

Modal geometry:
Remarks on the structure of a modal map¹

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Abstract

This paper takes a closer look at the ‘geometric’ structure of the semantic map of modality (Van der Auwera & Plungian 1998). By analyzing the different modalities into more basic modal features, we can get a better view on how the map is organized along different dimensions around a neutral middle modality, how the deontic modality fits on the map and what role connectivity plays in defining polyfunctionality. Drawing on data from Dutch, we argue that a basic distinction on the map corresponds to the grammatical raising/control distinction.

1 Introduction: Modality’s Map

A recent development in the study of modality is the use of semantic maps (Van der Auwera & Plungian 1998, Van der Auwera, Kehayov & Vittrant this volume). Semantic maps are used to visualize the relations between different semantic functions and the polyfunctionality of linguistic elements (Anderson 1982, Croft 2003, Haspelmath 2003, de Haan 2004, among others). An important feature of semantic maps is the notion of *contiguity* (Croft 2003).

Linguistic elements can only represent a set of semantic functions that are contiguous.

Consider the following hypothetical semantic map:

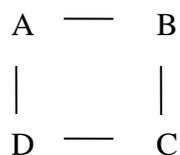


Figure 1: Hypothetical semantic map of four semantic functions

This map predicts the possible sets of functions that a linguistic element can have. Examples of these possible sets are [ADC], [BC], [ABCD], and [D]. There are two sets that are

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predicted to be impossible, [AC] and [BD], because neither A and C, nor B and D are connected on the map.

Semantic maps also have a diachronic aspect, although not every scholar working with semantic maps uses this aspect. The links in semantic maps represent routes along which grammaticalization can happen. Let us take the hypothetical semantic map in Figure 1 as an example again. A linguistic element on this map can for example cover only function A at one point in time, and both A and D or even only D at a later point:

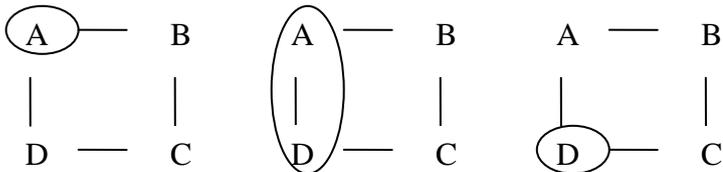


Figure 2: Possible grammaticalization route in three phases

Furthermore, the semantic map predicts that this element cannot gain function C directly from a point in time where it only has function A:

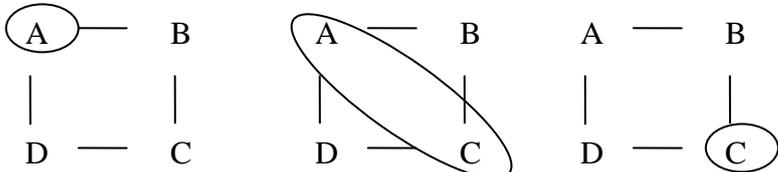


Figure 3: Impossible grammaticalization route

In some semantic maps (like the one of Van der Auwera & Plungian 1998), if a grammaticalization route is attested it is represented by an arrow instead of a line between functions.

Within this general methodology of semantic mapping, Van der Auwera & Plungian (1998) present the following semantic map for modality:

