

Inference and word meaning: The case of modal auxiliaries[☆]

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Abstract

In this paper I will present and defend an analysis of (a sample of) the English modal auxiliary verbs using a relevance-theoretic semantic and pragmatic framework. I will start by discussing previous analyses of modality in English with an eye to explaining how a cluster of related meanings – epistemic, root, and other – is expressed by the same set of lexical items. I will then go on to develop a unitary semantic approach to the English modals, treating them as (mostly) incomplete propositional operators. After defending the details of my semantic account, I will show how the proposed semantics can give rise to the range of root interpretations modal verbs can receive in context. Epistemic interpretations require some further theoretical machinery, which will make crucial use of the notion of metarepresentation. Finally, I will sketch the differences between natural-language interpretations of modal operators and their alethic/logical uses.

Keywords: Modality; Lexical semantics; Polysemy; Metarepresentation; Pragmatic enrichment; Interpretive use; Relevance

1. Introduction

Most linguistic discussions recognise two broad kinds of modality: epistemic and deontic modality. Epistemic modality deals with the degree of speaker commitment to the truth of the proposition embedded under the modal. Deontic modality is concerned with the necessity or possibility of acts performed by morally responsible agents, and thus with obligation and permission. The utterances in (1) and (2) are examples of epistemic and deontic modality respectively:

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- (1) a. You must be John's wife.
- b. That will be Santa Claus bringing the presents. (on hearing the doorbell)
- c. If you are bored by traditional courses, lectures in Caricature should prove interesting.
- (2) a. I must go on a diet soon.
- b. You may leave the room only after having signed these papers.
- c. Full credit should be given to the city authorities for having done so much for the environment.

Palmer (1990) introduces a third category, dynamic modality, for cases where circumstances in the real world make possible or necessary the actualisation of a state of affairs (see also von Wright, 1951). Dynamic modality includes two kinds: subject-oriented, where the circumstances are characteristics of the subject, and neutral, where the circumstances are general conditions holding in the world – see (3a) and (3b) respectively:

- (3) a. My dance teacher can walk on her hands.
- b. Salaries can rise very quickly in these professions.

However, the grounds for introducing this category are not clear, and many linguists use 'root' modality as a term covering both deontic and dynamic cases.

No matter what is the exact status (if any) of these traditional categories, it is an interesting cross-linguistic fact that the same class of lexical items is used to express both epistemic and root modality (see Perkins, 1983; Sweetser, 1990). In English, modal auxiliary verbs display an interesting array of meanings, which can be analysed either as semantic or as pragmatic 'ambiguity'. The space of modality has been notoriously employed as a test-bed for various claims about the semantics/pragmatics interface; in fact, due to the complexity of the area and the richness of both the theoretical and the empirical detail so far available for modal expressions, the solution to the debate over their lexical meaning is bound to prove illuminating for more general issues concerning the interaction between word meaning and pragmatic inference in utterance comprehension. In this paper I want to propose a semantic framework for modality, which is designed so as to interact naturally with pragmatic processing in order to yield the range of contextually available interpretations of modal auxiliaries.

The paper is organised as follows. In section 2 I deal with previous attempts to formulate a semantics for the English modals. In section 3 I start sketching a relevance-theoretic alternative – in which, for reasons of space, I concentrate mostly on *may*, *can*, *must* and *should*: I present a unitary semantics for this sample and make a case for treating the verbs as (mostly) incomplete propositional operators. In section 4 I go on to offer an account of the various root interpretations modal verbs receive in context. Epistemic interpretations require some further theoretical machinery, which I introduce and motivate in section 5. Finally, I sketch the differences between natural-language interpretations of modal operators and their alethic/logical uses.

2. Previous analyses

2.1. *The ambiguity view*

Ambiguity-based treatments of the English modals use as a starting point the traditional categories of root and epistemic modality, and supplement them with a range of additional categories to capture the full range of meanings natural language modals may express. Palmer (1990) provides a typical example. He separates epistemic, deontic and dynamic modal meanings on both descriptive and explanatory grounds, and subsequently takes each modal verb to encode a particular cluster of distinct modalities. Thus, *may* encodes epistemic and deontic possibility (i.e. permission) and, arguably, dynamic possibility, as shown in (4a)–(4c) respectively:

- (4) a. My boss may find this file interesting.
 b. You may enter.
 c. The mountain may be climbed from other points on this tour.

Can encodes dynamic possibility, either subject-oriented – typically an ‘ability’ reading as in (5a) – or neutral – as in (5b); it also encodes deontic possibility, thereby conveying permission and, ‘by extension/implication’, command – see (5c) and (5d):

- (5) a. Mary can tap-dance.
 b. You can get lost.
 c. You can come in casual dress.
 d. You can forget about the bonus – you’re not worth it.

Must encodes epistemic, deontic or dynamic (again, subject-oriented or neutral) necessity, as shown in (6a)–(6d) respectively:

- (6) a. You must be joking.
 b. We must leave immediately.
 c. You just must go around asking these indiscreet questions!
 d. John must go if he wants to catch the bus.

As for *should*, it linguistically encodes tentative or conditional necessity in either the epistemic or the dynamic realm – although Palmer acknowledges that the verb occasionally has ‘highly deontic characteristics’ (1990: 82):

- (7) a. You should be meeting them later on today.
 b. The doctors keep warning my uncle: he should really cut down on smoking.

I want to argue that the ambiguity view faces a number of problems, both descriptive and explanatory. To begin with, the categories introduced by the ambiguity view do not really correspond to distinct senses for the modals, among which it is always

possible to choose. For one thing, the distinction between the two kinds of dynamic modality is far from clear. Consider (8) (taken from Palmer, 1990: 85):

(8) One thing you want to avoid, if you possibly can, is a present from my mother.

Here, there is no way of distinguishing whether *can* expresses what is possible in a ‘neutral dynamic’ sense, or what the subject has the ability to do.¹ This indeterminacy is not due to lack of sufficient contextual information, but is rather caused by the fact that the ‘neutral dynamic’ reading subsumes the ‘subject-oriented’ reading. Problems also appear in the broader distinction between dynamic and deontic modality. As (9) shows, ‘dynamic’ *can* is capable of conveying a ‘deontic’ meaning:

(9) You can be the first person to join our forces at such a young age.

Palmer concedes that ‘permission’ readings may be pragmatically derived from ‘dynamic possibility’ ones; if generalised, this claim would open the way towards treating all ‘performative’, deontic meanings of modals as products of pragmatic interpretation and not of semantic decoding processes.

A second argument against the multiple ambiguity of the modals comes from the inability of the set of their ascribed senses to capture the range of meanings they may convey. Groefsema (1995) mentions the example:

(10) You must come to dinner sometime.

None of the meanings provided above for *must* accounts for the normal interpretation of (10), which is something like (11):

(11) We would like you to come to dinner sometime.

In a similar fashion, *can* may be used to communicate more than its proposed semantics would suggest (cf. Walton, 1988: 103):

- (12) a. You can clean the house for once.
 b. Can you pass the salt?
 c. Can I get you a drink?

The ambiguity view may attempt to incorporate such meanings in two ways: either by introducing semantic labels for them and thus inflating an already overloaded semantic component (see, e.g., Leech, 1987), or by hiving them off to ‘conventions of usage’ or ‘pragmatic extensions’ (see Palmer, 1986, 1990). In either case, descriptive adequacy will be achieved only at the expense of a truly explanatory account of the semantics and pragmatics of the modals.

¹ Essentially the same argument applies against Bolinger’s (1989) analysis of *may* and *can* in terms of (respectively) extrinsic possibility and intrinsic potentiality.

Although the proponents of the ambiguity view may offer different accounts of the modals, they are all subject to the above criticisms. For instance, Coates (1983) tries to accommodate the richness of possible interpretations of each modal verb (its ‘indeterminacy’) by representing its meaning as a fuzzy set (see also Leech and Coates, 1980). The indeterminacy is then attributed to the gradience between the semantic core and the periphery of each modal. In the case of *can*, for example, the continuum of meaning extends from the core of ‘ability’ to the periphery of ‘possibility’; gradience is manifested in utterances like (13), where it is difficult to adjudicate between the two meanings:

- (13) All we can do is rake up somebody like Piers Plowman who was a literary oddity. (Coates, 1983: 92)

Another source of indeterminacy is merger – cf. (8). As for *must*, *may*, and *should*, their deontic and dynamic aspects are grouped together under ‘root’ and are attributed distinct fuzzy set meanings from their epistemic counterparts; thus the three modals come out as polysemous.

Coates’ account again suffers from an excessive reliance on semantics to provide the whole array of meanings communicated by the modals; as a result, she constantly has to expand the semantic component so that it includes information about the degree of subjectivity or strength of the modality. Even then, the absence of a pragmatic component from her analysis makes it impossible to explain examples of the sort in (10)–(12). As shown by the use of the term ‘indeterminacy’, Coates is primarily worried by the inadequacy of semantic labels to yield an empirically satisfactory analysis of the modals: however, no problem would arise if this indeterminacy were seen as resulting from the flexibility of pragmatic interpretation. The proof that there is no need for recognising phenomena such as gradience or merger is that these phenomena do not actually have any visible effect on the comprehension process: contrary to what one would expect on Coates’ account, utterances of the sort in (8) are not more difficult to understand than (2a), an utterance conveying the ‘core’ meaning of *can*. This intuitive estimate seems to be supported by recent psycholinguistic research, which has consistently singled out and tested utterances of the type in (12) – especially (12b) – for speed of comprehension, thereby supporting the view that this class of utterances may cause some interesting processing complications; no similar hypothesis has ever been considered for Coates’ gradience or merger examples (for experimental results, see Gibbs, 1994: 88–91).

2.2. *The polysemy view*

Sweetser (1990) places her discussion of modality within a more general study of polysemy in natural language. Adopting a broader Cognitive Linguistic framework, she claims that polysemy is often motivated by a metaphorical mapping from the concrete, external world of socio-physical experience to the abstract, internal world of reasoning and of mental processes in general. She argues that modal verbs display

a similar, motivated polysemy, thus rejecting the ‘standard’ view that they are ambiguous between unrelated senses.

Sweetser uses as a basis for the semantics of the modals Talmy’s (1988) notion of ‘force dynamics’. Root modals are taken to encode force-dynamic notions in the external world: for instance, *may* encodes the existence of a potential but absent barrier, *must* a positive compulsion, and *can* either a positive ability on the part of the doer, or some potential force/energy. These notions are extended metaphorically into the internal, ‘mental’ domain and give rise to epistemic meanings: *may* and *must* thus come to denote barriers or forces operating in the domain of reasoning. To illustrate: (14)–(17) give pragmatically enriched paraphrases of the semantic content of the utterances in (14)–(17) respectively; (14) and (15) are examples of root modality, whereas (16) and (17) exemplify epistemic uses of modals:

- (14) You may spend this sum any way you wish.
- (14′) You are not barred (by some or other authority) from spending this sum any way you wish.
- (15) You must be back by midnight. (Our parents said so.)
- (15′) The direct force (of our parents’ authority) compels you to be back by midnight.
- (16) The butler may have committed the murder in the meantime.
- (16′) I am not barred by my premises from the conclusion that the butler has committed the murder in the meantime.
- (17) The guests must have had a really good time.
- (17′) The available evidence compels me to the conclusion that the guests had a really good time.

On this account, the metaphorical mapping between root and epistemic senses is part of the semantics of English, i.e. it has become conventionalised. For individual occurrences of modal items, it is the task of pragmatic interpretation processes to decide which of the two domains (root or epistemic) is the intended one, i.e. to resolve the structured polysemy in the modal semantics (cf. Langacker, 1991: 273ff.).

Sweetser believes that an account based on ‘modality in two worlds’ explains the acquisitional and historical priority of the root over the epistemic meanings of the modals.² However, although her approach correctly moves in the direction of supplying motivation for the systematic relation between root and epistemic uses of modal expressions, it cannot avoid some of the criticisms directed against the ambiguity view. For instance, distinctions between root/epistemic or ability/potentiality readings imply, first, that it is always possible to choose between them, and second, that cases of gradience or merger should be more difficult to comprehend; we saw that neither of these conclusions is warranted.

² Sweetser goes on to tentatively propose a further mapping of force dynamics in modal verbs, this time into the speech act domain; I have discussed that part of her proposal elsewhere (Papafragou, 1996a).

