes this by virtue of linguistic convention, it is a lexical property of the word.[5] Grice calls such properties *conventional implicatures.*

The Gricean theory, then, holds that *and* contributes no more than & to an utterance. *And's* variations are caused by general properties of the speaker's use of it. On the other hand, *but* contributes its own implicature of contrast to the sentences it conjoins. Neither *and* nor *but* affect the truth conditions of the conjuncts they join.

It is this claim about *and* that Gazdar defends

> The prime candidates for truth-functional connective status in English are *and* and *or* but Cohen (1971) has argued that meaning differences between them and their logical counterparts cannot be handled by a Gricean pragmatics, but must be treated as semantic properties of the words.... On a Gricean account, the temporal order or causality of the events... is only pragmatically implied, and so cannot affect truth conditions.
>
> (Gazdar 1979:69-70)

Such a model of conversation allows for a wide variety of *uses* of expressions independent of the meaning of the lexical items involved or the rules of semantic composition, thus simplifiying the lexicon and the semantic component.

It also explains many constraints on usage. Differences between *and* and *&* do not weigh against the *and=&* theory, if those differences can be discourse motivated. So, for example, discourse requirements of relevance and perspicuity can explain R. Lakoff's observation that neither totally unrelated sentences nor identical sentences can be conjoined (see below).

---

[5] Rieber's view of *but* as a performative would predict that *but* contributes constraints on use -- on the felicity of utterances in which it occurs. But presuppositions, conventional implicatures, and even truth functionality also constrain use.

Bar-Lev & Palacas responded to Grice's pragmatic simplification of *and* with a demonstration that there are sentence sequences which can sustain discourse interpretations barred by the introduction of *and*. *And* could therefore not be equivalent to <& +discourse constraints>, since *and* could not be used for all discourse contexts in which *&* would be the logical interpretation. Despite their observations, so far as I know, no one has ever tried to interpret *and* using *but* or some other conjunction, although it is easy enough to define *and* without using *and* or *&* but by using any one of several other conjunctions.

One further reason for the bias toward *and/&* as a defining term is that *&* can be reduced by definition to the function from sentential truth values to sentential truth values:

> and=& $_{def}$, the function f from truth values of pairs of sentences to truth values such that the function gives a value T (true) if and only if the value of both sentences is also T, F (false) otherwise.

The meaning of *and* can thus be referred to this function without reference to any words beyond "true" and "false". *&* simply is this function *f*.

Finally, it could be argued, in defense of *and/&,* that negations of *and*-conjoined sentences have the truth conditions of the sentences conjoined with *&.* There are two problems with this defense. First, it is factually wrong. To the sentence

> Annie has married and has had a baby.

one might reply, "False. It's not true that Annie married and had a baby: she had a baby and married." The pragmatic explanation of the temporal order cannot be brought to bear on this example without begging the question. Second, the truth function for the negation of *&* yields the value True just in case at least one conjunct is false. But this also applies to any sequence of sentences without *and*:

> "Roses are red, violets are green," is false.
> =It's false that roses are red and violets are green.

Moreover, that one might respond to

> It's false that roses are red and violets are blue. Roses are pink!

with the reply

> "But violets ARE blue."

shows that there may even be something in the nature of word-play in denying an entire conjunction on the basis of the falsehood of only one of the conjuncts.

In any case, straightforward forms of English negation can't take scope over *and*

> Roses are not red and violets are blue
> ≠ ~(Roses are red & violets are blue)

Only using a truth functional *or* can the negation of *and* be expressed

> Roses are not red or violets are not blue
> = ~(roses are red & violets are blue)

but not without some discomfort, since English *or* is usually interpreted as exclusive either/or. Yet English has means to express wide scope of negation over *or*

> Roses are not red nor are violets blue.

If *and* were the truth function *&*, we should expect it to be possible to negate it straightforwardly, at least as straightforwardly as negating *or*. Each of these facts points away from *&* as the translation of *and*.

Data of the next section show that *and* is quite distinct from *&* and should be taken as in no way more fundamental than any other conjunction. Rather, it may be more convenient and closer to the truth to define *and* in terms of the other conjunctions. The problem will then be defining these other conjunctions as truth functions, discourse markers, and constraints on pragmatic felicity or semantic well-formedness.

3.4 *and* is a relation not a function, *and* ≠ *&*

Bar-Lev & Palacas (1979) suggest that the logical conjunction meaning of *and* need not, and probably should not, be assumed to be basis of linguistic *and*, since the alternate hypothesis, that language users derive their understanding of logical *&* from linguistic *and* is just as valid an hypothesis, and given the priority of language use to logical skill, probably the better hypothesis. It might be argued, against their view, that logical skills may be prerequisites for linguistic use and that speakers use *and* with some tacit knowledge or know-how, even if they cannot yet define clearly the logical properties of the connective expressed by the conjunction they know how to use. Bar-Lev & Palacas's preliminary argument would be inconclusive without the empirical support. But there is plenty of empirical support.

R. Lakoff's 1971 consideration of conjunction provides some of the evidence that *and* is not based on logical conjunction. She produces many instances of tautologies that are not felicituosly conjoined with *and*:

> John eats apples and John eats apples.
> John eats fruit and John eats apples.

and the like show that either there is a constraint on tautology, or, more simply, that *and* is a discourse marker that is just not equivalent to logical *&*, though capable of being used in special academic registers as a technical bit of jargon to mean *&*.

This is only the most obvious constraint on *and* conjunction. Lakoff begins her discussion with a review of Gleitman's 1965 blanket statement that any two sentences can be conjoined:

> My grandmother wrote me a letter yesterday and six men can fit in the back seat of a Ford.

Lakoff points out that this sentence actually seems rather odd. The question which this oddity raises is not simply whether its oddness should be ascribed to discourse factors or to the linguistic meaning of the English conjunction *and.* It's whether *and* is just a conjoiner of sentences -- in which case properties of discourse account for the constraints -- or *and* is a discourse marker which contributes discourse properties of its own by convention. The discourse theory takes *and* as a logical connective, burdening the discousre with the constraints. In a semantic theory, *and* has (at least) two meanings, one of which is not equivalent to *&* but is semantically asymmetrical (must conjoin temporally or causally ordered events in their temporal or causal order) and constrained in use. But there is a third possibility, that *and* is more than *&* but that its additional contribution is not a truth conditional one, but a non truth conditional implicature. Some support, though not conclusive, for this third hypothesis comes from the following contrast:

> John eats fruit and John eats apples
> John eats fruit. John eats apples.

The paired sentences not only don't seem so odd as the conjoined sentences, the second actually has a discourse induced meaning that makes it quite acceptable:

> John eats apples. John eats fruit

may easily be used as a way of answering the question *do you know whether John eats fruit?* by someone who knows that, at the very least, John eats apples so he must eat fruit. The other direction of deduction works as well:

John eats fruit. John eats apples

may answer the question *Does John eat apples?* by someone who is presupposing that someone who is a fruit eater will not have qualms about eating apples. Amending the sentences to

John eats any kind of fruit. John eats apples.
John eats any kind of fruit and John eats apples.?

leaves the conjoined version a tautology and strange, and makes the paired sentences more acceptable.

Despite the context, then, it seems that *and* cannot be used to conjoin sentences to express the *therefore* or *then* of deduction. Yet the simple sequencing of the two sentences can do this. Therefore *and* blocks at least this discourse function of conjunction.

The constraint is highlighted in a full deductive argument:

How do I know Bill Clinton is an ass?
Anyone who supports NAFTA is an ass. Bill Clinton pushed NAFTA. Bill Clinton is an ass. QED.
Anyone who supports NAFTA is an ass and Bill Clinton pushed NAFTA and Bill Clinton is an ass. QED.?
Anyone who supports NAFTA is an ass. Bill Clinton pushed NAFTA and Bill Clinton is an ass. QED.?
Anyone who supports NAFTA is an ass and Bill Clinton pushed NAFTA. Bill Clinton is an ass. QED.

The versions in which the conclusion is conjoined with one or more of the premises contain a deductive tautology and seem to state that the speaker knows that Clinton is an ass because the speaker knows (among two other claims -- that Clinton pushed NAFTA and that anyone who wants NAFTA is an ass) that Clinton is an ass, a trivial tautology with the ring of childish insistence. The versions in which the conclusion is a sequenced sentence retain the sense of the conclusion of a syllogistic deduction.

Bar-Lev and Palacas offer even more compelling examples showing that *and* is not equivalent to *&*:

> Max didn't go to school; he got sick.
> Max didn't go to school and he got sick.

The simple juxtaposition of two sentences can induce a contextual causal reading, while the same sequence conjoined with *and* refuses such a reading and places in its stead the *and then* interpretation. These show clearly that *and* cannot be interpreted in the Gricean pragmatic way as meaning only *&* plus pragmatic assumptions induced by the discourse order.

The significant point here is what the discourse context cannot get *and* to do. It is, of course, also true that the conjoined sentence *John eats fruit and John eats apples* can be used to challenge someone's insistence that John eats no fruit and especially dislikes apples. This is interesting in itself because it suggests that *and* conjunctions can respond to prior discourse sequences.

To get this meaning of *and* it is sufficient that the context contain two claims; one that John does not eat fruit and another that he especially or most certainly doesn't eat apples. Then the response can be conjoined with *and*. This *and* seems to serve to mark the individual response to each separate claim.

The other direction of reply, from the specific to the general, is also acceptable as a statement that the general claim is false by proof of the specific: John eats apples, therefore John eats fruit. So, John eats apples and John eats fruit. But there is still no suggestion of *therefore* in this statement. It is as close to *&* as possible, both semantically and pragmatically.

What the foregoing *prima facie* suggests is that *and* cannot be used unless some added information is being offered in the and-conjunct. However, *and* will not support the burden of certain kinds of information. It cannot convey cause or deduction. It seems to allow itself to be carried along by some pragmatic factors of discourse but not by others.

Suppose that *and* were defined as *not only that but* or *also* or *in addition to that.* Of these, the most discourse explicit interpretation is *not only that but* since *that* refers to a distinct prior discourse element as a discourse element and *not only* characterizes that element as something entered in the discourse alone. One is again tempted to assume that *also*, because it is shorter, is the more basic term. However, I do not see how a definition of *also* can be given without using the other terms ("not", "only", "that", "in addition"), while the other terms seem amenable to simple definition without using *also*.

Substituting these terms for *and* has encouraging results:

> Max didn't go to school today (not only that, but/in addition to that) he overslept.
> Max didn't go to school today, also he overslept.

The interpretation of these sentences cannot be causal.

John eats apples (not only that, but) John eats fruit.
John eats apples, also John eats fruit.

These sentences cannot be interpreted as evidence in the antecedent followed by deductive conclusion in the consequent presumably because deductions add nothing to the premises.

The questions to answer, then, are: Why can't *in addition to that* or *not only that but* not be construable as introducing causal or deductive information? What is the meaning of *also, in addition to that*, and *not only that but*, and of particular interest to this study, what is *but* doing in *not only that but*? and are these paraphrases the semantics of *and* or is *and* a discourse marker with these conventional implicatures? Partial answer to the last question is present in the terms themselves. The translations of *and* and *also* by *not only that but* and *in addition to that* show that they refer to prior discourse. Whatever else is contained in their semantics, they are certainly discourse markers. They indicate the speaker's relation to her own speech. As a discourse move, they act as a step further in a direction taken, a gesture of continuity. The types of relations which Bar Lev & Palacas note are impermissible with *and* are conclusivity, exemplification, and explanation. Conclusions and examples are internal relations, while explanation is a relation of precedence. All three disrupt the forward momentum which the relation *and* facilitates.

The "addition" aspect of *and* could be a conventional implicature. It prevents causal interpretation because causality is prior and internal to an event, not an addition to it. As Bar-Lev & Palacas showed, and as the deduction examples show, discourse can carry such deductions as syllogism and causal relation. It is not the pragmatics then that brings external addition to the meaning of *and*, it is part of the semantics of the word, its conventional meaning, a conventional implicature.

Modal, or conditional, contexts provide some apparent counterexamples to this interpretation. Conditional sentences set up a special relationship between antecedent and consequent. Neither stands alone semantically.

> Give me some more time and I'll show you how it can be done.
> (van Dijk, 1977)

This sentence does not entail that the speaker has made the request

> Give me some more time.

nor that the speaker has committed to

> I'll show you how it's done.

The meaning has the form of a conditional

> *If* you *were* to give me more time *then* I *would* show you how it's done.

It cannot be translated into

> Give me some more time, (not only that but) I'll show you how it can be done.*

which is malformed, there being no contrast between the conjuncts. Notice though that

> You gave me some more time, (not only that but) I showed you how it can be done.

may translate

> You gave me some more time and I showed you how it is done.

This phenomenon of modal relation between sentences shows that *and* retains its forward looking implicature even when the sentences conjoined are modally interactive. A similar situation prevails in causal relations. *And* can express forward causal relation but not, as has already been shown, right-to-left cause.