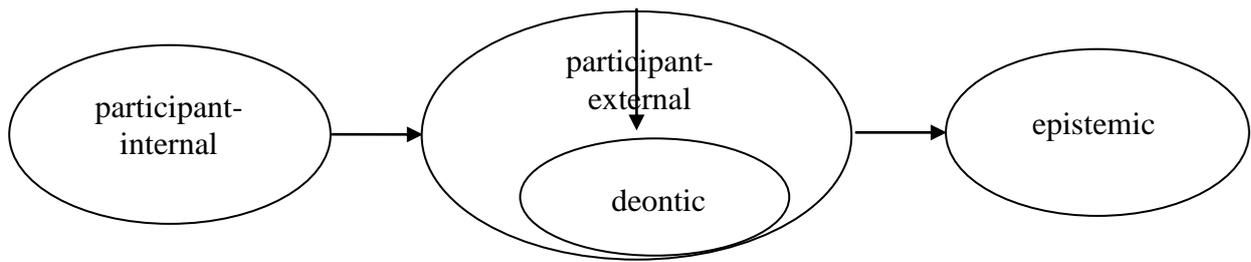


Figure 4: Van der Auwera & Plungian's (1998) semantic map of modality

They take their point of departure in the study of Bybee et al. (1994). The linguistic elements relevant to this semantic map are, mainly, modal verbs, and the semantic functions are four types of modality. These types of modality are *participant-internal*, *participant-external*, *deontic* and *epistemic* modality. Each type comes in two variants, a *strong* one (expressing necessity) and a *weak* one (expressing possibility). The following examples will feature the weak variants only. (1) is an example of participant-internal modality:

- (1) John can swim

Participant-internal modality expresses the internal need/capacity of the sentence subject. With the verb *can* in (1) the ability of the subject John to swim is expressed. With participant-external modality, the locus of the possibility no longer resides in the subject of the sentence, but in the circumstances:

- (2) To get to the station, John can take bus 66

Participant-external modality denotes possibilities that exist on a specific point in time. In (2) taking bus 66 is an option there for John if he wants to get to the station. The existence of this possibility does not come from John himself. Deontic modality is used whenever permission or obligation is expressed:

- (3) John may stay up late

In (3) it is expressed that somebody has given permission to John to stay up late. With epistemic modality the truth of the proposition as a whole is evaluated:

(4) John may be rich

In (4) there is a proposition, *John is rich*, which may or may not be true according to the speaker. More meanings can be distinguished within these four meanings, but these are the most important ones, also for our purposes. See Bybee et al. (1994), Palmer (2001), de Haan (2005), among others, for discussion on the classification of modal meanings.

We basically agree with Van der Auwera & Plungian's proposal, but in this paper we want to raise some general issues about how the structure, the 'geometry', of the modal map is defined in the first place. Essentially, we want to contrast the semantic map approach with a more classical approach in terms of semantic features. This comparison also allows us to look at some basic conceptual questions regarding modality. What kind of a priori principles do we have to structure the map for modality in a particular way, independent from the way lexical or grammatical items divide up modal meanings among themselves? More specifically, what do we know about modal meanings that allows us to set up a map with a particular geometry? Our conceptual approach has several results. It will lead us to a revision in the structure of the map (abolishing the inclusion relation as a special relation between meanings). This has consequences for the way we look at the contiguity property. Our approach also allows us to refine the deontic part of the map, a refinement that we will try to connect to the grammatical distinction between raising and control modality. Some of our points are specific to the semantic map of modality, but we think that our analysis also has implications for the semantic map methodology in general. We assume, with the semantic map theorists, that modal words have a range of closely related meanings and that these meanings cannot always be reduced to one underspecified meaning that gets differentiated in one way or another, as in some approaches (Kratzer 1977, among others). A comparison between such monosemous approaches and the polysemous approach taken here is not in order.

The structure of the paper is as follows. First, in section 2, we will do a rough comparison of the semantic map and the semantic map approach for modality, leaving aside deontic modality. Then we will investigate the special position of deontic modality in section 3 and relate our findings to the difference between raising and control constructions in section 4, using mainly data from Dutch. Finally, in section 5, we will indicate what the consequences of our findings are for the concept of modality.

2 Global structure of the modal map

Consider the hypothetical map in Figure 1 again, repeated here as Figure 5.

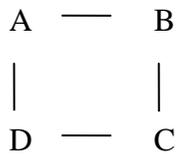


Figure 5: Hypothetical semantic map of four semantic functions

There is an alternative way to represent Figure 5, by decomposing the points of the map in terms in more basic properties or features. Suppose we have two features, let's say P and Q , corresponding to the dimensions of the map. Every point of the map is characterized by the presence (+) or absence (–) of these properties. One of the ways to do this might look as follows:

	–Q	+Q
–P	A	B
+P	D	C

Table 1: Feature decomposition of a hypothetical semantic map

How does the map in Figure 5 relate to this feature decomposition? We can observe that there is a line between two points if those points differ in just one feature, like $A = [-P, -Q]$ and $B = [-P, +Q]$.