In the second place, even if one adopts the idea of a metaphorical mapping among modal concepts, this mapping will come out as very different from other examples of metaphorical mapping which have been claimed to motivate lexical polysemy. Consider the case of perception terms, which have displayed a cross-linguistic tendency to develop meanings related to mental processes (cf. *see*, *view* etc.). According to Sweetser (1990: 23ff.), this can be explained in terms of a metaphorical construal of the internal world delivered by reasoning on the basis of the external world delivered by perception: the semantics of perception terms thus includes a metaphorical mapping which relates two independent and distinct senses. In the case of modals, however, the senses allegedly linked through metaphor are not so distinct, as a range of indeterminate examples in the previous section has demonstrated. Consequently, even if we grant for the sake of argument that metaphorical mappings exist in the case of perception verbs, the parallel between these and modals is not straightforward.

A third problem for the proposal based on a metaphorical extension of modal meanings is that its application is constrained in various ways. An obvious case is positive *can*, which is not normally used epistemically. Sweetser's account cannot handle similar examples, as she herself acknowledges (1990: 154). Curiously, Sweetser tries to turn this into an argument against a unitary semantic approach to the modals: "It is not the case (as we might expect if the modals were simply monosemous) that all root modals *must/can* have epistemic uses – this is neither historically true for the English modals nor a cross-linguistic universal" (1990: 68). It is not necessary, however, for a monosemous account to make such an assumption; on the contrary, a single semantics for the modals could leave room for a pragmatic explanation of the gaps in their distribution.³

³ There is also something to be said on the historical basis of Sweetser's arguments, namely the precedence of the root over the epistemic meanings. In the first place, there seems to be some evidence against the alleged priority of root meanings. Goossens (1982) claims that epistemic uses of the modals existed in Old English, though they had a more restricted distribution than root ones. For instance, *magan* ('may') had already begun to express epistemic possibility, while other root modals like *willan* ('will') and *sculan* ('shall') were occasionally used to express epistemically coloured predictions. Although he claims that there was no modal counterpart for the present-day English epistemic *must*, Tanaka (1990) argues that *sculan* took up the position corresponding to the latter.

In the second place, semantic change in the modals did not involve only their root and epistemic meanings, but also took place between two root senses. For example, Shepherd (1982) reports the semantic development of *can* from initially expressing intellectual capacity in Old English to expressing general capacity and later possibility or permission. This, according to Tanaka (1990), was partly due to *can* taking over parts of the meaning of Old English *may*, which consequently changed from expressing general ability to expressing permission and possibility (see also Groefsema, 1995). It seems, therefore, that the historical development of the meanings of the modals cannot be explained in terms of a simple metaphorical mapping along the lines proposed by Sweetser. One should at least consider the role of pragmatically derived aspects of meaning (implications), which might at some stage become conventionalised and lead to semantic change. In any case, the extent to which diachronic evidence is relevant for a synchronic analysis of linguistic competence is a fairly controversial issue. Even if root meanings were the first to appear, the semantics of the English modals may well have developed towards a unitary meaning. As for the development of epistemic interpretations in items which initially encoded root concepts, there may be alternative explanations; I will briefly explore one such alternative towards the end of this paper.

Polysemy-based accounts of modal expressions in English and other languages have also been advocated by a variety of scholars, especially within the grammaticalisation literature (Bybee, 1988a,b; Bybee and Fleischman, 1995; Bybee and Pagliuca, 1985; Bybee et al., 1994; Heine et al., 1991; Traugott, 1982, 1988, 1989, 1995; Traugott and König, 1991; cf. also Chung and Timberlake, 1985; Lyons, 1977; Halliday, 1970); I will not examine these proposals in any greater detail here (although see Papafragou, in preparation, for relevant comments). The conclusion from the discussion so far seems to be that neither the ambiguity nor the ‘motivated polysemy’ approach can give a plausible semantics for the English modals.

2.3. *The monosemy view*

The most formally explicit of previous monosemous accounts belongs to Kratzer (1977, 1981) (cf. also Ehrman, 1966; Wertheimer, 1972; Groenendijk and Stokhof, 1976; Tregidgo, 1982; Perkins, 1983; Haegeman, 1983). Kratzer (1981) introduces three factors which jointly underlie modal operators within a possible-worlds framework: the *modal relation*, the *modal base* and the *ordering source* (cf. also Kratzer, 1977). The modal relation includes essentially the notions of possibility and necessity, or what the symbols $\langle \rangle$ and \square of modal logic are designed to capture. The modal base (or *conversational background*) involves a set of assumptions against which the modal relation can be understood; these sets are expressible with the phrase ‘in view of –’. Kratzer’s theory includes, for instance, epistemic modal bases (where a given modality is understood to hold in view of what is known), teleological modal bases (where modality is understood to hold in view of one’s aims), deontic modal bases (where modality applies in view of what is commanded) etc.; these are exemplified in the uses of *must* in (18a)–(18c) respectively:

- (18) a. Isolde must be Sigmund’s sister: they have the same smile.
 b. I must buy a bicycle to get to college quickly every day.
 c. Soldiers must do their duty.

In (18a), in view of the available evidence, Isolde is necessarily Sigmund’s sister. In (18b), in view of the speaker’s aim to get to college quickly every day, it is necessary for her to buy a bicycle. In (18c), given certain orders, it is necessary for soldiers to perform their duty. Kratzer postulates a long list of modal bases, which further include categories such as stereotypical or *buletic* (related to wishes); all of these are formally treated as sets of possible worlds over which quantification by the modal operator takes place. Not all conversational backgrounds are the same for every possible world – obviously the epistemic conversational background in a world where there is no space travel is different from the one in the actual world. Kratzer points out that modal expressions are context-dependent and vague, since the sort of modal base which will be selected for their interpretation is determined pragmatically (often by some rule of accommodation of the sort proposed by Lewis, 1979).

Not all worlds contained in a modal base are taken into account in the interpretation of an utterance containing a modal. For instance, in (18a) the speaker does not consider the possibility that Isolde has the same smile as Sigmund because they have spent hours in front of a mirror imitating each other, or the possibility that the similarity in their smile is mere coincidence. Why should that be? A first approximation is that worlds containing these states of affairs are further removed from the actual world and not easily accessible from it; they represent ‘wilder’ possibilities, which need not be taken into account. More precisely, they are removed from what we take to be the normal course of events, or the causal relations that hold among states of affairs. Therefore, we need an *ordering source* which will rate worlds in terms of similarity to the normal course of events and specify the minimal degree of ‘distance’ from normalcy a world should satisfy. The closer a world is to normal conditions (usually, what holds in the actual world), the more probable it is that a modal relation will be understood to hold in that world. Modal bases come with different ordering sources: in the case of epistemic modal bases, a departure from what is known is not such a serious offence; in the case of deontic bases, however, even a slight breach of what is commanded is more problematic. The idea of an ordering of possible worlds along the lines of similarity belongs to David Lewis (cf. his theory of counterfactuals outlined in Lewis, 1973; see also Lewis, 1986).

In this system, a proposition is a human necessity (cf. the relation expressed by *must*) in a world *w* in view of a modal base and an ordering source iff it is true in all those accessible worlds which come closest to the normal (incidentally, since the order is not total, there can be more than one ‘most normal’ world). A proposition is a human possibility in a world *w* in view of a modal base and an ordering source iff its negation is not a human necessity in that world. Depending on the type of the modal base selected, modal expressions are capable of expressing more specific kinds of necessity or possibility (epistemic, dispositional, circumstantial, etc.). Recall (18a), repeated below as (19): the semantic content of the utterance can be paraphrased as in (19’):

(19) Isolde must be Sigmund’s sister.

(19’) In all those epistemically accessible worlds which come closest to the normal, Isolde is Sigmund’s sister.

In other words: in all worlds which do not depart radically from what we know, Isolde is Sigmund’s sister. Different modals encode distinct clusters of modal relations, modal bases and ordering sources, as Kratzer (1981) demonstrates with respect to German modal verbs.

The picture I have outlined is certainly appealing as an abstract description of how the semantics of modality operates. Kratzer’s proposal is particularly successful in assigning to modal expressions a weak semantics, which together with additional contextual considerations yields epistemic, deontic etc. interpretations. However, there are a number of problems, both traditional and new, which the theory has to face.

First, the possible-worlds model is not meant as a psychologically plausible model of how speakers represent and handle alternative possibilities. In fact, the

model as it stands rather runs counter to experimental findings, which have consistently attested that human subjects have difficulty with the systematic mental manipulation of even a few alternatives (Johnson-Laird, 1982). The psychological reality of possible worlds is the subject of a long and heated debate which falls outside the scope of the present discussion (but cf. Smith, 1983; Smith and Smith, 1988). One way out would be to suggest that worlds do not correspond to full-fledged representations of states of affairs but to partial specifications of them, or *situations*.⁴ Another would be to assume that sets of possible worlds are not individually represented but subsumed under a single description. In the best case, the theory as outlined above should be taken to capture some facts about the speaker's semantic competence while remaining neutral as to how this competence is to be cognitively represented (see similar suggestions in Stalnaker, 1986: 120–121).

Now some more immediate points about Kratzer's analysis. We saw that it is not designed to fit with a cognitively informed pragmatic theory. Still, it seems that two of the three components of modality, namely the conversational background and the ordering source, involve non-linguistic knowledge and consequently belong to pragmatics (Kratzer herself makes vague but repeated references to the role of contextual factors in the overall comprehension of modals). The way pragmatics is dealt with in her account, however, is at least dubious.

For one thing, the idea of a fixed inventory of conversational backgrounds favouring one modal interpretation over others presupposes a rigid and inflexible conception of the role of context in comprehension. In this sense, it reflects earlier views in the literature on communication, according to which context was a determined/ 'given' chunk of information fixed independently of the utterance (see, e.g., Brown and Yule, 1983). As Sperber and Wilson (1986/1995) have shown, however, constructing the context for understanding an utterance is part of the interpretation process, constrained by general pragmatic principles.

Moreover, the idea that possible worlds have an absolute ordering based on their similarity to an ideal needs amendment if it is to be compatible with any adequate account of utterance interpretation. Speakers certainly do not possess such an ordering: it would put too great a burden on human cognitive capacities with little foreseeable gain, especially since the notion of similarity is too vague to be used on its own (see the well-known puzzles of Goodman, 1970, and Lewis, 1973). So even if we knew how to give a psychologically tractable picture of possible worlds, the similarity metric would still remain a mystery.

Kratzer explicitly states that she does not want "to get into the mess of context theories" (1977: 343), and intentionally limits herself to a mere sketch of pragmatic aspects of meanings communicated by modal expressions. Obviously, an adequate pragmatic framework including a theory of context selection could be far more explanatory than a classification of the contextual specifications of the meaning of

⁴ This notion does not necessarily correspond to the use of Barwise and Perry (1983); for some discussion see Krifka et al. (1995: 57–58).

modals, which is bound to fail even on descriptive grounds (see the cases of gradience or merger in the previous section).⁵

3. Modal verbs and context-dependence: A proposal

3.1. Background: Tripartite structures in quantification

The semantics I am going to propose for modal verbs is based on an assumption already familiar from other monosemous approaches: modals are context-dependent expressions, in that their linguistic semantics radically underdetermines the overall meaning they communicate. I assume, partly agreeing with Kratzer, that the semantic content of modals consists of two components: a logical relation *R* (basically: entailment or compatibility), and a domain *D* of propositions. Roughly, then, what the modals are used to convey is that a certain proposition *p* bears a certain logical relation *R* to the set of propositions in a propositional domain *D*, or, schematically:

(20) *R* (*D*, *p*)

The structure in (20) is an instance of a general tripartite structure which has been proposed for a number of quantificational devices in natural language, such as conditionals, *when*-clauses, quantificational determiners (*everyone*, *all*) or adverbs (*always*, *generally*, *often* – see Lewis, 1975; Heim, 1982; Farkas, 1981; Farkas and Sugioka, 1983; Schubert and Pelletier, 1989; Partee, 1989, 1995; Roberts, 1995; cf. also Papafragou, 1996b). This tripartite structure has the following form (Krifka et al., 1995):

(21) operator (Restrictor, Matrix)

The operator takes scope over the proposition in the matrix and relates it to another proposition (the restrictor). In the case of modals, the operator is the logical relation (entailment or compatibility), the matrix is the embedded proposition *p* and the restrictor is the domain of propositions which the matrix is being placed in relation to; it is the restrictor that is responsible for the different types of modal concepts which a modal expression is capable of expressing in different contexts. As one would expect from a tripartite quantificational structure, the restrictor in modals may be either linguistically present, as in (22), or pragmatically inferred, as in (23):

⁵ Monosemous accounts of the English modals have been offered within a relevance-theoretic framework by Smith (1989), Walton (1988), Klinge (1993) and Groefsema (1995). Especially Groefsema's analysis contains an articulate proposal based on a sound division of labour between semantics and pragmatics. I have elsewhere presented the differences between my proposal and Groefsema's account in detail and, for reasons of space, will not go into them here (but see Papafragou, forthcoming/1998b, in preparation).