> Mary left the room. John smoked a cigar. (van Dijk 1977) (+/- cause)

may be used either to express a sequencing of events or a right to left causal relation between John's smoking and Mary's leaving.

> Mary left the room. John had smoked a cigar.

is clearly causal.

> Mary left the room and John smoked a cigar. (-cause)

can only reflect a left to right sequence.

> Mary left the room and John had smoked a cigar

is surprisingly no better at expressing the causal relation that should be quite explicit. But

> John smoked a cigar and Mary left the room

has a ready causal interpretation brought out by its denial

> John smoked a cigar and Mary left the room, but she had to catch her train anyway.
> John smoked a cigar and Mary left the room, but that's not really why she left.

Unless the sequence is left to right, *and* cannot be used to express it and the inclusion of *and* will induce quite unrelated meanings. In

> Go to the deli and get a sixpack

the speaker intends that the sixpack be bought at the deli

Get a six pack and go to the deli

implies most easily a trip to two stores, one store to buy a sixpack, another to the deli. If the second conjunct is emphasized as an afterthought, it can be made to express

Get a sixpack. And (by the way) go to the deli to get it.

But this is arguably because there are in fact two sentences here, one which happens to begin with an *and*, but two distinct sentences nonetheless. Such sequences of afterthoughts can be added easily and do not have to conform to even the basic requirement of common topic for a valid conjunct (pace Lakoff 1971, van Dijk 1979):

Get me a sixpack. And don't forget that your cousin is coming over tomorrow.

The relation established by *and* between conjuncts, then, is both distinct from and stronger than a mere discourse relationship. It is distinct in that it blocks right to left cause, and it is stronger because the left to right cause or sequencing cannot be broken without breaking up the conjuncts into separate sentences.

3.5 Speculative conclusions

In realization conjunctions, the forward looking function of *and* is to move beyond the irrealis into the real.

I can go and I will

should come out on our modal analysis to be a forward looking conjunction of assertions. It is not clear how it would in a crude possible worlds framework: *can S*, the accessibility of some possible world in which the subject does S, seems to include *will S*, which focuses on some one of those *can* worlds and identifies it as the real future world. This seems to be the kind of internal relation that should be blocked by *and*. If situations in which I can go lump situations in which I do go, we would have to abandon lumps or situations as an analysis too. Certainly the converse is true -- *will* lumps *can*, every situation in which I will go is one in which I can go.

> ?I will go and I can

should therefore be odd on a situational account, and it does sound odd outside a context which annuls the linguistic properties of *and* leveling it into *&*.

But not every situation in which I can go is one in which I will go. *Can* does not lump *will*. *Will* gives us the new information consistent with the forward looking we expect from an *and* conjunction.

Consider again

> XiaoMei stayed home. She got sick.

Every situation in which XiaoMei stayed home is a situation in which she was sick. These propositions lump each other. From such evidence we might conclude that some such rule constrains the use of *and*

> Do not use *and* to conjoin lumped propositions unless they are in causal or temporal sequence.

But this rule sounds suspiciously like a pragmatic rule

> Unless otherwise indicated, assume that the order in which information is delivered reflects the order in which the things or events referred to occurred.

In other words, lumping may feed the pragmatics of conjunctions, not the semantics. It is not necessary that the lumping constraint explain every prohibition against conjoining with *and* if other pragmatic considerations can be brought to bear.

All this sounds encouraging for situations. However, I don't pretend to use this as an argument against possible worlds -- there may be many ways of manipulating worlds to accommodate the requirements of *and.* In fact, it does seem important that the real future worlds of *will* be accessible from *can* worlds for such conjunction to work.

The evidence comes from *could. Could* also does not lump *will,* so nothing should be wrong with

?I could go and I will

It appears to be the conditional mood that excludes the real from the irreal of *could S. Can* worlds don't exclude *will* worlds because the future is possible. *Could* worlds have a remoter relationship to the real or the future. The next chapter contains discussion of the conditional nature of such conjunctions.

Finally, the facts about *might* are murkier.

XiaoMei might go and she will/won't

is an epistemic modality. It must be interpreted not just as a set of possible situations, but as situations selected in view either of the speaker's or the subject's knowledge: *I know of some possible worlds in which XiaoMei goes, not only that but she does/doesn't in fact go.* Both *does go* and *doesn't go* should work as *and* realizations, but they don't. How does *might* exclude the real? It is not a conditional. In the last chapter I will provide possible explanations, one suggesting, as at the beginning of this chapter, that the modality is one of not-knowing, not one of knowing; another suggesting that the modality is one of probability or likelihood, not knowledge.

Chapter 4 *but*

4.0 Introduction

This chapter continues the investigation of realization conjunctions, now focussing on *but*. Various prior theories of the conditions on the use of *but* are considered, each of which is shown to be inadequate. Evidence that *but* resists immediate recursion -- that a *but* clause often cannot immediately be followed by another *but* clause-- and evidence from *although* conjunctions brings to light the character of the contrast expressed by *but*. However, the interpretation of realization conjunctions themselves cannot be handled in any simple contrast theory of the implicature of *but*. Conclusions about the use of *but* are therefore tentative at best.

4.1 *Can* and *could* and *but*

There is a difference between

1. She can walk out of that relationship and she will.

and

2. She could walk out of that relationship and she will.

The two conjuncts of (1) are consistent but the two conjuncts of (2) are out of joint somehow. The difference is even clearer for first person assertions. Knowledge of context in first person assertions is hightened since the speaker has, if not perfect knowledge of her or his own dispositional states (the private language paradox preventing), at least the sense of perfect knowledge of them and special intimacy with them. This special relationship between the speaker and her or his states will reappear in the data in potentially significant ways. For the moment observe that (4) is much less acceptable than (3)

3. I can go and I will
4. I could go and I will

Can seems to imply possibilities consistent with actuality, while *could* seems to imply possibilities remoter from the actual. How consistent and how remote are these possibilities? What accounts for the difference in remoteness?

The remoteness implied by *could* is not sufficiently remote to support the use of *but*:

5. ?She could walk out of this relationship but she will.
6. ?I could go but I will.

Under the coercion of context *could* can be made consistent with conjoined assertions of realization of the *could* clause event.

7. A: Her shrink told me that if she could walk out, she wouldn't.
5. B: She could walk out of that relationship but she will.

(7) establishes a contextual condition: if she could walk out, and if her shrink is right, then she won't. This contextual condition, licenses *but* as the introduction to the second conjunct which denies this expectation.

The licensing of *but*, then, is context sensitive. In particular, *but* is a pragmatically sensitive conjunction the use of which depends on more than the surrounding words, sentences, clauses or utterances in isolation. This complicates the task of assessing the possibilities expressed by *could* and *can* in these sentences. However, since the goal is to compare uses across minimally distinct contexts, and the neutral context -- the context which would normally be assumed by a reader or hearer without any preparation -- is one context (among many), I use the neutral context to establish minimal contrasts while using alternative contexts as tests for the validity of the implications established by comparisons among neutral contexts. A shift in context sometimes demonstrates the limiting case, establishing the parameters of those implications, and sometimes indicates the specific conditions under which an utterance becomes acceptable. As a tool of investigation it need not be used only to deny a hypothesis, but as the exception that proves -- and defines -- the rule.

In the neutral context what follows *but* must deny an 'expectation' of what preceded *but*, yet that expectation must not be so strong as to be an entailment:

8. I want to go but I will

makes no sense unless the context establishes expectations that my wants are never fulfilled (a recovering neurotic who is trying to conquer self-destructive tendencies might coherently say (8)) and

9. I will go but I won't.

doesn't make much sense unless taken as a vacillating statement, a riddle or paradox.

Could seems to place a condition on actualization. *Could-but* actualizations alternate with the negations of *if* conditions:

10. I could go, but if I did I wouldn't be able to finish this chapter.
10' I could go, but I want to finish this chapter.

In other words, what comes between the speaker and going in (10) is a condition which the speaker has not committed to fulfilling. Volition is not the only personal circumstance that plays an important part in the use of *could* as evidenced by

11. ?XiaoMei could pass her exams easily, but she doesn't understand the material.
12. XiaoMei could pass her exams easily, but she doesn't have time to study.

(12) allows possibility based on ability. Volition plays no role. The condition appears to be determined by the kind of prerequisites normally associated with the action.

This leads to a paradox. If the condition of having time to study is a real constraint on passing then it should make sense to say

13. XiaoMei could pass, but she can't.

The sentence should be able to carry the meaning of the words in them, yet without emphasis on *could*, *could* seems to clash with *can't*. Even with a supporting context the sentence sounds odd without emphasis, requiring some such follow up explanation as

13' I mean she has the smarts, but she has a full time job; she just doesn't have the time.

The context has not improved the sentence by making it 'sound better', it has just permitted the oddity. It has allowed for the strangeness.

(13) is an example of the quandary of *could*: it seems to express a possibility which is too remote for *and* actualization of (2)

2. ?She could walk out of that relationship and she will.
2.' She can walk out of that relationship and she will.

but not remote enough for *but* actualization or *but* denial with *can't*

5. *She could walk out of this relationship but she will.
6. *I could go but I will.
13.*XiaoMei could pass, but she can't.

The prohibitive condition which *could* carries (unlike *can* which seems to express simple possibility) accounts for the remoteness of *could* . But if that condition were part of the meaning of *could*, then *but* actualizations of the condition should make sense. In sentence (14)

14. I could finish writing my dissertation, but my boyfriend would leave me.

the condition under which writing my dissertation is being excluded from actuality is stated in the actualization clause. That condition cannot then be an expectation of the antecedent clause.

If the condition on the use of *but* is contrast or denial, that condition is certainly fulfilled in *I might go but I will/won't.* The problem is, it is too much of a contrast/denial, it's a contradiction. Whether *but* in modal contexts is redundant, contrastive, or denying, contradictions are not acceptable *but* conjuncts.

4.2 *But* and presuppositions

At least two salient meanings or uses have been identified for *but*: denial and contrast (R.Lakoff 1971, Blakemore 1989). In 1971 G. Lakoff suggested that *but* was allowed in sentences in which the first conjunct implied a presupposition which the second conjunct denied. The sentence

John is a Republican, but he is honest

holds the presupposition, according to Lakoff, of the consequent clause of

John is a Republican-->John is dishonest

which in turn implies the consequent clause of

John is dishonest-->~(John is honest)

which is denied in the *but* clause

but he (John) is honest [presuppositon denied].

R. Lakoff then observed that some occurrences of *but* do not conform. In *John is tall but Bill is short,* the first conjunct does not imply a presupposition that Bill is short. This type of occurrence R. Lakoff calls "semantic opposition-but". The hypothesis that there are two types of *but* in English is further supported, she observes, by their complementary translation into two morphologically distinct forms in German and Spanish.

Dascal&Katriel (1978) challenge G.Lakoff's presuppositional account on the grounds that *but* sentences don't meet the negation test for presuppositions. One characteristic of presuppositions which distinguishes them from entailments, is that if S* is presupposed by S, then it should also be presupposed by ~S. But

It is not the case that John is a Republican, but he is honest

does not clearly presuppose that Republicans are dishonest. This is an illuminating objection, though perhaps not a valid one.

One must be careful to distinguish internal from external negation. "The king of

France is bald" presupposes that there is a king of France.[6] The internal negation "The king of France is not bald" also presupposes that there is a king of France. But the external negation "It is not the case that the king of France is bald" is ambiguous between "The king of France is not bald" and the rejection of the entire sentence on the grounds that the presupposition fails "It is not the case that the king of France is bald, because there is no king of France".

In Lakoff's example, the denial can be construed as a denial of the first conjunct, the second, or the appropriateness of *but* to link them. The B sentences below respond to each of these construals respectively

> *A*: Mohammad is a Republican, but he's honest
> *B*: What are you saying?! He's a democrat.
> *B*: What are you saying?! He's cheating on his wife.
> *B*: What are you saying?! It's the Democrats who are dishonest.

The assertion that Mohammad is a Democrat is consistent with Republicans being dishonest, as is the assertion that Mohammad is cheating on his wife. These first two correspond to internal negation which, as in Russell's example, has no effect on the truth of the presupposition. The last, that Democrats, not Republicans, are dishonest, is a direct rejection of the presupposition itself. This denial is parallel to denying the existence of a present king of France. Such denials would not be possible did the statements being denied not presuppose the proposition denied. You can't say

> But there is no King of France!
> But it's the Democrats who are dishonest!

unless the respective statements presuppose that there is a king of France and that Republicans, as contrasted with Democrats, are dishonest. Dascal&Katriel's

---

[6]Assuming the presuppositional account. The presuppositional account is not uncontested. Russell, who devised this *locus classicus* example, used it to argue against the proto-presuppositional position held by Frege.

objection only seems plausible if the internal negations are plugged into the *but* sentences

> Mohammad is not a Republican, but he is honest.
> Mohammad is a Republican, but he is not honest.

Neither of these sentences is consistent with “Republicans are dishonest”. In addition, “Mohammad is a Democrat” does not in itself presuppose that Republicans are dishonest. From these two facts Dascal&Katriel conclude that “Mohammad is a Republican but he’s honest” does not presuppose “Republicans are dishonest” since the presupposition test is not met. Alternatively it might as well be concluded that the presupposition test has been misapplied here or the test itself has never been properly formulated. Without elaborating, Dascal&Katriel suggest that the presuppositions associated with *but* might be pragmatic rather than semantic. What they do not consider is the third response, “What do you mean? It’s the Democrats who are dishonest”, which is the denial of the appropriateness of the use of *but*.

This third response denies the presupposition “Republicans are dishonest”. If this is so, then the presupposition is introduced by the *but* sentence as a whole or perhaps by the *but* itself. The hypothesis that *but* sentences should be treated as whole units headed by a contrast marker will reappear.

4.3 Denial of expectation *but*

Less contentiously than invoking presuppositions, *but* can be said to conjoin two sentences the second of which denies an ‘expectation’ implicated by the first sentence. I put “expectation” is scare quotes because the expectation denied by the *but* consequent is not always clearly present in the first clause:

> Mohammad is an architect, but he knows nothing about construction contracts.
> XiaoMei is a cop, but she's not brutal.

There is actually little reason to expect architects to know anything about construction contracts or to expect female police officers to be brutal. *But* seems to respond to an expectation that one might conceivably have or that might be possible if it were not ruled out explicitly by the *but* consequent. The *but* consequent may actually introduce or draw attention to an implication otherwise inchoate in the antecedent. Again, the property does not inhere in the antecedent clause, but is an implication resulting from the presence of a *but* clause.

Blakemore places this ability of *but* to draw out implications at the heart of her analysis. She views the use of *but* as a procedure that helps indicate the interpretation of the relevance of two conjuncts by constraining that relevance to denial of an implication of the first conjunct.

> In the denial of expectation use the proposition introduced by *but* negates or implies the negation of a proposition which the speaker assumes the hearer to have derived as a contextual implication from the first clause. That is, the speaker is understood to have presented two propositions each of which is consistent with the Principle of Relevance, and *but* is a constraint on the relevance of the proposition it introduces. In the contrast use there is no suggestion that the speaker is assumed to have derived P ... from the first clause. The first clause affects the interpretation of the second in the sense that it gives the hearer access to a property whose ascription is understood to be negated by the second clause.
>
> (Blakemore 1989:34-5)

However, Rieber (1986) finds this procedure clumsy, unlikely and representative of atypical examples: most examples of *but* conjunction do not require any constraint to indicate the implication to be denied. Those that do are often heard as word play or jokes.

Instead, Rieber offers a parenthetical performative analysis in which *but* is cashed out as a first person aside *I suggest this contrasts.* His general notion of contrast is broad enough to comprise both semantic opposition *but* and contrast *but.* The data of the present study seem to show that neither analysis as stated can be correct.

Sentences in the conditional already contain the denial expressed in the *but* clause: *I would go* already suggests, if not implies, that I won't go. Adding *but I can't* neither contrasts -- as Rieber would have it -- nor requires, as Blakemore argues, some marker to help identify the denied proposition.

Conditionals suggest that *but* is sometimes a redundant feature. When *but* is replaced with *and*

> I would go but I can't
> I would go and I can't

both seem to bear the same truth conditions and neither seems to differ considerably in meaning since there is nothing apparent being denied in the *but* clause. The *and* version even sounds slightly redundant. The denial of expectation theory incorrectly licenses sentences like

> I would go, but I want to
> I would go, but I will try to go

since the first clause clearly sets up the expectation

> I won't go

which is denied in the consequent clauses.

Other examples, however, draw out finer differences. The following two sentences sound as if they say much the same

XiaoMei would readily take on that responsibility, and shouldn't
XiaoMei would readily take on that responsibility, but shouldn't

but when cast in the first person

I would readily take on that responsibility, and shouldn't
I would readily take on that responsibility, but shouldn't

the *and* version is missing something. The identity of the speaker with the subject seems to heighten the contrast between boulomaic and deontic states. When discussing a third party, beliefs about dispositions and obligations are likewise objective. In discussing oneself, a dispositional statement amounts to a personal commitment against which a contrary obligation lies in stark contrast. It is as if there are multiple personalities at war. Conjoining these disparities with an *and* doesn't suffice for the contrast, as it seems to in discussing another's dispositions and then passing judgement on them.

First person instances aside, the denial explanation doesn't seem to cover these conjoined modals. A key to the meaning contribution of *but* comes from examining another, seemingly unrelated, fact about *but.*

4.4 *but* nonrecursion

The peculiarity of *but* is that, although it is a coordinating conjunction, the rule of its application is not recursive. It is neither Markovian, as the rule for *and* is, nor a context free recursive embedding rule, as the rules for conditionals are (Chomsky 1957). The rule for *and* as a coordinating conjunction could be expressed:

For any S, add *and*+S', where $S' \neq S$

(the addition of the same S may be ruled infelicitous by its redundancy, rather by grammatical violation) or

and addition: S--> S+and+S',

or just

S (andS)*

using the Kleene star of endless optional repetitions. The rule creates a simple Markovian chain. The rule for *but* does not allow simple recursion. In (1) the second *but* clause introduces material that contrasts with the first *but* clause

1. ?Mohammad is an architect but he doesn't know anything about construction materials, but he knows a lot about construction contracts.

Sentence (2), in which the second *but* clause contrasts with the main clause, is no better

2. *Mohammad is an architect, but he knows nothing about construction contracts, but he didn't build his own house.

nor is (3), in which the second *but* clause constrasts with all that precedes it taken as a whole

3. ?Mohammad is an architect, but he knows nothing about construction contracts, but that doesn't surprise me.

According to Blakemore, no explanation for the non-recurrence of *but* is offered in the literature.

Non-iteration seems mysterious if *but* conjunctions are thought of as left-to-right

Markovian chains as they appear superficially: If *but+S'* can be added to *S*, why can't it be strung on in Markovian concatenation with *S'* or added tree-wise to the *S''* created by *S+but+S'*?

Not many elegant solutions offer themselves. A simple lexical constraint on iteration is the least elegant solution of last resort, being little more than a description of the facts. The facts are less than kind to even this basic and unpretentious interpretation. Sometimes, as in

> XiaoMei is rich, but she is unhappy, but she is better off unhappy and rich than unhappy and destitute.

it actually is possible to string along another *but*.

Rieber's 1997 hypothesis that sentential connectives are tacit performatives does not offer answers. According to Rieber, *XiaoMei is rich but she is unhappy* means that XiaoMei is rich and (it is suggested that this contrasts) she is unhappy. Rieber does not go so far as to bring his analysis to bear on why *but*s cannot easily be strung on recursively. Additional explanation is needed for the special cases in which *but*s can be strung along:

> XiaoMei is rich and (it is suggested that this contrasts) she is unhappy and (it is suggested that this contrasts) she is better off being unhappy and rich than unhappy and destitute

seems no better than a *but* denial of the prior conjunction

> XiaoMei is rich and (it is suggested that this contrasts) she is unhappy and (it is suggested that this contrasts) knowing her, it's not surprising

or a *but* denial of the previous *but* clause

> XiaoMei is rich and (it is suggested that this contrasts) she is unhappy and (it is suggested that this contrasts) Daffy Duck makes her laugh.

Yet

> XiaoMei is rich, but she is unhappy, but she is better off unhappy and rich than unhappy and destitute.

does sound much better than

> XiaoMei is rich, but she is unhappy, but Daffy Duck makes her laugh.

or

> XiaoMei is rich, but she is unhappy, but knowing her, it's not surprising.

which sounds better if the last *but* clause is taken as a new sentence.

4.5 *although* nonrecursion: a sentence initial contrast marker

Insight into one possible explanation is suggested by *although*. Because *although* clauses are often sentence initial, it is reasonable to suppose that a sentence beginning with *although* is not just a sentence with an *although* clause attached, it is a syntactic and semantic whole -- an *although* sentence requiring a single answer or antiphon to the *although* clause. The antiphon generally cannot itself be an *although* sentence. *Although* clauses can be added cumulatively to the main clause for rhetorical effect as in (4) (and it must be cumulative, not randomly added as in (5)), but an *although* clause cannot be added to an *although* sentence, as in (6), to give an *although* contrast to another *although* clause. That the meaning can be expressed is shown below:

4. Although Mohammad was rich, although he bribed the judge, he was convicted.
=Although Mohammad was rich, and although he even bribed the judge, he was convicted.
5. *Although Mohammad bribed the judge, although he was rich, he was convicted.
6. *Although Mohammad was not rich, although he bribed the judge, he was convicted
=Although Mohammad was not rich, he nevertheless bribed the judge and still he was convicted.

Although clauses cannot be infixed either

??Although she ran to catch the bus, although she was tired, she missed it.

Even if it is supposed that a syntactic rule requiring *although* to be attached to a sentence rules out an *although* attached to another *although* clause, what rules out an *although* clause attaching to a sentence which happens to be an *although* sentence? The question seems puzzling until one tries to imagine what kind of *although* clause could qualify as an *although* sentence. Suppose an *although* sentence presents an '*although* construction'. The fact that an *although* clause cannot be prefixed to it suggests that an '*although* construction' might not be a truth functional assertion of truth conditions. It could be a construction of the contrast between two truth functional assertions. The only *although* clause to prefix to an *although* sentence is one which qualifies the contrast.

8. Although it happens all the time, although she ran to catch the bus, she missed it.*
9. Although it was no surprise to her, although she ran to catch the bus, she missed it.*

These *although*s are comments on the attention to the contrast between two propositions. I invite the reader to try to imagine an *although* clause that qualifies an entire *although* sentence -- not qualifying the *although* clause that sentence contains or qualifying just the matrix assertion of the sentence -- that does not qualify the contrast itself between the *although* clause contained and the matrix assertion.

From this perspective it is easy to imagine a rule preventing *although* clauses from being prefixed to *although* sentences: there is an evident difference of type between assertions and contrast constructions; *although* clauses can only be prefixed to assertions, not to contrast constructions. What makes contrast constructions different in type and why can't they be *although* qualified?

The difference is perhaps explained if we understand contrast constructions as being about an attitude towards the relation between two propositions while assertions are simply the sense and reference of the proposition asserted. The whole is distinct from the sum of the parts.

Similarly for *but* if we think of sentences with *but* conjunctions as *but sentences*. This is often evident in conversation when the hearer anticipates a contrast:

> A: You have plenty of talent, you're charming, you're beautiful, you cut an elegant figure, you've got a great voice, great presence, poise, those piercing eyes, perfect complexion and I'd love to hire you...
> B: ...I hear a "but" coming...
> A: ...the part calls for someone taller than the lead. Sorry.

If, on the other hand, *but* conjunctions are treated as wholes, with the *but* in a prenex position, there is no syntactic puzzle at all, only a semantic question as to why *but* should differ syntactically from *and* and a syntactic question as to why *but* differs in position from *although.*

Treating *but* sentences as wholes explains the contrast noted earlier between

> I would readily take on that responsibility and shouldn't
> I would readily take on that responsibility but shouldn't

the *but* context of the whole setting up the expected contrast in the second clause to the second sentence. From this perspective, the but is not redundant and neither is the modal. The modal is a hedging anticipation of the contrast to follow. If the modals were stronger the sentence would be contradictory

> I will readily take on that responsibility, but mustn't.

A hedge in the antecedent clause allows for just the right contrast without contradiction. In the *and* sentence, the anticipated contrast is not fulfilled at all.

4.6 Inadequacy of a type-fit explanation

This kind of explanation runs into immediate problems. Other conjunctions which seem to create new propositions greater than the sum of their parts do not have the same recursion restrictions. The sentence

> I am a student, so I don't count

contains three propositions, *I am a student, I don't count, I don't count because I am a student.* But unlike *although, so* is perfectly comfortable with added *so*'s tagged on to the end

> I am a student, so I don't count, so don't include me, so I don't have to waste my time in committees all day!

as compared with

> ?Although she attended class every day, she didn't learn much, although she worked hard.

Other conjunctions aside, the type-fit explanation isn't even adequate to the facts of *but* and *although.* If *but* and *although* sentences are non assertive types, why can *but* sentences be appended with *although* clauses (though not with *but* clauses) and why can *although* sentences be appended with *but* clauses (but not with *although* clauses)?

> Although he bribed the judge, he was convicted, but the sentence was light.
> ?Although he bribed the judge, he was convicted, although the sentence was light.
> He bribed the judge, but was convicted anyway, although the sentence was light.
> ?He bribed the judge, but was convicted anyway, but the sentence was light.