(22) In view of the political situation, you must leave the country.

(23) You must leave the country.

Regardless of the linguistically realised or null form of the restrictor in the surface structure of the modal utterance, the semantic content of a modal item may make reference to the possible restrictors (i.e. domains of propositions) it admits; alternatively, the semantic entry may remain silent as to the admissible restrictors, thereby leaving their specification entirely to the domain of pragmatic processing. It is reasonable to assume that both cross-linguistic comparison and historical change in the semantics of modal expressions mostly turn on facts about/developments in the type of admissible restrictors. For the moment, however, I want to explore the differences within a subset of the English modals as to the modal relations and restrictors specified by the semantics of each of its members.

My analysis of the semantics of modals will proceed in three steps. Firstly, I will develop the notion of domains of propositions which may serve as restrictors for modal operators. Secondly, I will introduce semantic analyses for a sample of the English modal verbs which includes *may*, *can*, *must*, and *should*. Thirdly, I will elaborate on the specific types of context-dependence exhibited by modal verbs by motivating both ‘pragmatic saturation’ and ‘pragmatic enrichment’ analyses to deal with individual modals.

3.2. *Domains of propositions as modal restrictors*

Following Sperber and Wilson (1986/1995; Sperber, 1997), I assume that any given proposition can be entertained and stored in memory in several different ways. Firstly, and most obviously, a proposition can be entertained as a truth-conditional description of a state of affairs in the actual world – in different terms, a factual assumption (a case of what relevance theory calls the ‘descriptive’ use of propositions – see Sperber and Wilson, 1986/1995). Factual assumptions are the means whereby we represent reality to ourselves. They come in two main varieties: on the one hand, there are factual propositions describing wide-ranging, empirical generalisations about classes of objects and events; on the other hand, there are specific factual propositions concerning instances of events or particular individuals at given temporal and spatial locations. Factual assumptions are the default (or ‘base’) type of assumption for the purposes of communication, since they form a rich and highly accessible contextual background against which ostensive stimuli are processed. Propositions describing the actual world (in either past, present, or future manifestations) can thus be considered to belong to a single domain – the factual domain.

Other domains of propositions include more constrained systems of laws, regulations or rules; I will call them ‘regulatory’ domains. Regulatory domains include legal rulings, chess rules, laws of biology or chemistry, etc.

Similar to these are domains in which propositions are handled as descriptions of states of affairs in ideal, or stereotypical worlds; at least as far as a sub-case of ideal-centered domains, the domain of moral beliefs, is concerned, there has been some

evidence that it is stored and handled by a purpose-specific internal module (Premack and Premack, 1994).

Yet other types of domain may involve propositions which are handled as descriptions of states of affairs in worlds desirable from someone or other's point of view. Desirability is a three-place predicate: an individual can entertain an assumption as a description of a state of affairs in a world desirable from that individual's or someone else's point of view (Wilson and Sperber, 1988).

Finally, propositions can be entertained and stored as abstract representations (i.e. hypotheses), or abstract representations of representations (where the initial representation may or may not be attributed to some source); these are examples of what relevance theory calls the 'interpretive' use of propositions, and will come out as a separate domain of propositions (for further elaboration of this last type, see section 5).

On this picture, then, propositions come with an in-built index, or indication of their type. In factual assumptions this index is null, since these assumptions are the default case of representing the world; in other types of assumptions, I assume that there is an indication in the language of thought as to their domain, i.e. the sub-part of the actual world or an alternative world they are taken to be descriptions of. Logical relations such as entailment or compatibility apply only among propositions of a given type.⁶

I should point out at this stage that I intend these types of domains to be neither exhaustive nor mutually exclusive. It is fairly obvious, for instance, that normative and ideal-centered domains will overlap; likewise, to the extent that the actual world furnishes instantiations of laws of nature, some phenomena will be described by propositions in both the factual and, say, biological domains. Moreover, this discussion is by no means intended to imply that propositional domains are rigid and pre-constructed mental structures (cf. my criticism of Kratzer's 'conversational bases'); I rather intend them as a sort of file-based organisation of our belief-desire system, which has a rich enough internal structure to be updated and expanded through the formation of novel domains. For purposes of constructing a framework for modality, domains of propositions establish a notional space which fulfils a two-fold purpose: in the first place, it will serve as a basis for the pragmatic computation of restrictors for modal relations. In the second place, it will provide a conceptual pool for grammaticalisation processes to draw on. As I have already suggested in my general discussion of restrictors, individual modal expressions will come out as permitting different kinds of domains of propositions as restrictors; consequently, domains of propositions will prove a useful tool for describing and comparing modal items in the same or different languages, or for tracing historical developments in modal meanings. Even if it turns out that it is wrong to treat domains of propositions as

⁶ The idea that propositions are organised in domains has been around for some time; its construals differ depending on the content which different proposals have ascribed to the term 'proposition'. For relevant discussion I refer the reader to Kuroda's (1982) 'indexed predicate calculus', Fauconnier's (1985) 'mental spaces' and Récanati's (1995) 'domains of discourse' (cf. also Kratzer's (1981) 'conversational backgrounds', with which my own proposal is most closely related).

underlying mental structures, or (when grammaticalised) as contributions to semantic meaning, they can nevertheless be considered as a useful way of thinking about modal structure.

3.3. *Semantics for modal operators*

I now want to introduce the semantics for a subset of the English modals. I propose that the information grammatically assigned to *may*, *can*, *must* and *should* is the following (where *p* is the embedded proposition, i.e. the proposition expressed by the rest of the utterance):

- May*: *p* is compatible with the set of all propositions in domain D
(D-value → *unspecified*)
- Can*: *p* is compatible with the set of all propositions in domain D
(D-value → *factual*)
- Must*: *p* is entailed by the set of all propositions in domain D
(D-value → *unspecified*)
- Should*: *p* is entailed by the set of all propositions in domain D
(D-value → *normative*)

On this proposal, *may* and *must* turn out to be more ‘general’ than *can* and *should* respectively: *may* and *must* place no restrictions on the value of the domains of propositions which may serve as restrictors of the modal operator (the D-value is unspecified), whereas the semantically encoded content of *can* and *should* includes information to that effect. In the former pair of verbs, on-line processes of pragmatic comprehension fill in the empty slot in the semantics of the verbs; in the latter pair, a semantically specified restrictor offers a conceptual search-space, which can be further narrowed down pragmatically, if necessary. In this sense, *may* and *must* are examples of pragmatic saturation of an unspecified semantics, whereas *can* and *should* are cases of free pragmatic enrichment of an already complete, albeit vague, semantic content.⁷

Saturation vs. free enrichment parallels exist in other constructions. In the class of quantificational determiners, to take just one example, *all* and *every* have no semantically attached restrictor-value, whereas *everything* and *everybody* semantically restrict the domain of the quantificational operator to sets of objects and sets of persons respectively:

- (24) All humans/animals/plants need space and light.
 (25) Every human/animal/plant needs space and light.
 (26) Everything looks old in this place.
 (27) Everybody looks old in this place.

⁷ For the term ‘saturation’, cf. Récanati (1993).

Before moving on, I would like to demonstrate that free enrichment and saturation represent two truly distinct and independently motivated semantic options, especially in the face of arguments to the contrary. In particular, it can be argued that saturation is not as straightforward a semantic possibility as free enrichment, insofar as the phenomena explained by saturation are also captured by two alternative analyses, related to it but definitely distinct. Adopting saturation analyses thus involves a tacit rejection of the other two alternatives, which should be argued for rather than simply asserted.

Let me use *must* to illustrate. Rather than assuming that the verb lacks a semantic value for the modal restrictor, we might assume either one of the following:

- (a) The semantic representation of the verb includes a specification of a value for the restrictor in the form of a ‘maximal’ domain of propositions (D_{\max}). The proposition embedded under *must* is taken to follow from the set of propositions in whatever domain satisfies logical consistency (i.e. includes no contradictions). This option lies behind all semantic accounts of *must* which analyse the verb in terms of absolute (or logical/alethic) necessity (cf. the ‘Modal Fallacy’ noted in Bradley and Swartz, 1979: 331); on this view, the various types of necessity which *must* is capable of conveying in natural language are the products of pragmatic narrowing of the broad semantic content of the verb. This position, then, essentially reduces saturation to a version of free enrichment: I will call it the ‘maximal restrictor’ solution.

If generalised to quantificational devices in natural language, the ‘maximal restrictor’ solution would imply that maximal quantificational domains form the semantic default value for a number of expressions. Bach (1994) explicitly takes this view with respect to another quantifier, *everyone*, when he notes that an utterance such as (28) literally (i.e. semantically) conveys (29a) and only non-literally (29b):⁸

- (28) Everyone is going.
 (29) a. Everyone in the universe is going.
 b. Everyone in the class is going.

- (b) The semantic representation of the verb contains no slot for the restrictor. What *must* semantically conveys, on this view, is that the embedded proposition follows from the set of all propositions. This complete, albeit vague, semantic content is then pragmatically supplemented by an appropriate restrictor. On this second alternative, pragmatic saturation is again reanalysed as a version of free enrichment: I will call it the ‘no restrictor’ solution.

⁸ There are differences between the type of quantification in *everyone* and a modal like *must*, of course: as already noted, *everyone* contains a semantic restrictor to the effect that it ranges over domains of persons. Maximal domains now come as a further restriction of this initial domain. In *must*, a maximal domain of propositions is the only restrictor which (it is argued) appears in the semantic entry of the verb.

Viewed in a broader light, the ‘no restrictor’ solution would imply that quantification in natural language is semantically unrestricted, thereby relying squarely on pragmatic processes to supply it with a specific domain (of propositions, individuals, objects, events, and so on) to range over.⁹

There is some evidence indicating that neither version of the free enrichment thesis can adequately replace the saturation view for modals like *must*. Regarding the ‘maximal restrictor’ hypothesis, there are at least two reasons for suspecting that the decision to place a maximal restrictor in the semantic entry of *must* is associated with the long-standing concern of logicians and philosophers with absolute, alethic interpretation of modals; on linguistic grounds alone, such interpretations are just one possibility among the range of interpretations which the verb may contextually accept. In the first place, the ‘maximal restrictor’ view accepts as the encoded content of *must* something which will rarely be communicated. This introduces a considerable computational complication: the hearer is obliged to access, test and, in most cases, reject the ‘literal’, absolute interpretation of the modal before opting for free enrichment. In this way, he invariably has to go through something which is false in order to arrive at the proposition which the speaker intends the modal utterance to convey.

Moreover, this approach entails that alethic interpretations should have a facilitation effect on the comprehension of utterances containing *must*; quite to the contrary, it seems that such interpretations have a restricted distribution in natural language data (Karttunen, 1972; Horn, 1972; Lyons, 1977; Palmer, 1990). For instance, the most natural interpretation of (30) is paraphrasable not by (31a) but by (31b):¹⁰

(30) The criminal must be from this area.

(31) a. In view of everything that is logically possible, the criminal must be from this area.

b. In view of everything that we know, the criminal must be from this area.

On the other hand, the ‘null restrictor’ solution, by recognising a complete, albeit minimal, semantic content for *must*, predicts that – in principle at least – there could be occasions on which the modal might express just this bare semantic content (i.e.

⁹ This view is argued against in Neale (1990), who also cites Quine (1940), Sellars (1954), Vendler (1967), Lewis (1973), Cresswell (1973) and Grice (1981) as preferring saturation over a ‘no restrictor’ approach; cf. Westerstahl (1985).

¹⁰ For similar reasons the ‘maximal restrictor’ solution is problematic even if it is construed in a weaker way, i.e. as a generalisation about pragmatic (rather than semantic) defaults for modals like *must*. In more general discussion of quantification, Roberts (1995) seems to be advocating this view: “In examples where the relevant maximal domain is not plausible as the intended domain for an operator, if the operator has no explicit restrictive term, then felicity requires that there be some other salient and familiar domain restriction to satisfy the familiarity presupposition of the free variable R [the operator]” (Roberts, 1995: 692). I will have more to say about the pragmatic role of the maximal restrictor in modal environments in section 5.3.

an unspecified type of necessity). In support of this approach, one might point out that, according to some writers, it is possible to understand an utterance containing a modal verb without having to decide which kind of modality the utterance expresses: Coates' (1983) examples of indeterminacy are a case in point (see section 2.1). The difficulty with this view is that pragmatic indeterminacy is exhibited by all modals, not just those for which the 'no restrictor' solution can be proposed; more importantly, none of the types of indeterminacy usually recognised for modals is particularly suitable for representing 'no restrictor' semantics. Consider (32) – taken from Coates (1983: 145):

- (32) The quality of the final product must be influenced by the quality of the raw material, and the methods of processing may influence its nutritional quality.