Although there are other reasons to believe that *but* conjunction creates a *but* sentence, it is probably wrong to conclude, however, that simply because a *but* creates a *but* sentence, the *but* sentence is not of the same type as the sentences which are its parts.

Is there any more to be said than that no *but* sentence allows for more than one *but* contrast? That is not much better than the descriptive rule, one *but* per sentence.

4.7 The contrast in contrastive conjunctions

The lack of *but* iteration is related to the need for *but* in conditional conjunctions. At the outset it was remarked that in conditional conjunctions *but* appears to be a redundant form. Replaced with *and* the sentence meaning remains the same. The antecendent introduces the conditional which requires an antiphonal response: *I would go* calls for a contrast clause. Here the analogy with *although* holds. Both types of sentences are introduced at the very start as requiring two clauses, antecedent and antiphonal consequent. That the *but* does not appear in the syntactic initial position scarcely matters. If the sentence is introduced by this requirement, to which the *but* is attached as a redundant feature, and this requirement-plus-feature are attached to the initial clause, then the rule of *but* conjunction will turn out to be nonrecursive over whole sentences since the requirement could not be attached to a whole sentence, but only to the antecedent clause with its incomplete condition.

Why then can an *although* be added to a *but* sentence? Is it because *although*s and *but*s can be tagged onto any sentence as long as the clause contrasts with the prior clause or sentence and the conjunct of the nearest clause, if the nearest clause contains a conjunct?

> I would go but I can't, although I did buy a ticket
> Although I bought a ticket, I couldn't go, but I would like to have
> Although I bought a ticket, I couldn't go, although I would like to have

What prohibits

> Although he bribed the judge, he was convicted, although the sentence was light

might be the sequencing related notions. If the final *although* regards a prior concern, the sentence sounds better

> Although he was convicted, he didn't serve time, although he should have.

This leaves us still with no explanation for

> XiaoMei is rich, but she's unhappy, but she's better off unhappy and rich than unhappy and destitute

except that the weight of the longer clause may attract the main initial *but* marking to itself.

From all this evidence, the constraint on *but*, whatever it is, appears to be a weak one, something like: usually, *but* can only be used when it contrasts with the previous clause. What is contrast? Well, a *but* clause followed by a *but* clause sounds odd because the two *buts* don't contrast with one another. Yet we have seen that contrasting conjuncts introducing the clause is not a necessary condition. It is not sufficient, of course, either. In

> ?XiaoMei isn't ready to defend but she would anyway although she wants to

the lack of any contrast in the substance of the last two clauses is what make this sentence strange standing out of any context. So just having a different type of conjunction introducing the clause is not contrast enough.

> ?XiaoMei isn't ready to defend but she would anyway but her advisor won't let her
> XiaoMei isn't ready to defend but she would anyway although her advisor won't let her

So the contrast must be in the meaning of the clause not just in the lexical item introducing it. Contrast of meaning seems to be both a necessary and sufficient condition since clear or striking or highly motivated contrasts overcome the non-contrastiveness of a second *but.* In the next sections we will see that, while it may be a sufficient condition, it is not quite a necessary condition.

4.8 Possible worlds

Let us suppose that *can* and *could* relativize assertions to possible worlds. *I can go* means that there is a possible world accessible from the present real world in which *I go* is true. Under this assumption, *I can go and I will* means not only that there is a possible world accessible from the present real world in which *I go* is true, but also that this possible world is contained among future real worlds. Roughly, the truth of *I can go and I will* depends on the future, it is true if the future contains this possible world and false if it does not.

Not all cases of *can* concern the future. *I can see you from here* means little more than

I see you from here as evidenced by the fact that it cannot take an actualization *I can see you from here and I do* much less an actualization in the future *I can see you from here and I will.* Similarly *XiaoMei can hear you now* does not accept realizations, present or future, while *I can hit the target from here* accepts the realization of *and I will,* and *I can do clerical* accepts the timeless realization of *but I don't.*

As expected, *but* actualizations fit easily with the future sense

I can go but I won't
I can see you from here but I don't*
I can see you from here but I won't (if you move)

Not all possibilities introduced by *can* relate to future worlds either

A student can fail the CWAT and still be qualified for college level work
A student can fail the CWAT but be qualified for college level work
A student can pass the CWAT but still not be qualified for college level work

Such sentences can be interpreted as meaning that there is a possible world accessible from the real world in which some student who is qualified for college level work has failed the CWAT (vice versa for the third sentence). There may actually be no such student in the real present world. But if some such world is not accessible from the real world, the assertion is false. In this case the real world should be accessible to itself, since if the real world does contain such a student, the real world would be the closest demonstration of the truth of the proposition. The relation between possible worlds in this example, then, is reflexive.

Not so with futurity. *I can go and I will* cannot be verified by the present real world, regardless of where I am in it. So the relation which *can* introduces varies from context type to context type. Some contexts will support *but,* others won't.

The situation with *could* seems different. Assume that what makes *I could go and I will* strange is just the accessibility relation. If the world in which *I go* is true is inaccessible to the actual world, then in what sense does *could* indicate possibility? If *could* indicates the same accessibility relation as *can* why the oddness of *and* actualization?

One way to distinguish *could* from *can* without abandoning possible worlds is with a layering of remoteness to the accessibility relation. Without establishing any exact measure of remoteness, an order can be distinguished between the very accessible *can* and the less accessible *could*.

But this presents another problem. The remoteness doesn't show up in *but* contexts

> I can go but I won't.
> I can go but I will.*
> I could go but I won't.
> I could go but I will.*

If a *but* clause is only allowed when contrasting with the prior clause, the above paradigm indicates that *could* does not even suggest a contrary to fact assertion. That conclusion may be hasty. Stronger assertions counter to fact cannot be *but* contrasted

> I would have gone, but I couldn't.
> I would have gone, but I had another commitment.
> I would have gone, but I did.*

From these it seems that counterfactuals do not fit into the standard paradigm of *but* contrast. What's going on?

4.9 *but* conditionals

Rieber's analysis also fails to account for much stronger uses of *but*. In the sentences

> I would have another beer, but I have to write tonight.
> I could kick your ass, but I'd have to clean up the mess.
> She would have had the baby, but she was afraid to tell her daddy.
> The first party could have made it up the peak in better weather, but it wasn't meant to be
> I might have spent the whole day the museum, but we had to get ready for dinner.

The interpretation *I would have another beer and (it is suggested that this contrasts) I have to write tonight*, simply misses the meaning. *I might have spent the whole day at the museum* does not set up an expectation that I spent the whole day at the museum, but rather the expectation that I didn't spend the whole day at the museum. *The first party could have made it up the peak* clearly sets up the expectation that the first party never made it to the peak, an expectation borne out by *but it wasn't meant to be.*

Even were the pragmatic interpretation generous, filling in why a contrast is being indicated (following Jackson 1987), the Rieber interpretation would not get at the conditional meaning. The sentence does not merely contrast. The *but* consequent *denies* a condition. The sentences above are equivalent to

> If I did not have to write tonight, I would have another beer.
> If I didn't have to clean up the mess, I'd kick your ass.
> If she had not been afraid to tell her daddy, she would have had the baby
> If it hadn't been that the second party had been lost in the monsoon, the first party could have made it to the peak
> If we hadn't had to get ready for dinner, I might have spent the whole day in the museum

In these sentences *but* operates on possibilities, excluding them from actuality on the basis of a condition. The intensional nature of conjunctions was noticed as early as van Dijk (1977) though it appears that, contrary to van Dijk's assumption, it is not the conjunction that introduces the intensional context, but the modals *would* and *could.*

Finally, Rieber's performative analysis skirts the problem of formalization. G. Lakoff had, in a presuppositional account, a means of reconstructing the relevant semantic elements of a *but* sentence: *but* denial identified a presupposition. Facing Rieber's account, we want to know what makes a contrast contrastive? Is it denial of a presupposition? or of an expectation? or an implication? Rieber doesn't say.

4.10 Summary and conlcusions

A theory of *but* must comprise some very recalcitrant facts. Modals don't show contrast as non modal *but* conjunctions do, and iterations of *but* clauses are sometimes allowed, sometimes not. Although a type-fit explanation seems unlikely given the facts from other conjunctions and alternating iterated contrastives, there seems to be some weak promise to the sentence initial marker theory. Several questions need to be worked out for such a theory to succeed. The nature of the antiphonal response the marker demands must be spelt out as well as the exact conditions under which the marker can move.

Whatever the theory, the facts about modals in *but* conjunctions remain stark although the exact relationship among possible worlds that reflects the meaning of these modals is not entirely clear from the conjunction data. This is largely due to the lack of an indisputable account of the meaning of *but.* The more accurate the theory of *but,* the easier it will be to understand the meaning of the modals, and vice versa, a better understanding of the meaning of modals will bring us closer to an accurate theory of *but.*

Chapter 5 *not*

5.0 Introduction

This chapter coordinates the puzzling facts about negation, relating the pattern of wide scope negation over modals of possibility to several other strange negative phenomena, including the lack in natural language of lexical quantifiers expressing *not all*, and the tendency in natural languages to polarize scalar negations at all levels of linguistic semantics. It occurs at the lexical level: *don't like* is used to mean *dislike* and is not used to include *have neutral feelings about*. It occurs at the morphological level: *dislike,* which has a meaning stronger than just not liking and *unhappy,* which means not merely lacking happiness but actually being sad, both exclude the middle ground. At the sentential level *don't think S* means *think not S,* which is much stronger than simply not having the thought that S. In all these strengthenings of the opposition the negative creates contraries out of simple contradictories. Relying on Horn's observations and analysis, all these phenomena coordinate with a broader tendency in natural language to avoid the O (not all/some not and not necessarily/possibly not) corner of Aristotle's square of oppositions. The wide scope of negation over modals of possibility is one instance of this tendency.

5.1 Modal negation and Aristotle

If there are reasonable grounds for asserting that *might* is used to express not a modality of possibility, like *could* or *can*, but a modality of knowledge, then we will not be surprised when we find *might* behaving distinctly from the other modals of possibility or necessity. One context in which *might* proves exceptional is described in Laurence Horn's *Natural History of Negation* (Horn 1989).

In English, modal verbs contract with the negative particle:

could not	-->	couldn't
would not	-->	wouldn't
can not	-->	can't
must not	-->	mustn't
should not	-->	shouldn't
will not	-->	won't

with two notable exceptions, *may* and *might.* A peculiarity of contracted forms is the absence of narrow scope negation with the verbs of possibility: *can't* carries the sense of NOT-POSSIBLY, it does not carry the sense of POSSIBLY NOT. The negation of *can*, though it appears to follow *can* includes *can* in its scope. *I can't hand my thesis in today* means that it is not possible for me to hand it in today, it is necessary that I not hand it in today. With emphasis, the scope of the negative particle can be forced into place. *I can NOT hand my thesis in today, if I need to work on it over the weekend* means that it is not necessary that I hand it in today. This sentence is silent on whether I actually can hand it in today -- it would be true even if I couldn't hand it in today, if the first sentence were true. So according to the first sentence, I will definitely not be handing in my thesis. But the second sentence is vague on this point. It is silent on my ability or inclination, for that matter, to hand in my thesis today. It simply states that if I don't wish to hand it in, I don't have to, I am under no burden of necessity to hand in my thesis. The wide scope negation -- *can't* = not can -- tells us clearly what to expect. The narrow scope negation -- *can NOT* = can not -- appears to tell us less. It tells us what need not happen, what may happen, but not what will happen or will not happen.

Can't is the contradictory of *can,* yet, oddly, *mustn't* is not the contradictory negation of *must.* The contradictory negation of *must* is *not must*, which carries the sense of NOT NECESSARILY. But *mustn't* carries the sense of NECESSARILY NOT, the contrary negation of *must.* The scope of negation is narrow for *mustn't* -- it excludes the modal which precedes it. The scope of negation is wide for *can't* -- it includes the modal which precedes it.

Recall Kratzer's interpretation of deontic modals. *Mohammad mustn't leave* tells us specifically that, were the world to follow our prescriptions for it, Mohammad is not leaving. But *Mohammad NOT MUST leave* only tells us of a nonexistent pressure on Mohammad. It is silent on whether, were the world to follow our prescriptions for it, Mohammad will leave or not.

What is true of the negation of *must* proves to be true of all the other modals that carry the sense of necessity. *Shouldn't* means *should not, oughtn't* means *ought not.* The only contracted modal of necessity that takes wide scope negation is *needn't,* and since *need* does not belong to the syntactic category of modal verbs -- it does not combine with the bare infinitive *I need go** unless within the scope of negation *I don't think you need go,* it may be considered a negative polarity item and treated as a separate phenomenon (see Ross 1967, Horn 1971, 1989).

Similarly, what is true of *can't* proves true of *couldn't,* also a modal expressing possibility. These modals avoid the narrow scope of negation.

Horn notes that this is consistent with the general linguistic avoidance of basic forms that express the contradictory of **all** or **necessarily**. Recall Aristotle's squares of opposition:

<u>for quantifiers</u>

all	none
some	not all

<u>for modalities</u>

necessarily (not possibly not)	necessarily not (not possible)
not necessarily not (possibly)	not necessarily (possibly not)

The lower right corner of each square is underrepresented in linguistic forms in most languages (e.g., Horn 1989:260ff). English has the quantifiers *all/every, none, some/a* but no *nall* to mean not-all. We have *must* (upper left corner), *mustn't* (upper right corner), *can* (lower left corner) but no basic form for the lower right corner, since *can't* cohabits in meaning the upper right corner with *mustn't.*

5.2 Negation and quantifiers

Constraints on the lexicalization of quantifiers has been the subject of much study since Montague's innovative treatment of them (Montague 1974) as logically independent terms. Previously, logical expressions for quantified sentences were non compositional, relying on Frege's use of variables bound by abstracted quantifiers. Frege would translate *Every student left*

$$\forall x(\text{student } x \dashrightarrow \text{left } x)$$

which flies in the face of the constituent form of the English sentence. *Student* is there, and *left* is there, but where is *every*? Is it the operator ∀? the variable x? or the implication -->? *Every* has undergone a transformation from a linguistic constituent into a logical sentential form. By interpreting quantifiers as independent constituents, Montague not only allowed for a compositional logical treatment of language, but also opened the door to evaluating the mathematical properties of these constituents (Ladusaw 1971, Barwise and Cooper 1981, Keenan and Stavi 1987, Westerthal 1989).

Among the most linguistically interesting of these properties is *monotonicity* or the property of retaining truth under widening or narrowing contexts. If it is true that all dissertations are deadly boring, then it must be true that all dissertations are boring; *all* preserves truth despite the widening of the predicate from the set of deadly boring objects to the set of boring objects of which the deadly boring are a subset. *All* is upwardly monotonic with respect to the verb phrase. However, even if it is true that all long dissertations are boring, it need not be true that all dissertations are boring. *All* does not preserve truth when the noun phrase is widened, in this case from the set of long dissertations to the larger set of dissertations, of which long dissertations is a subset. On the contrary, if all dissertations are boring, then all long ones will be too. *All* is 'downwardly' monotonic on its 'left' argument and 'upwardly' monotonic on its 'right' argument.

If not all dissertations are boring, then not all dissertations are deadly boring, but not vice versa: *not all* is downwardly monotonic on its right argument. If not all long dissertations are boring then not all dissertations are boring and not vice versa. *Not all* is upwardly monotonic on its left argument.

down *ALL* up down *NONE* down

up *SOME* up up *NOT ALL* down

These simple mathematical properties have reflexes in natural language. Ladusaw, for example, observed that negative polarity items only occur in the scope of downward operators.

> Everyone who has ever written a dissertation enjoys it. (left down)
> *Everyone who has written a dissertation has ever enjoyed it. (right up)
> No one who has ever written a dissertation has ever enjoyed it. (left & right down)
> Someone who has ever written a dissertation has enjoyed it. (left up)
> Someone who has written a dissertation has ever enjoyed it. (right up)

The left-up, right-down combination is the underrepresented corner. Horn comments

> ...without a grounding in the pragmatics of scalar operators, B&C's approach to the constraints on quantifier lexicalization is ad hoc; worse still, it fails to generalize to modals and other nonquantificational values.
> (Horn 1989:265-6)

Following the scholastics, Horn refers to these interpretations as **A** (all, necessity), **E** (none, impossibility), **I** (some, possibility), and **O** (not all, possibly not). **A** and **E** are contraries, polar opposites

> **A** All dogs are smart
> **E** No dogs are smart / All dogs are not-smart

while **A** and **O** as well as **E** and **I** are contradictory

> **A** All dogs are smart
> **O** Not every dog is smart / Some dogs are not-smart
> **E** No dogs are smart / All dogs are not-smart
> **I** Some dogs are smart / Not all dogs are not-smart

That is, *all dogs are smart* and *not every dog is smart* cannot both be true; *no dogs* *are smart* and *some dogs are smart* cannot both be true; these are logical contradictions. *But some dogs are smart* and *some dogs are dumb* are not contradictory -- they may both be true, although they are polar contraries.

All these sentences can be expressed with negatives: *There are no dogs that are not-smart* is equivalent to *all dogs are smart.* But only the **A** and **I** corners can be expressed without negatives: *all are, some are.* One can get something close by using *stupid* or *dumb* for the **E** and **O** corners, but that does not yield equivalent sentences, since being not-smart does not entail being stupid. Again, smart and stupid are contraries, not contradictories. Smart and not-smart, stupid and not-stupid are the contradictory pairs. Some predicates, unlike *true* and *false* or adjectives in -*able* (Jespersen 1961), admit no range of values. Their contraries are contradictory. But many predicates do admit a range of values. There are smart dogs, dumb dogs and some neither particularly bright nor particularly dull, just in between, average dogs. The average dogs belong in the class of not-smart dogs. These dogs can be referred to using the contradiction of *smart,* namely, *not-smart,* which also includes the dumb ones.

5.3 Contraries contra contradictories

Language not surprisingly avoids this contradictory designation that throws the dumb in with some of the not-dumb, specifically the average ones. While the contradictory is simpler to calculate and manipulate, the contraries make more pragmatic sense. How useful would it be to have a linguistic form which designates a class of individuals -- the not-smart -- who are distributed among more than one salient class, the dumb and the average? Apparently, language accommodates the designation of clear defining characteristics of membership, not clear definitions of exclusion. It is not surprising that the property of being dumb is more valued by language for the purpose of characterizing than the symbiotic property of being not-smart. The class of not-smarts is privative. Smartness and dumbness are not.

This is not to say that contraries bear equal weight on the scale of values. It is well known that the scale of values discriminates against one end, perceived to be the bottom end. So we have the words length and height, but not *shorth*, *speedy* means fast not slow, intelligence is the gauge of mental capacity not dumbness. Negation, Horn notes, plays a role in this discriminatory favoritism. *Mohammad isn't too dumb* doesn't mean he's smart, but *Mohammad isn't too smart* is used to mean he's pretty dull if not stupid.

Nevertheless, the attribution of contrary character brings us closer to specific notions by narrowing the reference, whether to preferred or dispreferred referents or measures of value. The dumb have more character than the not-smart, the slender have a more specific character than the not-fat. Where logic prefers the set theoretically simple and easily manipulable, language prefers relevance and informativeness.

The tendency away from the contradictory does not end with quantifiers, modals and adjectives. It has a parallel in the avoidance of contradictory negations. Verbs expressing a scale of values, when negated, often express the contrary value -- the polar opposite -- rather than the contradictory range of values. *XiaoMei doesn't like Mohammad* typically means that XiaoMei dislikes Mohammad (polar opposite/contrary of like).

The logical negation of *like* in predicate calculus is *~like,* a term which covers both dislike and neutrality. If it is not the case that XiaoMei likes Mohammad, it may be because she dislikes him, but it may also be that she doesn't have any strong feelings one way or the other about him, that she has no decisive impression of him, or that she simply never met him. If I think vegetables are okay, I may not like them, but also not dislike them. But I cannot say I both like vegetables and think they are just okay without contradicting myself. The entire range of values not covered by *like* belongs to the predicate calculus negation of *like* for good reason. Contradictory negation is truth value preserving in a bivalent logic. So the negation of p will always be false if p is true and always true if p is false. Combined with other truth value preserving connectives, tautologies and contradictions can be stated simply:

> pv~p (tautology, always true)
> p&~p (contradiction, always false)

All the more interesting that this form of negation -- contradictory negation -- is not always preferred in language. Contrary / polar negation, which so often appears in language, is not truth value preserving in a bivalent logic. *XiaoMei likes Mohammad or XiaoMei dislikes Mohammad* is not a tautology because it could be that XiaoMei neither likes him nor dislikes him. The range of values in affixal negation is typically narrower than contradictory negation, expressing a contrary/polar range of values.

> ...*unjust* generally implies the opposite of *just*; *unwise* means more than *not wise* and approaches *foolish, unhappy* is not far from *miserable,* etc. Still, in most cases we have only an approximation...
>
> (Jespersen 1961)

5.4 Negative transportation

When such verbs as *seem, think, suppose, believe, intend,* are negated, the negation acts as though it applied not to these verbs, but to the lower clause. The phenomenon does not apply to all such verbs of belief: *know, realize, claim, hope,* *feel* can all be negated.

> Mohammad doesn't seem to be very smart
> = Md seems to be very not-smart
>
> XiaoMei doesn't think she can make it
> = XiaoMei thinks she cannot make it
>
> I don't suppose you will go
> = I suppose you will not go
>
> I don't intend to finish
> = I intend to not-finish
>
> Mohammad doesn't believe the court findngs
> = Mohammad disbelieves the court findings
>
> I don't know that XiaoMei left
> ≠ I know that XiaoMei didn't leave
>
> I didn't realize you needed help
> ≠ I realized you didn't need help
>
> Mohammad didn't claim you knew
> ≠Mohammad claimed you didn't know
>
> Mohammad didn't hope you'd die
> ≠Mohammad hoped you wouldn't die.

This semantic lowering of the negation onto the complement clause has been the object of long scrutiny under the name of 'neg raising'. The name derives from repeated attempts to demonstrate through examination of syntactic reflexes, that the negation originates in the lower clause and is raised by a syntactic derivation into the upper clause. One could, alternatively, view the phenomenon semantically as a lowering of the negative interpretation. I will use the expression negative transportation or negative transposition in order to remain theory-neutral.

At the beginning of the debate over the existence of negative transportation, Dwight Bollinger cast doubt on the semantic justification for the investigation. Comparing

I expect it not to happen
I don't expect it to happen

"The second, to me, signifies, 'I rather believe it won't happen.' The negative affects the main verb. The negation is milder"
(Quoted in Robin Lakoff 1969 from a letter to G. Lakoff)

Setting aside semantic justification, Lakoff presents Kajita's (also from a personal communication to her) syntactic evidence -- that negative polarity items are licensed in the lower clause by negation in the higher with these negative transporting verbs only:

I thought John wouldn't leave until tomorrow
I didn't think John would leave until tomorrow.
I said John wouldn't leave until tomorrow.
I didn't say John would leave until tomorrow.

To these she adds evidence from tag questions, which reverse the valence of the statement they are tagged onto, positive statements getting negative tags and vice versa. Yet

I don't suppose the Yankees will win, will they?
I don't suppose the Yankees will win, won't they?*

In support of a complex theory of syntactic predicate lowering, Seuren presents evidence suggesting that something more than mere neg-raising is at work. Sentences with transposed negatives resist contrastive stress:

I don't believe Tom has seen the problem, *Fred* does*
I don't *believe* Tom has yet seen the problem, I *know* it
I don't believe *Tom* has yet seen the problem,. I believe *Fed* has.
I don't believe Tom has yet seen the *problem*, I believe he has seen the *data*
I believe Tom has not yet seen the problem, not *Fred*
I *believe* Tom has not yet seen the problem, I can't say I *know* it.
I believe *Tom* has not yet seen the problem, not that *Fred* hasn't yet seen it.
I believe Tom has not yet seen the *problem*, not that he hasn't yet seen the *data.*
(Seuren 1974:187)

Though he doesn't bother to explore it, these data do not tell either for or against negative transportation but for the ability to stress in a negative context. Replacing the negative transporting verb *believe* with the non transporting verb *hope* gets the exact same results:

> *XiaoMei* doesn't hope Tom has seen the problem, Mohammad does.*
> *XiaoMei* hopes Tom has not yet seen the problem, not *Mohammad*.

Similarly with the other sentences, although one might want to quibble with Seuren's judgements for many of them, the judgements will not vary from the *believe* examples to those with *hope*.

Negative transportation is not peculiar to English. Horn provides this example from Tobler to whom he attributes the first systematic treatment of the phenomenon:

> Ich will nicht, dass man mir dergleichen hinterbringe.
> I do not want to be told about such things

and this from Kalepky's thesis on negation in Old Provencal:

> Ja non degra dir ver esquern
> He not should scorn (meaning, He should not scorn)

and Martinon (1927), who notes that the neg raised

> Je ne veux pas que vous sortiez
> I don't want you to leave (meaning, I want you not to leave)

has replaced the sentence with the negation in its semantically rational position

> Je veux que vous ne sortiez pas*

Horn takes issue with Epstein's (Epstein 1976) surmise that such replacement provides an explanation. Epstein asserts that because

John wants not to kiss Mary

is not available,

John doesn't want to kiss Mary

has filled the expressive vacuum. However, Horn notes, there are sentences in which the in-place negation is available and yet the transposed negation is still used:

John doesn't want me to kiss Mary (transposed)
John wants me not to kiss Mary (in place)

Likewise Horn rejects the generative contention that neg raising is a syntactic rule since the transpostion is not meaning preserving. There is, as Bollinger and Jespersen had already remarked, a gradient of approximation in meaning between raised and in-place negatives:

I think she's sad
I think she's unhappy
I think she's not happy
I think she isn't happy
I do not think she's happy.
I don't think she's happy
(Horn 1989:316)

Horn judges these as successively weaker, although the last appears to me to have a use in which it is stronger than the three which precede it, giving support to any thesis which identifies neg raising with morphological processes like contraction. There is a casual use of *I don't think she's happy* which is just an indirect way of saying *I think she's sad/unhappy. I do not think she's happy* has no such use since it is not a casual locution. But there may be contexts in which it too can be used to express *I think she is unhappy*, where the context calls for greater circumlocution, for example. Such variances of judgment suggest that the push toward negative transposition is pragmatic, not syntactic.