Since the two modals in (32) can receive either a root or an epistemic interpretation, the utterance is to some degree pragmatically indeterminate. There are two construals of the term 'indeterminacy' which have a bearing on the interpretation of (32). According to the first, indeterminacy arises simply because the utterance cannot be unequivocally interpreted in isolation; further contextual information, though, would make it possible to distinguish which interpretation was the one intended by the speaker. Since this is only superficially a case of indeterminacy, I will disregard it in what follows. On the second, more interesting construal, indeterminacy arises from the fact that both root and epistemic interpretations have (roughly) the same degree of accessibility for the hearer and are capable of causing a similar range of cognitive effects; hence, relevance considerations cannot adjudicate between them even in the presence of a fuller context. The question which now arises is: could this type of indeterminacy be viewed as a case where what is communicated is the bare (unenriched), 'no restrictor' modal meaning delivered by the semantics – which is naturally going to be perceived as indeterminate between various candidate interpretations?

The answer has to be: no. Notice that the indeterminacy of the 'no restrictor' solution makes no reference to possible enrichments of the semantic content of the modals; the point of the example was precisely to come up with a case where the 'no restrictor' thesis would make a prediction which would be unique to that thesis, and therefore critical in the comparison between the 'no restrictor' and the saturation thesis. However, it seems that this absolute indeterminacy does not correspond exactly to the situation in (32): it is not so much that the utterance is indeterminate *tout court*, but rather that it is indeterminate between two alternative (but specific) ways of narrowing down the semantic content of the two modal verbs. In fact, I doubt that there can be any case where total indeterminacy exists in modal utterances. If I am right, then it is not the case that the 'no restrictor' solution is in a position to make predictions which the saturation view for modals cannot; moreover, it seems to make the wrong predictions by allowing for interpretations which never arise in a natural way.

To conclude: rather than symmetrifying the picture of the semantics of modals by reducing saturation to free enrichment, it seems that both options have to be main-

tained to deal with individual cases. In the next section, I demonstrate how different semantic inputs are pragmatically processed to yield the variety of interpretations of modal verbs.

4. Deriving root interpretations

4.1. *Root interpretations of modals*

Imagine that (33) is uttered by a bank employee to a young customer:

- (33) Our branch may convert your account into a student account; you just need to supply us with proof of student status.

The utterance has the logical form in (33'):¹¹

- (33') It is compatible with the set of all propositions in domain D that p [Our branch converts your account into a student account].

This logical form requires some fleshing out before it can be a truth-evaluable representation; in particular, it remains to be specified what is the value of the domain D, or what is the kind of propositions with which the proposition p is considered to be compatible. This domain will have to contribute to an interpretation of (33) which is accessible enough for the hearer, and capable of achieving adequate cognitive effects in a way compatible with the speaker's abilities and preferences (i.e. it should be an optimally relevant interpretation); furthermore, the resulting interpretation should be one that the speaker could reasonably have intended to be optimally relevant for the addressee (thereby satisfying the requirements of consistency with the communicative principle of relevance – Sperber and Wilson, 1986/1995).

Suppose that (33) was an answer to the customer's query about a change in the status of his account: in such a context, the customer has made mutually manifest that he is interested in changing the type of account he has, or that he considers such a change desirable from his own point of view. As a result, it already forms part of the two interlocutors' mutual cognitive environment that the change is compatible with the speaker's preferences. The only accessible enough domain of assumptions for which it would be relevant to know whether it is compatible with p involves the bank regulations. As a result, (33) is interpreted as informing the customer that the bank regulations permit the branch to convert his account into a student account.¹²

Similar considerations apply to examples (34) through (36):

¹¹ In this and subsequent renderings of logical form I will omit details such as the resolution of referential indeterminacy, etc.

¹² For purposes of the present discussion I disregard the fact that (33) may also receive an epistemic reading.

- (34) I'll tell you about your journey, so that you may make arrangements.
 (35) To make this dish, any sort of pasta may be used.
 (36) During the seminar, you may interrupt as often as is needed.

In (34), the domain of propositions with which the embedded proposition is compatible is a sub-domain of factual propositions describing the hearer's abilities and general circumstances concerning his journey; in (35) this domain is provided by a description of a recipe (a regulatory domain). In (36), the situation is a little more complex. Suppose that the utterance is produced by the person teaching the seminar to the class. Then it is mutually manifest to the interlocutors that students are theoretically in a position to interrupt as long as the teacher does not object. It follows that the only domain of propositions that could relevantly contribute to an interpretation of the modal verb in (37) is that concerning the teacher's own preferences. Given two further, mutually manifest contextual assumptions, namely that interrupting the seminar as often as is needed is desirable from the students' point of view, and that the teacher has some authority as far as the seminar is concerned, (36) will be felt to convey a 'permission' interpretation.

One might observe a common pattern in the way *may* contributes to the relevance of utterances in which it occurs. In all cases, the context includes an assumption to the effect that the embedded proposition *p* is incompatible with the set of all propositions in a certain domain *D* (or assumed to be so). What *may* does, then, is to contradict and eliminate this contextual assumption, by conveying that *p* is compatible with the propositions in *D* – or, to put it differently, that the negation of *p* ($\sim p$) does not follow from the set of propositions in *D*. This explains how utterances containing *may* are capable of achieving any cognitive effects at all, given that their communicated content (according to which a proposition is compatible with a certain set of other propositions) makes for a very weak statement.

Indeed, a Gricean analysis would characterise utterances containing *may* as informationally impoverished, on a par with other constructions such as negative utterances (Karttunen, 1972; for a neo-Gricean account of negation, see Horn, 1989). The parallel is to be expected: if we consider compatibility as an implicitly negative term,¹³ the case of *may* falls squarely within the province of negative operators. As is generally noted, utterances containing a negation marker can be felicitously used only in special contexts: in discussing Pierre's news, for instance, it would be awkward to assert (37) in the absence of a contextual assumption to the effect that (it is expected that), after his divorce, Pierre will visit his daughter very often. Similarly for *may*, it would be awkward to assert (38) in the absence of a contextual assumption to the effect that (it is expected that) his divorce will prevent Pierre from visiting his daughter very often:

¹³ The term 'implicit negative' belongs to Fodor et al. (1975), and refers to terms whose underlying semantic representation includes a negative term. Their examples (*deny*, *doubt*) differ from *may* in that their syntactic behaviour parallels that of explicit negatives (e.g. they trigger negative polarity items).

- (37) After his divorce, Pierre will not visit his daughter very often.
 (38) After his divorce, Pierre may visit his daughter very often.

What this fact about negation suggests, according to a number of psychologists and linguists (Wason, 1965; Greene and Wason, 1970; Givón 1978; Horn, 1989), is that, on their commonest and most natural interpretations, negative statements are understood as denials. In this sense, negatives (and, by extension, *may*-utterances) in some pragmatic sense ‘presuppose’ the existence in the immediately accessible context of their affirmative counterparts.

In relevance-theoretic terms, the weak informativity of *may*-utterances and other structures can be redefined as non-productivity of contextual implications: in (37)–(38), the explicatures of the utterances are incapable of interacting with any existing contextual assumptions to yield contextual implications. Given that they are also incapable of strengthening any existing contextual assumptions, it follows that the only way open to them for achieving relevance is by contradicting and eliminating an assumption previously held in context. This typical path in the interpretation of root *may* is precisely what my analysis in the previous paragraphs has suggested. Naturally, as an aspect of pragmatic processing, the ‘contradiction and elimination’ interpretation of *may* is contextually defeasible: there is nothing in a relevance-theoretic account to prevent the explicature of an utterance such as (38) from interacting with a contextual assumption such as (39) to yield a contextual implication such as (40):

- (39) If, after the divorce, Pierre may visit his daughter very often, his ex-wife will be very upset.
 (40) Pierre’s ex-wife will be very upset.

It appears that, while unique to relevance theory, the proposed account of *may* is capable of capturing intuitions discussed in other accounts. This conclusion is reinforced by the observation that there is now an available pragmatic explanation for Sweetser’s (1990) idea that *may* encodes the existence of a potential but absent barrier. What the ‘barrier’ idea taps is that, although the proposition *p* which is embedded under *may* was (or could be) previously contextually expected to be incompatible with the assumptions in the relevant propositional domain, this is not in fact the case.

I now want to turn to uses of *can*. Consider (41):

- (41) Computer-based instruction can co-occur with more traditional methods of teaching.

The logical form of the utterance is given in (41’):

- (41’) It is compatible with the set of all propositions in the factual domain that $p_{[}$ Computer-based instruction co-occurs with more traditional methods of teaching].

According to my above suggestions about the encoded content of *can*, the verb semantically specifies as its restrictor the domain of factual propositions. This is the reason for the commonly held view that *can* encodes ‘potentiality’ (Walton, 1988; Bolinger, 1989; Klinge, 1993): a state of affairs is characterised as potential when it is compatible with the states of affairs in the actual world, and hence may itself be actualised at some point in the future. Further, the semantics of *can* may be contextually enriched to the point of isolating a certain sub-domain of factual assumptions which is intended to be the modal restrictor; this is illustrated by the possible paraphrases of (41) given below:

- (42) a. In view of the way schools are run these days.
 b. In view of the technical equipment available nationwide.
 c. In view of the teachers’ encouraging stance.
 d. In view of the new guidelines from the Ministry of Education, computer-based instruction can co-occur with more traditional forms of teaching.¹⁴

What about the ‘ability’ reading of *can*? A number of writers have argued that this is a non-modal use which corresponds to the basic meaning of the verb (see, e.g., Foolen, 1992). I will take the view that the ‘ability’ interpretations of *can* are as much the result of enrichment of the semantic content of the verb as the various ‘potentiality’ interpretations of (42). Consider the pair of examples in (43):

- (43) a. Mary can speak German.
 b. Mary can speak German at the meeting, because everybody is going to understand her.

In its most natural interpretation, the utterance in (43a) will be taken to communicate something about Mary: the hearer will retrieve (or construct on-line) the encyclopedic entry for Mary and process the embedded proposition p [Mary speaks German] against assumptions that have become available through the activation of this encyclopedic entry. In other words, the state of affairs described in p is taken to involve a property of Mary’s which is compatible with her other features. This way of narrowing down the factual domain of propositions in (43a) differs from (43b), where p is an instantiation of the general fact [Mary speaks German]: in order to compute whether p is compatible with the relevant set of propositions in the factual domain, we now need to take into account a broader sub-domain of factual propositions apart from those involving Mary’s internal properties – for instance, assumptions concerning the situation in meetings, the other participants, and so on. Therefore, we cannot get a pure ‘ability’ reading for (43b) as we can for (43a).

I suggest, then, that ability interpretations for *can* arise whenever the sub-domain of factual assumptions which is taken to be compatible with the embedded proposi-

¹⁴ (42d) might be thought to involve a ‘regulatory’ rather than a factual domain; however, it seems to me that the guidelines of the Ministry of Education contribute to the interpretation of (41) as if they represent established facts about the world – a sort of regularity of facts. This is a good candidate for domain overlap, as described in section 3.2.

tion belongs to the ‘file’ for an individual or object (which also normally appears as the sentential subject). This analysis predicts that, whenever both individual-specific and broader factual considerations bear on the comprehension of *can*, the traditional ability-potentiality distinction will collapse – this is exactly what happens in (43b). By resisting proposals to place ‘ability’ concepts within the semantics of *can*, this account also manages to avoid a host of problems which these proposals face. For instance, inanimate subjects and passive sentences, which provide counterexamples to an ability-based semantics for *can*, are naturally predicted to favour a ‘root potentiality’ interpretation on my account: there is no individual or object to furnish a fact-supporting conceptual (encyclopedic) entry, with which the new attribute would be judged compatible:

- (44) a. Bad weather can ruin the crops.
 b. The total sum can be divided into two equal parts.

Finally, the present account offers a satisfactory explanation of the relation between *can* and *be able to*; the latter is taken to encode ability, as shown in the following contrasts:

- (45) a. John can/?is able to swim, if he likes.
 b. We can/?are able to offer you a discount, if you wish.

Unlike what the conditionals convey, inherent ability cannot be subject to an individual’s wishes – John’s in (45a) or the addressee’s in (45b); this incongruity is the reason for the unacceptability of the utterances containing *be able to*. Utterances containing *can*, on the other hand, do not give rise to similar problems since ability is not present in the semantic content of the verb.