What unites all these phenomena is the shift toward the contrary. Horn gives the following generalization

> Contrary negation tends to be maximized in natural language.
> Subcontrary negation tends to be minimized in natural language.
> (Horn 1989:330)

But the haunting question is why? Throughout his book, Horn describes the shift to the contrary as a "strengthening". How is a contrary stronger than a contradictory or a subcontrary?

One salient difference is the degree of univocality. Having a positive thought about something and having a negative thought about something are both instances of having a thought. Not having a positive thought about something is ambiguous. It may indicate a state of having no thoughts on the subject at all, or the state of having only a negative thought on it.

> Mohammad thinks you should go
> Mohammad thinks you should not go
> Mohammad doesn't think you should go

If the last sentence is read off its surface structure with *think* in the scope of negation, it expresses a meaning that covers two cases, both of which are significant. If you are seeking advice from Mohammad on whether to go or not, it is mighty relevant whether Mohammad thinks you should not go or whether he has no opinion at all. The contrary interpretation, in which the negation has scope only over the lower clause, is stronger in the sense that it is unambiguous. Its meaning provides you with the advice you need -- don't go.

Similarly, *unhappy* could range over the not-happy and the sad all the way to the downright miserable, but it is strengthened in just this sense of univocality towards the sad to the exclusion of the merely not-happy. In the case of quantifiers, a word meaning *not all* would be vague, covering both *some-but-not-all* and *none*. It is true that the quantifier *some* expresses a similar vagueness, since *some are* doesn't exclude the possibility of *all are*. But *some* has existential import and is an affirmative. Without *some* we'd be stuck with *not none* a double negative even more obtuse than *not all.* Negation is itself a complex property -- a negation must be a negation of some positive, somewhere down the line. Among negations, it appears that language prefers univocality for its simplicity. It is this simplicity that is carried over onto the modals.

Must not, should not, will not, would not are all univocal and simple. They correspond to the **E** corner of the Aristotelean square. *Can not* and *could not* in their surface interpretations would not be univocal.

> Mohammad can not go, if he really is set on staying

is silent on whether he can go or can't. Where the question is whether you can or can't go, the statement that it is possible for you not to go is just irrelevant. Unfortunately, in English, there is no alternative formation

> I not can go
> Mohammad not can go

This is just a bald fact of English syntax. Yet this structure is the relevant one for most common practical discourse.

Supposing this explanation is correct, where does *might* fit in? If *might not* (narrow scope) is an **O** form, shouldn't it too contract into the **E** form as *can't* and *couldn't* do? Or if *might not* isn't an **O** form like *can NOT* (narrow scope) and *could NOT* (narrow scope), why not? Or is it that *not might* is not an **E** form? The next section will look at these questions.

Chapter 6 *might*

6.0 Introduction

This chapter presents and examines possible interpretations of the meaning of *might.* The evidence presented in the foregoing chapters establishes that *might* cannot express simple possibility but must express at least contingency. However, simple contingency interpretation must be discounted: contingency is just a conjunction of *possibly* and *possibly not*, and modal expressions of each of these can be placed in realization conjunctions, yet *might* resists realizations both in the negative and the positive. *Can and will* and *can but won't* show that possibility is consistent with either actuality or the denial of actuality. *Might and will, might but won't, might but will* and *might and won't*, all are inconsistent.

Metalinguistic negation provides a *prima facie* explanation of why wide scope negation over *might* is ambiguous. Possibilities can be denied by assertions of actuality in realization conjunctions on the conversational grounds that possibility is not strong enough to express actuality. Wide scope negation over *might* would then be ambiguous between *might not because actual* and *might not because not actual.* But if this were the source of the ambiguity of *might* under negation, then *can* and *could* would also be ambiguous in exactly the same way. But *can* and *could* do not resist realization conjunctions and are not ambiguous.

The evidence of realization conjunctions points, therefore, to an epistemic interpretation of the meaning of *might, might* as the expression of *uncertainty* or *anepistemic modality.* The formalism of this interpretation is presented through the modal logic of belief developed by Hintikka and Karttunen.

6.1 *might* as a modality of contingency

One possible theory of the meaning of *might* holds that *might* differs from modals of possibility because it expresses contingency, not just possibility. On this theory, *Mohammad might jump* doesn't just mean that jumping is possible, but that jumping is also not actual and not necessary. *Mohammad might jump* is a way of saying, maybe he'll jump and maybe he won't (only his psychiatrist knows for sure).

As a contingeny, *might S* could be notated as *<possible S & possible ~S>*. The wide scope negation of <possible S & possible~S> is ambiguous since it will be validated by the negation of either of the inner conjuncts. So the wide scope negation *Mohammad might not jump,* under this analysis, could mean either that it is not the case that Mohammad might jump because he definitely will or it is not the case that Mohammad might jump because he definitely won't. This analysis neatly explains why the scope of negation is not wide. Negation could not be raised into the wide scope position, following the observations of the previous chapter, because that position over *might* in this analysis is ambiguous, and the only motive for negative transposition is the avoidance of equivocality (ambiguity or vagueness).

There is some intuitive plausibility to such a theory. All evidence supports the incompatibility of *might* with the actual as well as with the necessary. If I know that hydrangeas grow here, I can still say *hydrangeas can grow here,* but it would be odd for me to say *hydrangeas might grow here.* As noted earlier, the actual must be possible, and potentia -- skills or abilities, for example -- do not lose their status as possibilities when they happen to be practiced and actualized. The possible, as in the case of *can*, must be consistent with the actual, but the actual need not be contingent.

This theory, for all its intuitive plausibility, is fatally flawed. The basic data of realization conjunctions under negation is incompatible with it. I can say

Mohammad can jump but he won't
Mohammad can jump and he will

because the possibility of his jumping is not incompatible with (the prediction of) the actuality of either his jumping or his not jumping. Yet

Mohammad might jump but he won't
Mohammad might jump and he will

are both inconsistent. To explain this one would have to assume that the contingent is incompatible with the actual. Yet the actual certainly admits of alternate possibilities to it. The actual is no more incompatible with the possibly-not than with the possible. It is only the necessary that is strictly incompatible with the contingent. It is, however, true that the knowledge of the actual is inconsistent with knowledge of the contingent. This will be the basis for an accurate interpretation of *might* as anepistemic.

A theory of *might* should relate these three phenomena:

1. Modals of possibility are equivocal when negation is narrow
2. Equivocal negation induces (semantic) negative transposition where the transposed form is univocal
3. Univocal negations only may contract

The hypothesis that the three facts about *might* are related can be satisfied by a simple non epistemic probability interpretation of *might*. The non epistemic probability analysis satisfies these:

1' *might not* with narrow construal is equivocal but
2' *NOT might* (wide scope) is ambiguous
3' *might* cannot contract because its transposed form is not univocal

6.2 *might* as a modal expressing non-epistemic probability

There is another problem with the contingency approach to *might* that suggests that *might* is equally weighted between *possibly S* and *possibly ~S.* Use is not so even handed. Often *might* is used to convey likelihood:

A: Will we see you there?
B: I might go (indicating that your expectations should be accommodated to my going)
B: I might not go (indicating that expectations should be accommodated to my not going)

The degree of likelihood is context dependent

A: You are definitely not going to be there --?
B: I *might* go. Don't count me out.
B: I might not go -- I didn't say I would definitely not go.

If we take *might* to indicate a chance ranging from the slim to the likely, the analysis of negated *might* introduces another ambiguity*. Mohammad might not vote for XiaoMei* when analysed as *Mohammad maybe will not vote for XiaoMei* is no more vague than *Mohammad might vote for XiaoMei* and is more relevant and perspicuous than *Mohammad can NOT vote for XiaoMei* since, where the question is whether Mohammad will vote for XiaoMei or not, the assertion that he has the ability to not-vote for her (can NOT) is completely silent as to his ability to vote for her, whereas the assertion that he maybe will not vote for her (might NOT) either pragmatically implies or directly entails -- depending on the theory -- that he maybe will vote for her. That's not silence, it's an irrelevant and equivocal diversion.

If, on the other hand, *might not* were a negative-transposed structure the sentence would be analysed as

Mohammad not maybe will vote for XiaoMei

This structure is ambiguous. Suppose, for ease of exposition, we interpret *might* here as meaning *likely*. Does the sentence mean that it is not likely that Mohammad will vote for XiaoMei because it is certain he won't or because it is certain he will?

There is a flaw in such an interpretation. If metalinguistic negation is called upon to explain the patterning of *might,* then it should bear on the patterning of *can* and *could* as well. Why can't one say, using metalinguistic negation *I can't go because I will* meaning, it's not the case that I CAN go, I WILL go. Yet we know that metalinguistic negation is not naturally available for these negated modals.

There are, then, two problems with the non-epistemic probability interpretation of *might*: It fails to distinguish *might* from the other modals of possibility, and it presents a problem equal to that which it purports to solve, namely, why don't all the modals of possibility not allow metalinguistic negation.

Recall Seuren's interesting data showing that stressed forms are not welcomed by negated verbs.

I don't believe John already saw the problem, *Fred* does etc.

If Seuren's judgements are right, then the non-epistemic contingency theory cannot be correct since the prohibition against metalinguistic negation in these contexts -- whatever its cause -- is not restricted to *can* and *could*. And this is just what we would expect from the conjunction data of chapters two and three, to which can be added:

I might not go out tonight, I will go*
I might not go out tonight, I won't go.*

Something remains to be said for the non-epistemic contingency interpretation. Although the negative-transposed version appears, from the above consideration, not to be equivocal, it is nonetheless uncertain, just as the narrow scope reading is, though not to the same degree. *It is probable that not S* and *it is not probable that S* are contradictories:

> It is probable that you will not like it
> (asserts a probability -- bets are on not-liking)
> It is not probable that you will like it
> (denies probability -- bets are off all around, liking or not liking)

If uncertainty were the determining element in semantic negative-transposition or contraction, the fact that both narrow and wide scope are uncertain could bear explanatory force.

6.3 *might* anepistemic

Recall that a theory of modals should account for the following three facts

1. *Might* does not undergo not contraction
2. *Might not* does not force wide scope negation
3. *Might* resists realization conjunctions

A theory is neat that relates all these together. Here is one.

Suppose *might* is not a modal of possibility but an epistemic modal, a modal expressing the state of knowledge of the speaker. In particular, suppose *might* expresses a lack of knowledge. If I know that Mohammad is going, I would have to violate a principle of conversational cooperation to utter *Mohammad might go* because I know more than that he might, I know he will. *Mohammad might go* doesn't mean he can go, or that he would go but can't. It is not primarily about real world possibility. It means that to the best of my knowledge, based on what I know

now about Mohammad's state of mind, or about his abilities, or about circumstances beyond his control, there is a good chance that he will go, though there is also a chance remaining that he will not, and I cannot tell for sure which will happen.

The story of *might* is not completely explained by either the possible worlds analysis of Stalnaker-Lewis or Kratzer's situations and lumps or Rohrbaugh's events, but in the logic of knowledge and belief which has been formalized by Jaakko Hintikka (1962) and adapted to linguistic theory by Karttunen (1972).