Next, I want to comment briefly on uses of *can* to convey a suggestion or an offer. This type of interpretation requires the presence of the following collection of contextual assumptions: (i) the embedded proposition *p* represents a state of affairs which is manifestly desirable to the hearer from his own point of view, as well as beneficial to him; (ii) the speaker has the responsibility for bringing about the state of affairs described in *p*; and (iii) the speaker manifestly lacks any obligation to bring about this state of affairs:

- (46) a. We can meet one day after work.
 b. I can give you a lift.

Finally, *can*, like *may*, is used ‘deontically’ to communicate permission. The differences between the two verbs are brought out in (47):

- (47) a. You can smoke in this room.
 b. You may smoke in this room.

Suppose that the following contextual assumptions are mutually manifest to the speaker (Monica) and hearer (Patrick): (a) the state of affairs in which Patrick

smokes in the room is considered desirable from his own point of view; (b) it is within Patrick's power to bring about this state of affairs; (c) Monica has some sort of authority over Patrick. By using (47a), Monica informs Patrick that there is nothing in the factual domain which blocks his smoking in the room. In other words, circumstances are such that he is allowed to smoke. By contrast, (47b) can be used to communicate that Patrick's smoking in the room is compatible with a variety of assumptions; for instance, if the context included an additional assumption to the effect that Monica's preferences could disallow Patrick's smoking, then it would follow that in (47b) the modal restrictor for *may* would include (apart from factual assumptions) the speaker's preferences. This is the reason for generally considering *may* a more polite form for giving permission than *can* (since it conveys, in a sense, greater speaker involvement).

This is not to say that *may* is always felt to be polite. Imagine that (48) is uttered by a general after interrupting a soldier who is talking: the soldier will feel under greater obligation to go than if he had simply received permission:

(48) You may go home, Jones.

Here, the context lacks the assumption that Jones considers going home as desirable from his point of view (I will call this assumption *z*); actually, the fact that Jones was in the middle of talking rather makes mutually manifest the opposite assumption (i.e. that he does not wish to leave immediately). However, it is difficult to see how the general could have intended (48) to be optimally relevant to Jones, unless the general believed that *z* is true. So Jones has to supply *z* as a background assumption and attribute it to the speaker (even though he knows *z* is false). The interpretation would proceed along much the same lines as (47a) above, except that Jones knows that the general knows that *z* is false: the general makes as if *z* were a mutually manifest contextual assumption. The intuition that, under these circumstances, the utterance is rude, results from the fact that the general ignores the hearer's preferences, although these are contextually salient. A similar analysis can be given for the following examples with *can*:

- (49) a. You can forget about your Christmas present – you haven't been a good boy.
 b. You can start looking for a new job.

The pragmatics of *must* can be dealt with quite straightforwardly in the above framework. Imagine that Mary finds herself in a very cold room and utters (50):

(50) I must sneeze.

The logical form of the utterance is provided in (50'):

(50') It is entailed by the set of all propositions in domain *D* that p [Mary sneezes].

What the hearer is expected to retrieve is that Mary's sneezing is a necessary outcome given her condition and the circumstances in the room. This entails that the unspecified domain D in (50') has to be pragmatically narrowed down to a sub-set of factual propositions. Other types of contextual enrichment of the semantic content of *must* are given in (51):

- (51) a. In opening a game of chess, the players must move a pawn.
 b. The President must formally approve the new Government before it can undertake its duties.
 c. The accused must remain silent throughout the trial.

These three utterances require regulatory domains of different types: (51a) expresses a necessity with respect to the rules of chess, (51b) a necessity with respect to the Constitution and (51c) a necessity with respect to judicial rules.

Must admits a variety of propositional domains as restrictors. (52) is a slightly more complex example:

- (52) I must lose weight.

Assume that the speaker, Amy, wants to become attractive and realises that the only way to achieve this is by losing weight. It follows that losing weight is necessary in view of Amy's desire to become attractive (and the factual assumption that, unless she loses weight, she will not do so). (52), then, is the product of (one version of) what philosophers have called 'practical syllogism', i.e. a kind of syllogism which is not concerned with belief-formation and persuasion but with intention-formation and action (von Wright, 1963; cf. Anscombe, 1957; Harman, 1976; Kratzer, 1981); practical syllogism has the following general form:

- (53) a. I want to attain y .
 b. Unless z is done, y will not be attained.
 Therefore, z must be done.

Applied to (52), (53) yields:

- (54) a. Amy wants to become attractive.
 b. Unless she loses weight, Amy will not become attractive.
 Therefore, Amy must lose weight.

or, more formally, (55):

- (55) a. q [Amy becomes attractive], where $q \in D_1$ (D_1 = domain of propositions describing what is desirable from Amy's point of view).
 b. z { p [Amy loses weight] $\vee \sim q$ [Amy becomes attractive]}, where $z \in D_2$ (D_2 = domain of factual propositions).
 c. Therefore, p must be true in D_3 , where $D_3 = D_1 \cup D_2$.

What (55) captures is that, for Amy, losing weight is a necessary means to a desirable end; this type of necessity is commonly conveyed by *must*. This account fares better, I think, than previous approaches to deontic *must*; for instance, Groefsema (1995) has proposed that the proposition expressed by utterances such as (52) becomes enriched to the point that it represents a desirable state of affairs. (52), on her analysis, comes out as having the following enriched propositional form (assuming my semantics for the modal):

(56) Amy desires that $k\{p$ [Amy loses weight] is entailed by the set of all propositions in domain D}.

As far as I see, however, (56) does not correspond to an intelligible desire; moreover, what Amy desires is effectively not the state of affairs described by k but a different one – that she becomes attractive – for which losing weight is a prerequisite (see Papafragou, forthcoming/1998). On my account, what the speaker considers as desirable will not be directly retrieved from the surface structure of the utterance in (52) but will be contextually supplied by the hearer.

There is only a short distance from the type of interpretation in (52) to the purely deontic (i.e. obligation-imposing) uses of *must* in (57):

(57) a. You must write 100 times ‘I will never yawn in class again’.
b. You must love your fellow humans.

The deontic interpretation of (57a) arises in case (i) the modal restrictor involves a set based on the speaker’s desires and factual assumptions (or, alternatively, a set of regulatory propositions which the speaker is entitled to enforce); (ii) the speaker has authority over the hearer; (iii) the hearer is in a position to bring about the state of affairs described in the embedded proposition. An interesting variant of the ‘obligation’ interpretation arises in cases of imperative suggestions/offers (cf. section 2.1):

(58) a. We must go for a drink one day.
b. I absolutely must walk home with you.
c. You must come and visit us sometime.

Consider in particular (58a): the utterance conveys that it is entailed by (the relevant sub-set of) the speaker’s desires that she and the addressee go for a drink one day. Since the addressee most probably has to show sensitivity to her interlocutor’s desires due to the social rules governing their relations, the utterance will be interpreted as an urgent form of suggestion (for the contextual background against which ‘suggestion’ readings typically arise, see the discussion of (46) above).

I come, finally, to *should*. The verb is often felt to convey obligation of a weaker type than *must* in examples like the following:

(59) You should Hoover the place once in a while.
(59') It is entailed by the set of all propositions in the normative domain that p [You Hoover the place once in a while].

According to its semantically specified restrictor, *should* expresses a necessity relative to existing stereotypes, norms or expectations. The comprehension of *should* relies quite heavily on the sort of structured knowledge humans typically possess about the normal course of events, which has been referred to by various writers in cognitive psychology as ‘scripts’ (Schank and Abelson, 1977), ‘frames’ (Fillmore and Atkins, 1992), ‘scenarios’, and so on. To the extent that norms, apart from being statistical generalisations, acquire regulatory status as well, root interpretations of *should* become indistinguishable from those of *must*. Still, since what is expected/normal can be quite different from what is commanded, *should* is generally seen as communicating a less urgent kind of necessity than *must*.¹⁵ From that point of view, the verb bears certain similarities to *ought to*, which, I want to suggest, semantically specifies as its modal restrictor the domain of ideal/morally recommended propositions:

(60) One ought to respect one’s country.

(60′) It is entailed by the set of all propositions in the domain of ideals that ρ [One respects one’s country].

(61)–(62) illustrate the differences between the types of necessity communicated by *must*, *should*, and *ought to*:

(61) In this game, you must/?should/?ought to carry an egg in a spoon and be careful not to drop it.

(62) Chief scout to the younger boys:

a. You must be back by midnight, ?although it’s fine by me if you aren’t.

b. You should be back by midnight, (?)although it’s fine by me if you aren’t.

c. You ought to be back by midnight, although it’s fine by me if you aren’t.

¹⁵ I assume, with a number of researchers in the field (see Warner, 1993), that *should* is not synchronically perceived as the past tense form of *shall* but has entered the modal system as a separate, individual item. Still, there are a number of uses of the verb which are considered to retain overtones from its original meaning, or to be generally unrelated to the rest of its root interpretations (Ehrman, 1966; Coates, 1983; Palmer, 1990); for instance, *should* is used in ways similar to hypothetical *would* as in (i), as a hypothetical marker with inverted word-order as in (ii), or with a seemingly null contribution to meaning (i.e. as a place-holder) in the quasi-subjunctive construction in (iii):

(i) I should be grateful if you could bear my case in mind.

(ii) Should you require any further assistance, please feel free to contact us.

(iii) I do not desire that I should be left alone in this task.

These examples involve hypothetical environments with varying degrees of complexity. Some might be dealt with rather straightforwardly within the existing framework; the first one, for instance, requires us to add an extra condition to the ‘expectation’ restrictor of *should*, namely the antecedent of the conditional. What (i) conveys is paraphrasable thus: ‘given my expectations and the fact that you could bear my case in mind, it follows that I am grateful’. The other examples represent more idiosyncratic aspects of the English modal system, which probably have to be learnt individually: this is especially true for (ii), where the use of *should* correlates with a distinct syntactic configuration peculiar to auxiliaries (which is parasitic on the semantics of the conditional). Since these possibilities fall outside the main scope of this paper, I will not discuss them further.

In (61), since *must* lacks any semantic conditions on the restrictor, it is open to an interpretation where the rules of the game function as the restricting domain. The utterance with *should* is slightly worse: although the rules of the game can do duty as a normative domain, this particular game is far removed from what is a typical game activity (compare: ‘In this game, you should try to reach the end faster than your opponent’). Finally, *ought to* in (61) is distinctly odd, since the domain semantically provided for the interpretation of the verb clashes with the pragmatic requirements on the comprehension of the utterance.

In (62), the differences in acceptability also bear on the selection of the restrictor: (62a), on its most accessible interpretation, is construed as imposing an obligation on the younger scouts (given a number of contextual assumptions concerning authority and social relations in the group); the continuation of the utterance therefore becomes unacceptable. (62b), although it can receive a similar interpretation, is also open to another reading: the chief scout simply reports what is entailed by the norms/expectations concerning a scout’s behaviour, but is manifestly not in agreement with those norms, so that he will not use his authority to enforce them. Finally, (62c) is a mere statement concerning what ideals or duty entail, which can differ substantially from what the speaker is prepared to accept in practice.

The detailed discussion of the root meanings of modals in this section has shown that the divergence of contextual interpretations can be adequately predicted by a simplified semantics plus a richly articulated and powerful pragmatic machinery. What emerges as a clear conclusion is that classic modal categories such as ‘deontic’ or (basic) ‘root/dynamic’ are not well-defined and clear-cut, but can be traced along a continuum depending on specific contextual assumptions about the social relations between the interlocutors.

4.2. *Selecting and/or constructing modal restrictors*

In the previous paragraphs I have argued that modals are context-dependent expressions, in that they depend on inferential pragmatic enrichment processes to complement the information they semantically encode. Depending on the type of enrichment they permit, modal verbs are understood as communicating different kinds of modal meanings. The process of pragmatic enrichment dovetails with relevance considerations, which supply the intended restricting domains for modals. My purpose in this section is to comment more extensively on the selection and construction of modal restrictors and deal with a number of objections which could be raised to my analysis of root modality.

A first potential objection could be formulated as follows:

Your account has so far remained silent on the precise mechanism of domain-selection for modals. This, however, is no trivial task: the question of which domain of assumptions to select as the background for modality bears directly on the issue of what to consider as ‘relevant evidence’ for a proposition (in the pretheoretical sense of ‘relevant’) – a thorny question which has occupied much research in philosophy, psychology and artificial intelligence (cf. the discussion of the ‘frame problem’ in Fodor, 1983; Pylyshyn, 1987). Your solution to this problem will be crucial, especially for some modals for which you have assumed a very weak semantics. Consider *may*: anything can be said to be compatible with the set

of propositions in some domain or other. For instance, the proposition that I become Mayor of Paris is compatible with the laws of arithmetic: what is there in your account to stop me from uttering ‘I may become Mayor of Paris’ with the laws of arithmetic in mind?