Hintikka's system relies on possible alternative states of affairs. Uttered by a speaker *a*, a sentence "it is possible that p" ("$P_a p$") can be interpreted relative to possible alternatives:

> Let us suppose that μ is a description of a possible state of affairs; and let us suppose that "$P_a p$" ∈ μ. In more intuitive terms, let us consider a state of affairs in which it is true to say that it is possible, for all that the person referred to by the term *a* knows, that *p*. Clearly the content of this statement cannot be adequately expressed by speaking of only one state of affairs. The statement in question can be true only if there is a possible state of affairs in which *p* would be true: but in this state of affairs need not be identical with the one in which the statement was made. A description of such a state of affairs will be called an *alternative to μ* with respect to *a*...Hence we have to impose the following condition on a model set μ:
>
> If "$P_a p$" ∈ μ , then there is at least one alternative μ* to μ (with respect to *a*) such that *p* ∈ μ*.
>
> (Hintikka 1962:42)

This is the familiar strategy of a possible worlds treatment of modality with the explicit added reference to the speaker. Relativized to speakers' knowledge, Hintikka follows with some conditions

> ...we required that it is possible, for all that the person referred to by the term *a* knows, that *p*. Hence everything he knows in the state of affairs described by μ he also has to know in the alternative state of affairs described by μ *.
>
> (Hintikka 1962:43)

and

> It is obvious that the following condition has to be imposed on model sets:
> (C.K.) If "$K_a p$" $\in \mu$, then p $\in \mu$.
>
> (Hintikka 1962:43)

That is, in a given circumstance, if I know p, then p is true in that circumstance. More narrowly, if I assert that I know p, then I am asserting the truth of p itself. This is the condition which accounts for the factivity of the verb *know*, although Hintikka limits the strength of the factive. In English *know* is presuppositional. *Mohammad knows that XiaoMei is dangerous* and *Mohammad doesn't know XiaoMei is dangerous* both presuppose *XiaoMei is dangerous.* But for Hintikka $\sim K_a p$ does not entail p. Karttunen suggests the following translation

> $\sim K_a p$= what *a* knows is not that p
>
> (Karttunen 1972:9)

Other conditions complete the definition of knowledge in terms of possibility: if I don't know p in a state of affairs, then I can assert that ~p is possible; if I can assert that p is not possible in a state of affairs, then I know ~p in that state of affairs. So not knowing something is tantamount to acknowledging that its negation is at least possible. Here it should be remarked that *know* is not being used to mean *aware of.* English *know / don't know* affords the speaker the third option between knowing the truth of a proposition and admitting the possibility of the truth of its negation, namely, not knowing its truth in the sense of not being aware of the proposition at all. In this last sense of *know* the speaker is not logically required to admit the truth of the negation of the unknown proposition, in fact it is unlikely that she would be aware of the negation, not being aware of the proposition itself.

More peculiar in Hintikka's system is the condition that any propostion the speaker claims to know, she must know in all alternative states of affairs:

> If "$K_a q$" $\in \mu$ and if μ^* is an epistemic alternative to μ (with respect to a) in some model system, the "$K_a q$" $\in \mu^*$.
>
> (Hintikka 1962:170)

Karttunen offers the following justification:

> The interesting point is that in ordinary language, simple unqualified, nonmodal statements, such as *It isn't raining in Chicago,* carry with them an implicit claim *I know that it is so,* from which it follows that the speaker may not simultaneously admit that it might not be so without violating the rules of discourse. That is, simple declarative statements ought to be not just true, but epistemically necessary for the one who utters them.
>
> (Karttunen 1972:11)

In Hintikka's system Karttunen finds the explanation for why it is that discourse seems to follow the rule, contrary to classical modal logic

> *Whatever is cannot possibly be otherwise.*

No one says, for example,

> *It isn't raining in Chicago, but it may be raining there

although that it is raining in Chicago is not a logical necessity. This phenomenon is distinct from the Gricean conversational rule of quantity by which offered information is interpreted as complete: the actual and the possible are mutually exclusive, saying that it may be raining implies that the speaker has no better relevant knowledge. But Karttunen's rule covers a semantic phenomenon. If you state that it is raining in Chicago, you are likely to assent, albeit grudgingly, to the question *Then it is possible that it is raining in Chicago?* But you will not assent to the question *Then it is possible that it is not raining in Chicago?* Your answer to this question will be "No, I said it is raining in Chicago" or "No, I know it is raining in Chicago." The adducing of ones knowledge into the argument against the possibility that circumstances might be otherwise further supports the Karttunen-Hintikka contention that when a speaker asserts a proposition, she implies that she knows that proposition to be true, unless she states otherwise.

Karttunen points out that Hintikka's strong position on knowing is borne out by this contrast also

> I think it isn't raining in Chicago, but it may be raining there.
> *I know it isn't raining in Chicago, but it may be raining there.

How does Hintikka's modality of knowledge and belief apply to *might*? Recall that Kratzer, following the common understanding of Lewis and Stalnaker, interprets *might* as meaning *for all the speaker knows ___ is possible,* that is, *might* for these writers is indistinguishable from epistemic *could* or *can*. But non-epistemic *could* and *can* concern positive assertions regarding what is possible. Not so with *might*. The non-epistemic sense of *might* concerns not what is possible but what is likely to some degree.

In the non-epistemic sense, *Hydrangeas can grow here* means that physical circumstances will permit hydrangeas to grow here. In terms of possible worlds, there is some world close to the real world in which hydrangeas grow here. The real world is in fact included among these possible worlds: there is nothing wrong with saying, *Hydrangeas can grow here -- indeed there are some growing right there.* There is a Gricean conversational implicature imparted by the maxim of quantity that *can* excludes *is*. But this is in the pragmatics, and, of course, the implicature, as the preceding sentence demonstrates, is defeasible.

Hydrangeas could grow here means, in the non epistemic sense, that were certain conditions to prevail -- were there more water, were there someone to attend to the gardening, were someone to plant the seeds or bulbs -- hydrangeas would grow here. In terms of possible worlds, there is some world, excluding the real world and removed from the real world by some property or circumstance, but otherwise close to the real world, in which hydrangeas are growing here. **Hydrangeas could grow here -- indeed there are some growing right there* only works if, seeking proof that the first sentence is true (Hydrangeas could grow here) the speaker suddenly discovers after having stated the first sentence, the presence of the hydrangeas "right there". It would be equally odd to follow up that sentence with *See, hydrangeas could grow here!* Rather, it seems that the natural response would shift from *could* to *can*

> Hydrangeas could grow here. Indeed, look, some are growing right there!
> You see, hydrangeas *can* grow here!

In both these modals, *can* and *could*, the speaker can assert knowledge of some possible world in which hydrangeas grow. With *can,* that world may be the real world; with *could* that world differs in specifiable regards from the real world, but accommodating those differences, that world is accessible.

In the non-epistemic sense, *Hydrangeas might grow here* asserts something even more remote. No matter how many conditions are stipulated and met, *Hydrangeas might grow here* only guarantees a *chance* that those conditions will suffice for the growing of hydrangeas here. In terms of possible worlds, the speaker intends that conditions *are* such or *could be* such that there is a probability greater than 0 and less than 1 that there is a world close to the real world with respect to these conditions in which hydrangeas grow. Note that the conditions cannot be null, since the real world is not included in the probable worlds. But the conditions could be utterly minimal. The remoteness is created by probability, or more perspicuously, by the lack of certainty:

I know that hydrangeas might be growing here

remains uncertain. Uncertainty is a direct matter of knowledge. Possibility, on the other hand, may be epistemic, but it can also be relativized factuality, that is, the factual conditions under which the possible would be actual can sometimes be the grounds for the assertion of "possible S".

There is a difference, then, between degrees of likelihood and degrees or distances of possibility. Probability is a wager in ignorance. Possibility includes conditional or counterfactual knowledge. *Could* and *can* are modalities of such factual conditional and counterfactual possibility which also can be used as epistemic modalities in which the conditions are known. *Might* is not a modal of factual possibilities, nor is it a typical epistemic modal. It is an *an*epistemic modal, a modal of ignorance, a specific and peculiar subtype of epistemic modality.

6.4 Formalities

Consider the following rules.

Can
Can S is true in a world w iff there is some accessible world w' accessible from w in which *S* is true

Could
Could S is true in a world w iff there is some world w' meeting both of the following conditions
(I) w' is accessible from w and
(ii) w'≠w
in which *S* is true.

Might
Might S is true in a world w iff there is some world w' and some world w" such that
(I) w' is accessible from w
(ii) the probability that w" is accessible from w' is >0 and <1
(iii) *S* is true in w"

It will be understood that (ii) implies that w' and w" are distinct.

These rules may suffice for some aspect of the meaning of *can* and *could*, adequate to account for our dialogues

A: Hydrangeas can grow here.
B: Oh look! There's one right there!!
A: You see, Hydrangeas CAN grow here!

A: Hydrangeas could grow here.
B: Oh look! There's one right there!!
A: You see, Hydrangeas CAN grow here!*

A: Hydrangeas might grow here.
B: Oh look! There's one right there!!
A: You see, Hydrangeas MIGHT grow here!*

but the rule for *might* doesn't prohibit

I know that hydrangeas might grow here.
I might go and I will
I might go and I won't
I might go but I will
I might go but I won't

Another way to interpret *might* is to combine accessibility among possible worlds with explicit reference to knowledge.

Might
Might S = $\sim K_a S \ \& \ P_a S$

According to this rule, the *I know that* which can be prefaced to *can* and *could* sentences can now also be prefaced to a *might* sentence without harm, since its representation will be

I know that a) I don't know that S and b) possibly S

This rule shifts away from probability of access to a possible world to explicit uncertainty. This shift also affords a solution to the non contraction problem.

Recall the problem as presented by Horn -- O forms are eschewed in natural language because they are interpretively weak or vague or lacking in specificity. *Possible not* fails to address what is most pertinent in the exchange of information, concrete assertion, whereas *not possible* is explicit with regard to all cases. Narrow scope negation of *could S* and *can S* are O forms providing the least relevant information. The wide scope negations of *couldn't* and *can't* translate into *not possible* providing the most information available with respect to possibility. The negation of *might S*

$$\sim(\sim K_a p \ \& \ P_a p)$$

as the negation of a conjunction is ambiguous. It is true in case

$$\sim P_a p$$

but it is also true in case

$$K_a p$$

In other words, *not might S* means either that the subject knows S is true or it means that S is not possible (both conjuncts could be false too, but only in an inconsistent world -- or mind -- in which p and ~p were both true). These are not only distinct cases, they are radically different meanings. It should be no surprise, then, that wide scope negation is not an option for *might.*

Narrow scope of *might not* translates into *might ~S*

$$\sim K_a \sim p \ \& \ P_a \sim p$$

which is just what *might S* means in English. This form is vague -- it is an O form -- but it is not ambiguous. Furthermore, it means exactly what *might S* means, since

$\sim K_a \sim p$

implies

$P_a p$

which, as Hintikka maintains, is only epistemically defensible if its utterer also believes

$K(P_a p)$

Hence there is no vagueness lost in the narrow scope negation of *might.* This is not true with *can* and *could.* To say *can S* is to claim that there is a world in which S is true. It does not imply that the utterer believes that there is also a world in which S is false. *Could S* means that where certain conditions hold, S may be true. It does not imply that there is also a world in which those conditions hold but S does not. But *might* clearly has this dual nature *I might go* can be used as well to hedge on an invitation as to encourage one.

A: So you're coming with us?
B: I might go
A: So you won't be coming with us?
B: I might go

The role of context in the interpretation of *might* is crucial, and deserves a study of its own.

6.5 Summary

This study purports to answer several questions through the analysis of logical structure of *might*: Why doesn't *might* pattern with the other modals of possibility under negation? Why does *might* resist realization conjunctions? and more generally, Why are forms expressing *not necessarily* and *not all* (Aristotle's O corner in his square of oppositions, see chapter 5:129ff) dispreferred syntactically, morphologically and semantically?

From realization conjunctions it may be concluded that *might* expresses uncertainty, not just possibility or even just contingency. That *might* expresses uncertainty is not a new observation. Palmer (1979) describes *might* as *tentative*, and Coates (1983) describes it as *epistemic possibility.* The realization conjunctions show something that is, I believe, a little bit stronger: that uncertainty is not just a different kind of possibility, but is fundamentally distinct in its entailments. It is not a mere difference in conversational implicature as is the case with the modals of simple possibility -- the second conjunct of *I can and I do/must* effectively cancels any implicature which excludes actuality or necessity from the meaning of the modal of possibility. Realization conjunctions confirm Grice's original observation that possibility, because it is on a scale with necessity, excludes necessity, thereby including *possibly not* in the use of *possibly*, and providing the cancellable implicature of contingency.

Such cancellation is not possible with *might.* The distinction between *might* and the other modals of possibility must therefore be a part of its semantics, not the pragmatics of its use. It is reflected in its logical structure, and it is the logical structure that holds the key to all the other questions addressed here. Taking the logical structure of *might* to contain a conjunction of at least an assertion of possibility and a denial of knowledge, it is now possible to identify the reason why wide scope of negation, typical of auxiliaries expressing possibility, does not characterize *might* under negation. The negation of a conjunction is ambiguous, and ambiguous in an informationally crucial way. This in turn suggests that the reason negations of necessity and universality (the O corner of Aristotle's square of oppositions) are underrepresented in language is that they are, like the negation of *might,* informationally weak, either vague or, as in the case of *might,* ambiguous.

When Aristotle wrestled with the modality of possibility, exacting from it two notions, simple possibility consistent with necessity, and contingency, inconsistent with necessity, he did not consider either of these to be essentially epistemic. Later logicians and linguists have interpreted the whole of modality to be essentially epistemic. But realization conjunctions also suggest that there is a distinction to be made between the essentially epistemic mode of uncertainty, or linguistic probability, and modals of simple possibility. The power of the analysis of the logical structure of *might* to explain linguistic patterns demonstrates that the modality of knowledge plays a role in the development of linguistic forms.

BIBLIOGRAPHY

Allwood, J., L. Andersson and O. Dahl 1977 *Logic in linguistics.* Cambridge: University Press.

Aristotle 1938 *Categories, On interpretation, Prior analytics.* H.P.Cooke, and H. Tredennick trans. Cambridge, Mass.: Harvard University Press.

Bar-Lev, Z. and A. Palacas 1980 "Semantic command over pragmatic priority," *Lingua* 51:137-146.

Barwise, J. and R. Cooper 1981 "Generalized quantifiers and matural language," *Linguistics and philosophy* 4:159-219.

Bendix, E. 1971 "The data of semantic description," in D. Steinberg and L. Jakobovits, eds., *Semantics: An interdisciplinary reader in philosophy, linguistics and psychology.* Cambridge: University Press.

Bierwisch, M. and K. Heidolph eds. 1970 *Progress in linguistics.* The Hague: Mouton.

van Bentham, J. 1984 "Questions about quantifiers," *Journal of symbolic logic* 49:443-466

Blakemore, D. 1989 "Denial and contrast: a relevance theoretic analysis of *but,*" *Linguistics and Philosoophy* 12:15-37.

Bybee, J., R. Perkins and W. Pagliuca 1994 *The evolution of grammar:Tense, aspect and modality in the languages of the world.* Chicago: University Press.

Chierchia, G. and S. McConnell-Ginet 1990 *Meaning and grammar: An introduction to semantics.* Cambridge, Mass.: MIT Press

Chomsky, N. 1957 *Syntactic structures.* The Hague: Mouton.

Coates, J. 1983 *The semantics of modal auxiliaries.*London: Croom Helm.

Cohen, L. 1971, "Remarks on Grice's analysis of logical particles in natural language," in Y. Bar-Hillel, ed., *Pragmatics of natural languages,* 50-68. Dordrecht: Reidel.

Cole, P. and J. Morgan eds. 1975 *Syntax and semantics 3: Speech acts.* New York: Academic Press

Cushing, S. 1976 *The formal semantics of quantification.* Unpublished dissertation, UCLA.

Dascal, M. 1977 "Conversational relevance," *The Journal of pragmatics* 1:309-27.

Dascal, M. and T. Katriel 1978 "Between semantics and pragmatics: The two types of 'but' -- Hebrew 'aval' and 'ela'," *Theoretical linguistics* 4: 143-72.

van Dijk, T. 1977 *Text and context: Explorations in the semantics and pragmatics of discourse.* New York: Longman.

Ducrot, O. and T. Todorov 1972 *Dictionnaire encyclopedique des sciences du langage.* Paris: Editions du Seuil.

Edgington, D. 1995 "On conditionals," *Mind* 104:235-329.

Epstein, S. 1976 *Investigations in pragmatic theory.* Dissertation, UC San Diego.

Fillmore, C. and D. Langendoen, eds., 1971 *Studies in linguistic semantics.* New York: Holt, Rinehart and Winston.

Fitch, F. 1949 "The problem of the Morning Star and the Evening Star," *Philosophy of science* 16:131-141.

Fitting, M. and R. Mendelsohn 1998 *First order modal logic.* Boston: Kluwer Academic.

Frege, G. 1952 *Translations from the philosophical writings of Gottlob Frege.* P. Geach and M. Black eds. Oxford: Blackwell

Frege, G. 1972 *Conceptual notation and related articles.* T. Bynum, trans. & ed. Oxford: Clarendon.

Frawley, W. 1992 *Linguistic semantics.* Hillsdale, New Jersey: Lawrence Earlbaum

Gazdar, G. 1979 *Pragmatics: Implicature, presupposition and logical form.* New York: Academic Press.

Geis, M. 1973 "*If* and *unless,*" *CLS* 8:231-53.

Gleitman, L. 1965 "Coordinating conjunctions in English." *Language* 51:260-93.

Goodman, N. 1947 "The problem of counterfactual conditionals," *Journal of philosophy* 44:113-28. Reprinted in Jackson 1991.

Grice, H.P. 1975 "Logic and conversation" in P. Cole and J. Morgan eds. *Syntax and semantics 3: Speech acts* 41-58. New York: Academic Press.

Grice, H. 1989 *Studies in the way of words.* Cambridge, Mass.: Harvard University Press.

Haak, S. 1978 *Philosophy of logics.* Cambridge: University Press.

Hintikka, J. 1962 *Knowledge and belief.* Ithaca: Cornell University Press.

Hoeksema, J. 1986 "Monotonicity phenomena in natural language," *Linguistic analysis* 16:25-40.

Horn, L. 1971 "Negative transportation: Unsafe at any speed?" *CLS* 7:120-33.

Horn, L. 1985 "Metalinguistic negation and pragmatic ambiguity," *Language* 61:121-74.

Horn, L. 1989 *A natural history of negation.* Chicago: University Press.

Horn, L. and S. Bayer 1984 "Short-circuited implicature: A negative contributuon," *Linguistics and philosophy* 7:397-414.

Hughes, G.E. and M.J. Cresswell 1968 *An introduction to modal logic.* London: Methuen.

Jackson, F. 1987 *Conditionals.* Oxford: Blackwell.

Jackson, F. ed. 1991 *Conditionals.* Oxford: University Press.

Jespersen, O. 1965 *A modern English grammar on historical principles.* London:Allen & Unwin.

Jespersen, O. 1965 *The philosophy of grammar.* New York: Norton. Originally published in 1924, London: Allen & Unwin.

Kamp, H. 1973 "Free choice permission," in *Proceeding of the Aristotelean Society* 74. London: Methuen.

Karttunen, L. 1972 "Possible and must," in J. Kimball ed., *Syntax and semantics1*, New York: Seminar Press.

Karttunen, L. and S. Peters 1979 "Conventional implicature," in C. Oh and D. Dinneen, eds., *Syntax and semantics 11: Presupposition.* New York: Academic Press.

Katz, J. 1972 *Semantic theory.* New York: Harper & Row.

Katz, J. 1984 "An outline of Platonist grammar," in T. Bever, J. Carroll, and L. Miller, eds., *Talking minds: The study of language in cognitive science.*Cambridge, Mass.: MIT Press.

Katz,J. 1990 *The metaphysics of meaning.*Cambridge, Mass.: MIT Press.

Keenan, E. and J. Stavi 1987 "A semantic characterization of natural language determiners," *Linguistics and philosophy* 9:253-326.

Kiparsky, P. and C. Kiparsky 1970 "Fact," in M. Bierwisch and K. Heidolph, eds., *Progress in linguistics,* The Hague: Mouton.

Kneale, W.C. and M.H. Kneale 1962 *The development of logic.* Oxford: University Press.

Kratzer, A. 1977 "What 'must' and 'can' must and can mean," *Linguistics and philosophy* 1:337-55.

Kratzer, A. 1989 "An investigation into the lumps of thought," *Linguistics and philosophy* 12:607-53.

Kratzer, A. 1991 "Modality," in A. von Stechow and D. Wunderlich, eds., *Semantics: An international handbook of contemporary research.* Berlin: Walter de Gruyter.

Kripke, S. 1963 "Semantical considerations on modal logic," *Acta philosophica fennica* 16:83-94.

Ladusaw, W. 1980 *Polarity sensitivity as inherent scope relations.* New York: Garland.

Lakoff, G. 1971a "The role of deduction in grammar," in C. Fillmore and D. Langendoen, eds., *Studies in linguistic semantics.* New York: Holt, Rinehart and Winston.

Lakoff, G. 1971b "Presupposition and relative well-formedness," in D. Steinberg and L. Jakobovits, eds., *Semantics: An interdisciplinary reader in philosophy, linguistics and psychology.* Cambridge: University Press.

Lakoff, R. 1969 "A syntactic argument for negative transportation," in *CLS* 5:140-7.

Lakoff, R. 1971 "*If*s, *and*s and *but*s about conjunction," in C. Fillmore and D. Langendoen, eds., *Studies in linguistic semantics* 115-150. New York: Holt, Rinehart and Winston.

Levinson, S. 1983 *Pragmatics.* Cambridge: University Press.

Lewis, C. I. and C. Langford 1932 *Symbolic logic.* New York: Dover.

Lewis, D.1968 "Counterpart theory and quantified modal logic," *Journal of philosophy,* 65:113-26.

Lewis, D. 1973 *Counterfactuals.* Cambridge, Mass.:Harvard University Press.

Lewis, D. 1979 "A problem about permission," in E. Saarinin, R. Hilpinin, I. Niiniluoto and M. Hintikka, eds., *Essays in honor of Jaako Hintikka.* Dordrecht: Reidel.

Linsky, L.1969 "Reference, essentialism and modality," *Journal of philosophy* 66:687-700.

Linsky, L. ed. 1971 *Reference and modality.* Oxford: Oxford University Press.

Loux, M. ed. 1979 *The possible and the actual.* Ithaca: Cornell University Press.

Martinon, P. 1927 *Comment on parle en français.* Paris: Larousse.

McCawley, J. 1981 *Everything that linguists have always wanted to kinow about logic* but were ashamed to ask.* Chicago: University Press.

Merin, A. 1991 "Imperatives: Linguistics vs. philosophy," in *Linguistics* 29:669-702.

Montague, R. 1974 *Formal philosophy: Selected papers.* R. Thomason, ed. New Haven: Yale University Press.

Palmer, F. 1979 *Modality and the English Modals.* London: Longman.

Palmer, F. 1986 *Mood and modality.* Cambridge: University Press.

Perkins, M. 1983 *Modal expressions in English.* Norwood, New Jersey: Ablex.

Posner, R. 1980 "Semantics and pragmatics of sentence connectives in natural language," in M. Bierwisch, F. Kiefer and J. Searle, eds., *Speech act theory and pragmatics*, 169-204. Amsterdam: North Holland.

Portner, P. 1995 "Modal discourse referents and the semantics of the Mood Phrase," *University of Maryland working papers in linguistics.* Printed by the Linguistics Department of the University of Maryland, College Park, Maryland.

Quine, W. 1947 "The problem of interpreting modal logic," *Journal of symbolic logic* 12:42-48.

Quine, W. 1960 *Word and object.* Cambridge, Mass.: MIT Press.

Quine, W. 1961 *From a logical point of view.* New York: Harper and Row

Quine, W. 1966 *The ways of paradox.* New York: Random House.

Rieber, S. 1997 "Conventional implicatures as tacit performatives," *Linguistics and philosophy* 20:51-72.

Roberts, C. 1989 "Modal subordination and pronominal anaphora in discourse," *Linguistics and philosophy* 12:683-723.

Rohrbaugh, E. 1997 *Scalar interpretation in deontic speech acts.* New York: Garland.

Ross, J. 1967 *Constraints on variables in syntax.* Ph.D. dissertation, MIT. Published in 1985 under the title *Infinite syntax!* Hillsdale, N.J.: Erlbaum.

Russel, B 1905 "On denoting," *Mind* 14:479-93.

Schmerling, S. 1975 "Asymmetric conjunction and rules of conversation," in P. Cole and J. Morgan, eds., *Syntax and semantics 3: Speech acts,* 211-232. New York: Academic Press.

Seuren, P. 1974 "Negative's travels," in P. Seuren, ed., *Semantic syntax,* 183-208. Oxford: University Press.

Seuren, P. 1974 *Semantic syntax.* Oxford: University Press.

Smullyan, A. 1948 "Modality and description," *Journal of symbolic logic* 13:31-7.

Stalnaker, R.1968 "A theory of conditionals," in N. Rescher, ed.,*Studies in logical theory, American philosophical quarterly* 2:98-112. Oxford: Blackwell. Reprinted in Jackson 1991.

Stalnaker, R. 1976 "Possible worlds," *Nous* 10:65-75.

Stalnaker, R. 1978 "Assertion," in P, Cole, ed., *Syntax and semantics* 9:315-322. New York:Academic Press

Steinberg, D. and L. Jakobovits eds. 1971 *Semantics: An interdisciplinary reader in philosophy, linguistics and psychology.* Cambridge: University Press.

Strawson, P. 1950 "On referring," *Mind* 59:320-44.

Talmy, L. 1985 "Lexicalization patterns: semantic structure in lexical forms", in T. Shopen ed., *Language, typology and syntactic description: Grammatical categories and the lexicon.* Cambridge: University Press

Warner, A. 1993 *English auxiliaries: Structure and history.* Cambridge: Cambridge University Press.

Westertahl, D 1989 "Quantifiers in formal and natural languages," in D. Gabbay and F. Guenthner, eds., *Handbook of philosophical logic* IV:1-131. Dordrecht: Reidel.

Zwicky, A. and J. Sadock 1975 "Ambiguity tests and how to fail them," in J. Kimball, ed., *Syntax and Semantics* 4. New York: Academic Press.