Such an objection confuses two issues which need to be disentangled: one has to do with the general epistemological problem of deciding what type/domain of assumptions a proposition relies on for its confirmation or disconfirmation; the other has to do with the psychological problem of deciding what could be the intended domain for a proposition embedded under a modal verb. The epistemological problem, which is indeed one version of the famous frame problem, arguably has little bearing on the second, cognitive problem, which is the one involved in producing and understanding modal expressions in natural language. Instead of surveying the range of possible domains which might be used for evaluating the embedded proposition, and thus getting entangled in the complexities of the frame problem, a relevance-oriented organism such as the human cognitive system will obey specific constraints in considering evidence for/against a proposition; potential domains will therefore include assumptions which are easily accessible from the encyclopedic entries of the concepts in the embedded proposition and other assumptions which have become contextually available (see Sperber and Wilson, 1996, on how relevance considerations of effort-effect balance explain one (intelligible) version of the frame problem). Moreover, we are concerned not simply with an isolated assessment of possibility or necessity, but with a modal *utterance*; communication raises specific expectations of relevance, so that the speaker can only expect the hearer to arrive at the type of evidence she has in mind, if that evidence is recoverable on the basis of general assumptions about causality and law-like generalisations. In our example, the main reason for using a possibility statement with *may* is to reject a previous assumption, according to which the proposition embedded under *may* described an impossible state of affairs; for instance, the utterance ‘I may become Mayor of Paris’ encourages the hearer to concentrate on that set of evidence which was previously assumed to exclude my becoming Mayor of Paris, and invites him to reconsider it.

Talk of domains should not mislead one into thinking that the recovered modal restrictor invariably feeds into the proposition expressed by the modal utterance in the form of a set of ‘background’ propositions. As the discussion of root modality has suggested, I hold that the specification of the intended domain takes the form of a general description (‘factual’, ‘ideal’, etc.), which is normally pragmatically inserted in the proposition expressed in order for the logical form of a modal utterance to become truth-evaluable. I think that at least such a broad description of the intended modal restrictor (i.e. of the intended type of modality) is necessary for the comprehension of a modal utterance. There may be cases where the same range of assumptions is captured by more than one domain (e.g. the epistemic and root domains), and so there are two possible interpretations of the utterance; since we are concerned with extensionally equivalent domains, they are bound to be equally accessible and to have equivalent contextual effects. In those cases, the interpretation of the utterance will oscillate between the two domains, without having to be

resolved in favour of one or the other. Examples in point are cases which have been called ‘merger’ (Coates, 1983) – below I repeat the earlier example (32) as (63):

(63) The quality of the final product must be influenced by the quality of the raw material, and the methods of processing may influence its nutritional quality.

Still, one might insist that my formulation of domain-selection does not adequately characterise how modal restrictors are formed. A second objection might go like this:

Compared to previous accounts such as Kratzer’s, your account is considerably impoverished in this sense: Kratzer dealt with the problem of domain-selection by adopting two types of modal domain, a modal base and an ordering source, either of which could be empty, and whose interaction produced a variety of modal interpretations. In your own analysis, you do not distinguish between different kinds/sources of modal restrictors. Nevertheless, you seem to be tacitly assuming such a duality of restrictors at a number of points: namely, when you invoke mixed domains or a union of two different domains as you do in example (52). Aren’t you glossing over important pragmatic (if not semantic, as Kratzer assumes) aspects of the formation of domains here? Could that be evidence that the notion of domain is not appropriate or sufficient to restrict modal semantics after all?

In responding to this objection, I would like to repeat that the concept of ‘domains of propositions’ is not meant to suggest that domains are somehow clear-cut, ‘natural’ clusters of mutually dependent propositions. Apart from some crude distinctions, which correspond to different storage and processing spaces in the language of thought (ideals, stereotypes, laws, etc.), there is no easy way of distinguishing whether we are dealing with one domain or a union of domains. The interesting cases where there are clear intuitions about ‘mixed’ domain arise in examples like (52), repeated for convenience:

(64) I must lose weight.

The utterance expresses a necessity in view of what the speaker (Amy) considers desirable from her point of view (that she becomes attractive), given certain circumstances. Now in similar cases of practical syllogism, the idea behind a ‘mixed’ domain (or a modal base plus an ordering source) is this: the domain of desirable states of affairs is only incompletely specified. We therefore assume that it is identical to the factual domain, apart from specific states of affairs which are altered. This makes sense since the factual domain is, other things being equal, the most accessible and the richest domain of assumptions we have at our disposal.¹⁶ So when I said that utterances like (64) involve a mixed modal domain, I was in fact being quite

¹⁶ See Papafragou (1996b) for more detailed arguments on why the representation of alternative worlds sticks as closely as possible to the factual domain. There I argue that Kratzer’s (1981) ‘ordering source’ is a by-product of a semantic framework where an abstract construct such as possible worlds has to gain some cognitive plausibility as a tool for describing NL semantics – so cognitive factors such as judgements of similarity to the actual world and ordering with respect to the normal course of events are introduced in the analysis.

specific as to the content of that domain; using a different terminology, I might have said that only one domain, that of the speaker's desires, is involved – and leave it to pragmatic inferencing to construct this domain (mainly) out of factual assumptions.¹⁷

Let me work through an example to illustrate what I mean. Consider (65):

(65) Peter wants to get a promotion? Well, he must get to know his boss better.

What the second utterance communicates is this: the proposition p [Peter gets to know his boss better] is entailed by the set of all assumptions in the domain where his desires come true. That domain is identical to the factual domain inasmuch as the world in which Peter's desires come true is a version of the actual world. Is there any need to place an ordering on the admissible domains à la Kratzer, i.e. is there a means of securing that a domain will be uniquely selected during the comprehension of (65)? Relevance considerations ensure that a single domain will be selected, which will include all the most accessible and strongly supported assumptions which can relevantly contribute to the interpretation of the utterance. For instance, the hearer would not be warranted in concluding from (65) that Peter must get to know his boss better for the purpose of imitating the exemplar of a successful man (given his own desire to get promoted). The assumption that being on friendly terms with the boss may directly help one's career is more accessible and better supported, so it will be the one which will feed into the intended domain for (65).

It is often the case that, during a single conversational exchange, modal domains are shifted and modified. Imagine that Alice and her lawyer have been discussing the possibility of Alice's having a divorce; Alice utters (66) and her lawyer replies as in (67):

(66) I can't leave my husband penniless.

(67) Of course you can – the law allows you to.

It is clear that the modal restrictor in (66) includes assumptions about Alice's feelings and moral strength, whereas in (67) it includes assumptions about legal regulations. The shift in the value of the restrictor is an instance of accommodation (Lewis, 1979), where there is a change in the boundary of the relevant domains for modality. The capacity to perform appropriate shifts in the modal restrictors here is on a par with the more general ability to pragmatically infer the intended domain for a modal operator by monitoring cost-effect expectations which the speaker has built into the modal utterance.

¹⁷ I have assumed that the construction of alternative worlds proceeds essentially as a union between sets of factual and non-factual assumptions; most probably, the interaction of the two types of sets will bring about modifications, since assumptions standardly come in lumps (Kratzer, 1989), or smaller networks of locally dependent assumptions. Cognitive economy prevents a fuller conceptualisation of an alternative world than strictly necessary; still, to talk about 'mixed domains' or 'union of sets' when it comes to representing alternative realities is a simplification. Since nothing important hinges on this simplification, I will not discuss it any further here (though see Papafragou, 1996b; Kratzer, 1991).

5. Deriving epistemic modal interpretations

5.1. The metarepresentation hypothesis

Throughout the previous discussion I have assumed that modality operators encode a logical relation between a proposition and a set of other, contextually specified propositions. I now want to claim that what sets epistemic modality apart from the kinds of modality examined so far is that the proposition embedded under the modal here is a metarepresentation.

Let me start with some preliminary definitions, which I have already alluded to in section 3.2. According to relevance theory (Sperber and Wilson, 1986/1995), any representation of propositional form can be used in two ways: either descriptively, where the representation is used as a truth-conditional description of external circumstances, or interpretively, in which case the representation represents another representation with a propositional form which it resembles in content (i.e. with which it shares logical and contextual implications). This dichotomy corresponds to another distinction which is sometimes made between two sorts of propositional attitude (Wilson, 1993; cf. Sperber, 1997). Descriptive attitudes are attitudes towards propositions which are regarded as truth-conditional representations of states of affairs: for instance, fearing, demanding or regretting are cases of descriptive attitudes. Interpretive attitudes, on the other hand, are attitudes towards propositions *qua* propositions, i.e. abstract representations which can be entertained as elements of thinking episodes in an agent's mental life: doubting, proposing or wondering are examples of interpretive attitudes. Depending on their semantic content, propositional-attitude and other predicates pick out a specific use of the propositions under their scope. This becomes evident in the two possible uses of the *that*-clause in (68):

- (68) a. That the cabinet is corrupt is very sad.
 b. That the cabinet is corrupt is completely unfounded.

In (68a) *that* introduces an assumption which is put forth as a description of an actual state of affairs; it is this state of affairs that the speaker describes as very sad. In (68b), however, *that* introduces an assumption which is put forth as a representation of an abstract hypothesis, possibly entertained by some people with various degrees of endorsement; the attitude of the speaker focuses on the abstract hypothesis (rather than the state of affairs represented by it).

The interpretive use of representations couched in propositional form rests on our ability to entertain and manipulate second-order representations in the language of thought. This ability may, in fact, consist of separate specialised systems of metarepresentation: one possibility would be to recognise three such sub-systems, a metalogical, a metalinguistic and a metacognitive one.¹⁸ The metalogical system would be responsible for checking representations for logical consistency, detecting contradictions, and (in more advanced forms) judging a line of argument as valid or unde-

¹⁸ Dan Sperber (1997) has made proposals along these lines.

cidable, reasoning about hypothetical possibilities, employing *reductio ad absurdum* and, generally, generating possibilities that have not been specified in advance (cf. Moshman, 1990; Sophian and Somerville, 1988; Byrnes and Overton, 1986). The metalinguistic system would be responsible for ‘displaying’ utterances (public representations), thereby focusing on their content. As for the metacognitive system, it would deal with representations of mental states, such as beliefs and desires, and with the human capacity for reflecting on mental states, either one’s own or the projected mental states of someone else.

The latter capacity has in recent years been associated with the so-called ‘theory of mind’ hypothesis in psychology and the philosophy of mind (cf. the contributions in Carruthers and Smith, 1996). This hypothesis entails precisely that part of the human cognitive mechanism is the ability to know one’s own mind as such, i.e. to reflect on one’s mental contents and processes and to accommodate the results in a coherent picture of the mental world (see Wellman, 1990; Gopnik, 1993; Leslie, 1995). The theory of mind is based on specific ontological commitments, and is itself part of human ontological knowledge; moreover, it provides a causal-explanatory framework to account for/predict phenomena in the mental domain (for the domain-specificity of the theory of mind, see Gopnik and Wellman, 1994; Leslie, 1994).

I now come to the heart of my proposal. There is an obvious sense in which expressions of epistemic modality fit into a representational model of the mind: in their epistemic uses, modals like *may*, *must*, *should*, and *ought to* communicate – broadly speaking – a logical relation between a certain proposition and the speaker’s belief-set. The employment of epistemic modality rests crucially on the ability to reflect on the content of one’s own beliefs, to take into account the reliability of those beliefs (i.e. the relative strength with which they are entertained),¹⁹ and to perform deductive operations on them. The above processes jointly presuppose the ability to conceive of one’s mental contents as representations distinct from reality which may bear a variable degree of correspondence to the actual world.

On this picture, then, epistemic interpretations of modal verbs involve a propositional representation being used interpretively: the complement of the verb (the embedded proposition) is not used as a truth-conditional representation of a state of affairs in the external world but as a representation of an abstract hypothesis, which is considered to be compatible with/entailed by the speaker’s set of beliefs. This is the reason why epistemic interpretations are typically taken to convey how much evidence the speaker possesses for the embedded proposition. This type of modal interpretation contrasts with root modal interpretations, where modality operates over propositions handled as truth-conditional descriptions of states of affairs (in the present, or in an alternative – ideal, stereotypical, etc. – world). Epistemic operators take scope over propositions which are consciously entertained and manipulated *qua* propositions by the speaker. To put it differently, the proposition embedded under an epistemically understood modal is not to be treated as directly picking out a state of

¹⁹ On this notion of strength of assumptions, see Sperber and Wilson (1986/1995).

affairs in the world, but as describing what Sweetser (1990) has called an ‘epistemic object’.

If correct, the metarepresentation hypothesis about epistemic modality will afford a number of predictions about the truth-conditional behaviour of epistemic modal interpretations, their contribution to relevance, and their acquisitional peculiarities (Papafragou, forthcoming/1997, forthcoming/1998, in preparation). In the remainder of this paper, I will only illustrate how the metarepresentation hypothesis fits with the account of modality already developed for root interpretations in the previous sections.

As a last point before moving on, I wish to remove a possible objection to the metarepresentational account which might arise at this stage. Isn’t it the case, one might ask, that virtually all assertions are backed up to various degrees by the speaker’s belief-set, and can thus be considered as conclusions based on internally represented evidence? This is, after all, what underlies Grice’s second maxim of Quality: ‘Do not say that for which you lack adequate evidence’ (Grice, 1975: 67). Does this mean that we should mark all regular assertions as cases of interpretive use? Obviously, such a move would trivialise what the metarepresentational account is trying to capture: that is, the fact that the speaker has chosen to mark the proposition embedded under the modal as a conclusion and to linguistically indicate the strength of this conclusion by the conceptual information encoded by the modal verb (including both the sort of logical relation and the type of evidence involved in the inferential process). Naturally, assertions come with various degrees of speaker commitment which are often left implicit. In (69), for instance, the speaker may use intonational and other means to convey that her utterance is supported by all the evidence she possesses, although she cannot subscribe wholly to its truth because she manifestly still lacks some crucial information:

(69) Judy likes caviar.

In a case like (69), the strength ascribed to the proposition expressed by the utterance will be wholly pragmatically inferred, rather than computed on the basis of a linguistic trigger. By contrast, modal expressions, on their epistemic interpretations, typically mark the proposition embedded under them as a conclusion. In the specific case of English modal verbs, the conclusion is motivated in terms of inference; modal expressions in other languages may motivate a conclusion in terms of evidence from perception or from communication (for examples, see Palmer, 1986, on modality; cf. also the evidential adverbs *apparently*, *clearly*, and *allegedly*, *reportedly*).

5.2. Epistemic interpretations of modals

Consider the following examples:

- (70) a. Brian’s resignation may be a big mistake.
 b. Some of the neighbours must have seen the burglars.

The logical forms of the examples are given in (70′):

- (70′) a. It is compatible with the set of all propositions in domain D that p [Brian's resignation is a big mistake].
 b. It is entailed by the set of all propositions in domain D that q [Some of the neighbours have seen the burglars].

I will examine each utterance in turn. On hearing (70a), the addressee will have to determine the domain of propositions in D. Suppose now that it is mutually manifest that the communicator does not know Brian very well. It is, then, reasonable for the addressee to assume that whatever the assumptions included in D, they are bound to be limited: although nothing in the speaker's beliefs excludes the possibility that Brian's resignation is a mistake, there may be circumstances in the world which actually do (but which the speaker is unaware of). Since the speaker does not trust the background assumptions she uses to evaluate p to accurately and fully match the state of affairs in the actual world, a factual interpretation for the modal verb becomes inappropriate. Instead, the speaker should be taken to communicate that p describes a possible conclusion with respect to a set of assumptions available specifically to her – the resulting interpretation is, naturally, epistemic.

Example (70b) is very similar to (70a). The proposition q has a determinate truth-value at present, since it refers to an event which either has or has not taken place in the past. The speaker cannot have intended a factual propositional domain as the value of D, since she manifestly lacks complete knowledge of what happened at the relevant time-slot in the past (i.e. during the burglary); all she can do, therefore, is reason on the basis of incomplete and partly-supported evidence which she reconstructs from both encyclopedic and situation-specific information about burglaries (e.g. that the burglars have used one of the usual methods of getting into the house, that they were exposed at least some of the time, that the neighbours pay some attention to what takes place in nearby properties, etc.). Thus, q is presented as a necessary conclusion given an epistemic background domain.

This account captures Kratzer's insight that epistemic modality and root modality "involve a different categorisation of the facts" (Kratzer, 1981: 52). In factual, and more generally, root interpretations, the modal domain includes propositions taken as descriptions of states of affairs; in epistemic interpretations, the modal domain D is relativised to a set of propositions which form part of the speaker's belief-set – and thus participate in her mental life. This is not to say that beliefs themselves are not truth-conditional descriptions of states of affairs external to the individual; however, when they estimate epistemic possibility or necessity, humans are not simply concerned with such 'transparent' properties of internally represented propositions, but focus rather on the representational properties (such as accuracy or completeness) of their belief-system as such. In cases where the speaker has full cognitive access to assumptions that can determine the truth/falsity of the proposition embedded in the modal, there would be no need to relativise the modal restrictor to the domain of her beliefs; she could simply convey that the embedded proposition is compatible with/entailed by 'objective' circumstances or facts in the external world.

The metarepresentational analysis extends quite easily to the other modals. Consider (71), which has the logical form in (71'):

(71) That should be the plumber. (on hearing the doorbell)

(71') It is entailed by the set of all propositions in the normative domain that p [That is the plumber].

The speaker cannot be certain that the circumstances in the actual world guarantee that p is true; the only evidence she has for p comes from her beliefs about the normal/expected course of events. According to those beliefs, the plumber is expected to arrive some time after the speaker called him: so if the circumstances in the world have developed as the speaker expects them to, it follows that whoever is ringing the bell is indeed the plumber. This explains why notions such as 'prediction', 'expectation' or 'probability' have been assumed to feature in the semantic entry of *should* (see Ehrman, 1966; Walton, 1988; and Bybee et al., 1994, respectively). According to what the verb conveys, although it could still be contradicted by evidence which at present lies outside the speaker's cognitive environment, if reality develops in accordance with the speaker's expectations, the proposition embedded under the modal will turn out to be true.

This line of argument affords an explanation of the subtle differences between *must* and *should* when they function as epistemic markers. Consider the following pair:

(72) a. John must be easy to talk to.

b. John should be easy to talk to.

R. Lakoff, discussing these examples, has observed that they are appropriate in different circumstances (Lakoff, 1972). Suppose that speaker and hearer are standing outside John's office: (72a) could be uttered if there were indications that John had a visitor and they were both having a good time. By contrast, (72b) would be acceptable if the speaker knew nothing about John's habits from first-hand experience, but had heard that in principle John was very kind with his students. Lakoff concludes that *should* is used in the case of a likelihood based on future expectation and verifiable in the future, and *must* of a likelihood based on present conjecture and verifiable in the present.

The interpretations Lakoff offers for (72) unfold quite easily from the proposed semantics for the two modals. Although both utterances are guesses based on partial evidence (and hence involve epistemic readings of the modals), each verb allows for a different restrictor, and, therefore, a different type of evidence. *Must* leaves open the type of evidence that supports the embedded proposition p [John is easy to talk to]; in the situation Lakoff describes, the most accessible type of evidence capable of causing an adequate range of contextual effects is John's behaviour with his visitor. *Should*, on the other hand, admits only evidence which is based on expectation or stereotype; consequently, (72b) is appropriate when there is no direct experience of John's behaviour. The type of admissible evidence also

bears on the verifiability of each utterance: in the case of perceived evidence, as in *must*, the embedded proposition *p* is verifiable at present, whereas expectation-based evidence, as in *should*, needs to await support or disconfirmation from factual assumptions.

I should note here that my analysis of *should* does not affect in any way the monosemy argument I have been advocating for the modals. On a first pass, one might be worried about the possibility of giving both root and epistemic interpretations to a verb which semantically admits only stereotypical or normative restrictors. This is not a real problem, however, since it is precisely that semantic information which allows for both types of interpretation in *should*: root interpretations occur when normative assumptions are regarded as representations of external states of affairs, whereas epistemic interpretations arise when the expectation-conforming evidence is focused upon *qua* set of internal propositional representations. In fact, the possibility of interpreting *should* as expressing both root and epistemic (weak) necessity while retaining the feature of stereotypicality rather favours a unitary meaning approach over, say, an ambiguity view. On the ambiguity position, the verb would be ascribed two unrelated clusters of conceptual content, one having to do with social normativity (root interpretation) and the other with likelihood (epistemic interpretation – see Ehrman, 1966, for an explicit adoption of this view). By contrast, the monosemous approach coupled with a metarepresentational stance on epistemic modality can naturally accommodate the fact that the specification of stereotypicality will ‘percolate’ from external to internal evidence for the embedded proposition.

A similar possibility arises with *ought to*, where the semantically specified domain is that of ideals, moral imperatives and the like:

(73) This problem ought to be very easy for a mathematical genius like you.

What about *can*? My semantic analysis precludes any epistemic uses for *can*, since the verb semantically restricts the value of admissible modal domains to the factual one. This restriction seems to receive support from the impossibility of constructing utterances where *can* is used instead of epistemic *may*:

(74) a. He may/?can have been joking when he asked if you cut your hair with a lawnmower.

b. Michael may/?can well get a first next year.

(75) Do you think that James is hiding something from the authorities?

a. He may be, and then again he may not.

b. ?He can be, and then again he cannot.

The intuition that *may* and *can* are typically used to communicate two distinct types of possibility has been expressed by several writers on modality. Leech (1987), for instance, argues that *may* expresses factual possibility and *can* theoretical possibility; van der Auwera (1986) takes *may* to convey indeterminacy and *can* contingency (see also Lakoff, 1972; Bolinger, 1989). What these authors standardly emphasise is

the contrast between epistemic interpretations of *may* and root interpretations of *can*, as well as the fact that *can* does not accept epistemic interpretations.²⁰

Let me go back to (75): in (75a), the speaker makes manifest that the proposition p [James is hiding something from the authorities] is compatible with the set of her beliefs, and goes on (after some deliberation) to assert that the negation of this proposition ($\sim p$) is also compatible with her beliefs (I follow standard assumptions about the scope of negation in epistemic modal interpretations). To put it differently, the speaker's current beliefs leave open the possibility for either p or $\sim p$ to come out as true: there is nothing unacceptable or ungrammatical here. By contrast, in (75b) the speaker communicates that p is compatible with the set of factual propositions – hence, that the state of affairs in the actual world allows for p to be the case – and goes on to suggest that p is *not* compatible with the set of factual propositions – thereby creating a contradiction.

Using the root-epistemic contrast, we can also explain why 'James may be hiding something' seems to rely much more on the future for the verification of the embedded proposition than 'James can be hiding something': in the former, but not in the latter, we expect the speaker's knowledge to develop so as to judge p as true or false. Similarly, we can account for the fact that in (76) it is the utterance containing *may* which expresses the greater likelihood that James is hiding something:

(76) James can be hiding something from the authorities; indeed, he MAY be hiding something from them.

The value of the restrictor in *can* being what it is, no 'percolation effects' can be used to elicit epistemic interpretations: these would violate the semantics of the verb. The presence of lexical-semantic factors which guarantee the non-convergence of *may* and *can* might be viewed as a means of securing a division of labour between the two lexical items – a synchronic situation which has gone through various stages of partial overlap of the meanings of the two modals (Tanaka, 1990; Traugott, 1989; Bybee et al., 1994). The pressure for differentiation between the two verbs is probably also responsible for the relatively low frequency of 'pure root possibility' interpretations for *may* (since *can* grammaticalises precisely this part of the conceptual space of modality in English).²¹

²⁰ *May* does, of course, accept root interpretations, as I have shown in section 4.1.

²¹ Still, one might argue, there are certain environments which can be said to elicit epistemic interpretations of *can* – specifically, interrogative, negative and 'generic' environments (Sweetser, 1990; Walton, 1988):

- (i) Can this allegation (ever) be true?
- (ii) This allegation can't be right.
- (iii) Defamatory allegations can bring an end to a political career.

If these are truly epistemic interpretations of *can*, then the semantics I have proposed for *can* will turn out to be incorrect. However, I do not think there is any compelling reason to attach epistemic readings to the utterances in (i)–(iii): the usual factual readings will do. Consider, for instance, (ii): *can't* is often said to give rise to the proposition in (iia), while on my account it rather conveys (iib):

- (ii) a. It is incompatible with the set of all the speaker's beliefs that p [This allegation is right].
- b. It is incompatible with the set of all factual propositions that p [This allegation is right].

Let me sum up what I have claimed so far. Epistemic interpretations of modals arise in contexts in which it is mutually manifest that an individual, in drawing a conclusion, say *p*, is not in a position to take into account every proposition that could affect the truth of *p*, because he/she is ignorant of existing evidence. The individual will then draw the most justifiable conclusion according to presently available evidence, and the overall degree of support for it will depend on the degree of strength of the various premises. Stated differently, the individual ends up with a logical conclusion whose premises are nevertheless more or less disputable, so that it is ultimately ascribed a correspondingly low degree of strength. What sets epistemic interpretations apart from other modal interpretations is that both the proposition embedded under the modal and the evidence for it are metarepresentational assumptions capturing the individual's internal representation of reality, which are likely to evolve and be revised, as new evidence becomes available.

Before finishing this section, I would like to show how the above analysis can be used to explain certain puzzles which have been discussed in the literature about the relation between a modalised assertion containing epistemic *must* and a non-modalised assertion. As Lyons (1977: 808) observes, "although it might appear that a statement is strengthened by putting the proposition that it expresses within the scope of an operator of epistemic necessity, this is not so, as far as the everyday use of the language is concerned". As Lyons remarks, an utterance such as (77a) is felt to be stronger than (77b) and to convey a higher degree of speaker commitment:

- (77) a. San Marino is the country with the highest life expectancy in the world.
 b. San Marino must be the country with the highest life expectancy in the world.

Contrasts in the *must-is* interface become more apparent when it comes to observational utterances, i.e. utterances that express propositions verifiable through/directly reporting facts from perception. Assume that Peter is watching a football match; at some point the ball is kicked off the field. Peter may produce either of the responses in (78) but he will be taken to be recommending a higher degree of commitment to the proposition expressed by (78a) than to the proposition embedded under *must* in (78b):

- (78) a. That was an off-side.
 b. That must have been an off-side.

The reason for the asymmetry is, of course, that (78a) is presented as a factual assumption, guaranteed by Peter's (uninhibited) perceptual access to his environment. Perceptual beliefs, although not necessarily more likely to be true, are nor-

If (ii) communicates (iia), this will be the only case in English where an epistemic modal verb falls in the scope of negation. More generally, all utterances in (i)–(iii) would fail the standard tests used to distinguish epistemic from non-epistemic interpretations of modals. For further discussion of this point, I refer the reader to Papafragou (in preparation).

mally assumed to be causally related to the structure of reality; therefore, they are considered to be our securest form of contact with the world around us (Dancy, 1985: 178). Since we trust our perceptual experience to deliver information of high epistemological respectability, it follows that other sources of knowledge (e.g. inference) will be valued less when it comes to the assessment of the same piece of information.

A similar point applies to the examples in (77a) and (77b): again only the first is put forward as a piece of factual information, i.e. an assumption which the speaker trusts to be a true (or potentially true) description of a state of affairs in the world. What is more, on my analysis, epistemically interpreted modal verbs involve the metarepresentation of an assumption which is evaluated on the basis of evidence available to the speaker. So, although (77b) conveys that the speaker possesses compelling evidence about the country with the highest life expectancy, the possibility is left open for evidence lying beyond the speaker's beliefs to disconfirm the embedded proposition. This is what underlies the intuition that (77b) is weaker: by bothering to modify her proposition with an epistemic modal operator, the speaker explicitly indicates that she does not want to communicate the full range of effects the unmodalised utterance in (77a) would cause, or at least that she wants to moderate their strength.

On a relevance-theoretic account, (77b) is actually expected to produce extra or different contextual effects in comparison to (77a) simply because it is both structurally and semantically more complex, and thus more costly in processing effort. The same prediction arises in other epistemic environments, which also require the setting up of a metarepresentation. Compare:

- (79) a. There are nine planets in our solar system.
 b. As far as I know/In my view, there are nine planets in our solar system.

5.3. Alethic and 'objective epistemic' modality

It would be interesting at this stage to compare epistemic modality with another type of modal concept, which logicians have termed 'alethic (or logical) modality' (McCawley, 1981; Lyons, 1977). A proposition is a logical necessity if it is entailed by the set of all propositions in the maximal domain D_{\max} (where D_{\max} is the set of propositions which jointly describe all logically possible states of affairs in the universe). A proposition is a logical possibility if it is compatible with the set of all propositions in the maximal domain D_{\max} . The following are examples of logical possibility and necessity:

- (80) a. I haven't won the Lottery yet, although in theory I could have.
 b. It is possible that someone I know is going to win the Lottery.
 c. Winning the Lottery does not necessarily make one happy.

Several linguistic discussions ignore alethic modality: Lyons' is a rather typical remark when he notes that alethic uses are the products of a "rather sophisticated

and impersonal process which plays little part in ordinary non-scientific discourse” and is “secondary in the acquisition of language” (Lyons, 1977: 845, 849). This is especially true with regard to the modal verbs in English (and in general); the alethic interpretation of *must* in (81) is, indeed, felt to be contrived:

(81) He is a bachelor, so he must be unmarried.

Still, since the boundaries between alethic and epistemic modal interpretations are often empirically hard to distinguish, there have been attempts at conflating the two types of modality. One line of argument has been to reduce alethic interpretations to epistemic interpretations, since they are not morphologically distinct in English, or, apparently, any other language (Palmer, 1986: 11). The opposite suggestion has also been made: some writers have proposed that epistemic modality can (and should) be reanalysed as a subtype of alethic/absolute modality (Kneale and Kneale, 1962: 93; Hughes and Cresswell, 1968: 27; cf. Karttunen, 1972: 14ff.). On this view, we could interpret (82) as conveying that it is absolutely/logically necessary that, if the premises are true, then the conclusion is also true:

(82) If it snows throughout February, my birthday must be a snowy day. (assuming the speaker’s birthday is on the 11th February; adapted from Hughes and Cresswell, 1968: 27)

There are good arguments against conflating epistemic and logical modality (Karttunen 1972; cf. Iatridou 1990). First, alethic *must p* is stronger than the unmodalised proposition *p*, since the former means that *p* is not just true but necessarily true (true in all possible worlds). Epistemic *must p*, though, is felt to be weaker than *p*, for reasons explained in previous paragraphs.²² Second, in modal logic *p* and *possibly ~p* are consistent. However, in natural language there is some incompatibility between the two clauses of:

(83) ?It isn’t raining in Chicago, but it may be raining there.

Third, logically speaking, the form *must (p → q)* makes a different statement from *p → must q*. Yet there is little difference between the English forms in (84):

(84) a. It must be that, if Bill has a diamond ring, he has stolen it from someone.
b. If Bill has a diamond ring, he must have stolen it from someone.

As Karttunen (1972) has rightly observed, there is also a basic conceptual difference between the two types of modality. In my terms, the sort of assumptions that will be included in the modal restrictor differs in alethic and epistemic modality; as a result, it is a mistake to think that the one can be made to collapse into the other. One thing these analyses *were* right about was that alethic and epistemic modality bear a close

²² This is why we can infer *p* from alethic *must p* but not from epistemic *must p*.

relation; in fact, I think that the ability to entertain alethic concepts is essentially of the same type as the ability to employ epistemic notions, insofar as they both involve an aspect of metarepresentation.

While discussing the facets of the human metarepresentational device in an earlier section, I mentioned metalogical activity as part of it. Metalogical processes consist in the subject's 'displaying' propositions as abstract hypotheses and consciously performing deductive operations on them; metalogical reasoning rests on the assumption that logical relations such as entailment, compatibility, contradiction and so on, obtain between propositional contents in the abstract, mind-independently. The interest in performing metalogical computations, then, lies in recovering these logical relations. Alethic/logical modality presupposes precisely an ability to reason about what is simply possible or necessary, thereby considering alternatives which are not included among presently available circumstances in the real world, or states of affairs described by the agent's current beliefs, but predicted by general logical laws.

What alethic modality shares with epistemic modality, then, is the fact that they are both instances of the interpretive use of propositions: they both rest on the capacity to envisage propositional representations as *representations* which enter into specific logical relations. Alethic concepts differ, however, in that they involve propositions viewed as mind-independent abstract entities, whereas epistemic concepts relate propositions which are treated as participants in the agent's mental life (and therefore require a fully set-up theory of mind).

Within the lexical-grammatical system of English modal expressions I have described, alethic interpretations of modals will come out as yet another possible enrichment of the underlying basic meaning of modals (in cases where it is permitted by the specified modal restrictor). It is true that the distribution of such interpretations is very restricted, especially as far as the English modal verbs are concerned: they seem to occur more freely with modal adverbs and adjectives as below:

- (85) a. It is possible that there is life on other planets.
 b. One in three necessarily wins.

The metarepresentational analysis of both alethic and epistemic modal concepts entails the following prediction: in case the logical domain and the epistemic domain turn out to be extensionally equivalent (i.e. if the speaker's knowledge spans all logical possibilities), then it will be impossible to differentiate between a logical and an epistemic interpretation of a modal expression. Such 'mixed interpretations' do indeed occur: Lyons (1977) offers some examples and tentatively proposes that they belong to a separate category intermediate between epistemic and alethic modality. Imagine that a murder has occurred in a secluded hotel, where any communication with the outside world is impossible. The murderer then has to be one of the ten residents, who immediately become suspect and have their alibis checked by the police. After finding out that all of these suspects have unassailable alibis except for the guest in room 31, the police inspector produces (86):

- (86) The guest in room 31 must be guilty.

Lyons (1977: 798) analyses similar utterances as cases of ‘objective epistemic modality’, where a conclusion reached by the speaker presents itself as an objective fact. He contrasts these with classic examples of epistemic modality, which is termed ‘subjective’ and is thought to be a product of “opinion, or hearsay, or tentative inference” (Lyons, 1977: 799). Apart from objective epistemic necessity, we find cases of objective epistemic possibility: in the same detective-story context, and before the investigation began, the inspector might utter:

(87) The guest in room 31 may be guilty.

Since this guest is among the ten residents in the hotel at the time of the murder, there is an objective possibility that he is the murderer. As Lyons puts it, “the speaker might reasonably say that he knows, and does not really think or believe, that there is a possibility (and in this case a quantifiable possibility) of [this guest’s being guilty]; and if he is irrational, his own subjective commitment to the truth or falsity of the proposition ‘[The guest in room 31 is guilty]’ might be quite unrelated to his knowledge of the objective possibility, or degree of probability [1/10], of its truth, in the way that a gambler’s subjective commitment to the probability of a particular number coming up in roulette might be quite unrelated to the objective probabilities” (Lyons, 1977: 798 – my adjustments).

That this is not really a distinct type of modal interpretation, but rather a conflation of two interpretations, can be argued for as follows. In the first place, Lyons’ explanation faces a difficulty: the distinction between knowledge and belief, which is crucial for his distinction between objective and subjective epistemic modality, is at least dubious from a psychological point of view. Evidently the individual cannot distinguish knowledge and belief on subjective grounds alone. In examples (86) and (87), the individual’s knowledge about the circumstances of the murder is – from an internalist perspective – equivalent to a set of strongly held beliefs, coupled with the assumption that there will be no further data which could have a bearing on the truth of these beliefs. This is guaranteed by explicitly stating all factors that could have a bearing on the identity of the murderer; the speaker can therefore be sure that no additional evidence will influence the truth of her statement about the guilt of the guest in room 31, so that her statement will be fully backed up by her cognitive environment. What appears to be an ‘objective’ sort of epistemic modality is thus a conflated type of interpretation, where ordinary epistemic necessity or possibility is evaluated with respect to a fully determinate and strongly supported body of evidence. What lies behind Lyons’ intuition that this interpretation is close to alethic/logical modality is precisely the fact that the set of circumstances considered as evidence here span the range of logically possible circumstances; by being mutually manifest to the inspector and his interlocutor, this fact explains why (86), for instance, is perceived as a stronger statement than its unmodalised counterpart in (88):

(88) The guest in room 31 is guilty.

6. Concluding remarks

My aim in this paper has been to strike a middle way between polysemy-based and radical monosemy accounts of English modals. I have tried to offer a semantics rich enough to allow for differences in content among the various modals, and yet underspecified to the extent of drawing on extensive pragmatic inferencing until it yields a complete truth-evaluable representation (the proposition expressed by the modal utterance). I have attempted to draw together root and epistemic interpretations and to demonstrate how they can arise from what is – for most verbs – a common basic meaning. Still, epistemic interpretations came out as significantly different from root ones: I have argued that the ability to employ epistemic concepts is part and parcel of human theory of mind abilities, and therefore epistemic interpretations of modals make use of metarepresentations in a way that root interpretations do not.

I have not yet fully cashed out what I have called the ‘metarepresentation hypothesis’ for epistemic modals. If correct, this hypothesis could have important implications for a number of related issues, such as the acquisition of modality, the truth-conditional behaviour of modal expressions, or the development of epistemic markers out of what previously were exclusively root expressions. With respect to the last issue, for instance, it has been argued that the later emergence of epistemic meanings marks a ‘rise in subjectification’ in language (Traugott, 1989, 1995); the notion of metarepresentation may give a more solid psychological basis to subjectification, and may contribute to a clarification of what has largely been a term of convenience for historical linguistics. The exploration of this and other implications of the proposed analysis of modality remains a project for further research.

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