The features can be used to define only certain sets of meaning: $[BC]$ on the semantic map corresponds to $[\pm P, +Q]$; $[ABCD]$ corresponds to $[\pm P, \pm Q]$; and $[A]$ to $[-P, -Q]$. All these sets are contiguous on the semantic map, but there are also contiguous sets that can not be defined in this way, like $[ADC]$. The difference between a semantic map and a semantic feature approach in this case is that the semantic map approach predicts sets of three meanings to exist (e.g. $[ADC]$), while the semantic feature approach predicts that these sets do not exist, since they cannot be described with a single feature combination. This difference can be a way to decide which approach is more appropriate in a particular situation: a semantic map approach might predict sets of functions that are not attested, and a semantic feature approach

might fail to predict sets of functions that *are* attested.² On a more general level there is another difference between the two approaches. A feature approach assumes the existence of more basic properties or features, like P and Q in the above example, that define the geometry of the map. In this approach, it needs to be explained why these features should exist in the first place. The pure semantic map approach does not commit itself to these more basic attributes. Therefore, the feature approach is a more top-down approach than the map approach, starting from conceptual considerations. The map approach is more data-driven and bottom-up, making less conceptual commitments.

We would like to emphasize that our point is not that meanings on the map should receive one definitive decomposition into features that are both primitive and binary. What is important to us is that the meanings have properties and that they are related to each other because of these properties. So, we want to explore the idea that the geometry of a map could be derived from something more basic in the meanings. The properties might be scalar instead of binary, they might be reducible to more basic properties and one property might carry more weight than another property in defining a map. We have used a simple system with binary features here for the sake of concreteness, to give substance to the idea that meanings hang together in a particular way because of more basic properties that they have. A more sophisticated system of semantic properties might have consequences for the structure of the map.

Let us now turn to Van der Auwera & Plungian's map in Figure 4 and compare the results. Their map represents two types of direct relations between meanings. Two meanings can be *adjacent* to each other, connected by an arrow (like participant-internal and participant-external) or one meaning can be *included* in another meaning (like deontic is included in participant-external). The direction of the arrow represents the direction of grammaticalization. These are two ways in which the map differs from other graph-based semantic maps (Haspelmath 2003, Croft 2003, Cysouw 2001), where non-directed lines are used between primitive meanings. Since we want to focus on the global structure of the modal map first, we will leave out the more specific deontic meaning as well as the directions on the lines, giving us the following map:

² On the other hand, a feature approach might face a problem of overgeneration, when it postulates a system of features that gives us feature combinations that don't correspond to actual meanings. This is where we need 'feature cooccurrence restrictions' grounded in the semantic theory about the features. For example, the combination +propositional,+internal, presented below, will have to be excluded.

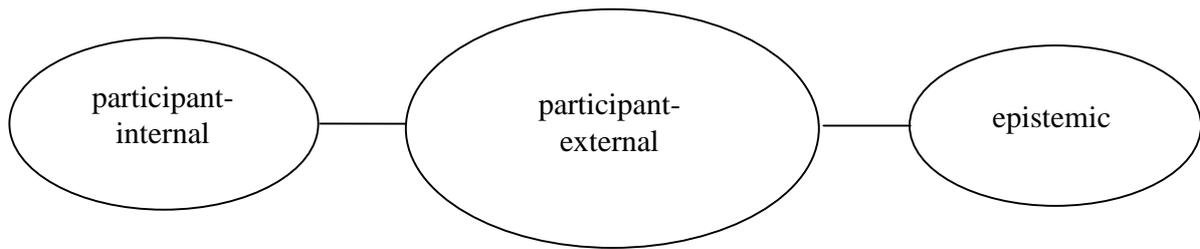


Figure 6: Modality's map without deontic modality

Why are the meanings ordered in exactly this way and not in a different way? Is there anything that we know about participant-internal, participant-external and epistemic modalities that we can use to derive or understand this structure? It is instructive to see what Van der Auwera & Plungian write on this:

‘Within the set of participant-internal, participant-external, and epistemic modalities, theoretically three subgroupings are possible: (i) participant-internal and participant-external modality together make up non-epistemic modality, (ii) participant-external and epistemic modality together make up non-participant-internal modality; and (iii) participant-internal and epistemic modality together make up non-participant-external modality. Only the first subgrouping makes sense, the reason being that both participant-internal and participant-external modality concern aspects internal to the state of affairs that the preposition reflects, whereas epistemic modality concerns (has scope over) the whole proposition.’ Van der Auwera & Plungian (1998:81-82)

Van der Auwera & Plungian already indicate that there is an important distinction between epistemic and non-epistemic. This corresponds to other distinctions that have been made in the literature (like root modality versus epistemic modality, event modality versus propositional modality). So, there is a grouping then of the participant-internal and participant-external modality, which sets these apart from the epistemic modality. Given this grouping we can understand why there is a link between participant-internal and participant-external, because there is a kind of tree structure in which participant-internal and participant-external are closer together:

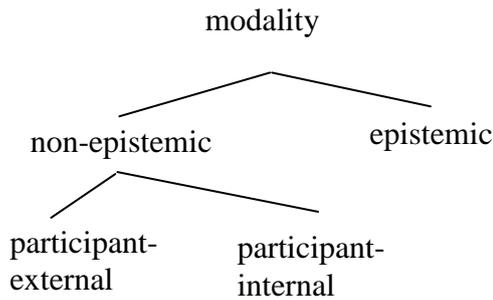


Figure 7: Epistemic - non-epistemic division

But this does not yet give us the structure of the map, because we still need to capture why participant-external is closer to epistemic than participant-internal? This does not follow the structuring in Figure 7. Van der Auwera & Plungian mention, but reject, a grouping of epistemic and participant-external as *non-participant-internal* modality. However, it is not clear on what basis this grouping can be rejected as not making sense. Any meaning that is not participant-internal must by logical necessity be non-participant-internal. So, both participant-external and epistemic are non-participant-internal: their possibility or necessity is not ‘connected to a participant engaged in the state of affairs’. This leads to the following grouping:

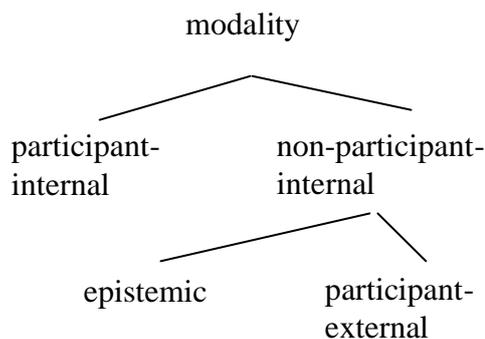


Figure 8: Internal - non-internal division

The idea is then that there are *two* dimensions of semantic features along which the three relevant modalities are distinguished, as indicated in Table 2. We use the feature \pm propositional to distinguish epistemic from non-epistemic modalities and \pm internal to distinguish internal from non-internal modalities.

	−propositional	+propositional
+internal	participant-internal	
−internal	participant-external	epistemic

Table 2: Feature decomposition of modality’s map minus deontic

This would logically lead to four distinct modalities, but the modality that is missing in Van der Auwera & Plungian is a modality that is both +propositional (i.e. having scope over the whole propositional) and at the same time +internal. This fourth modality can be excluded for principled reasons: a modality cannot at the same time operate at the level of participants internal to states of affairs, and at the level of the proposition as a whole. So, we assume that participant-internal epistemic is ruled out for this reason.

We can now use the two binary features to approximate the semantic map approach to modality:

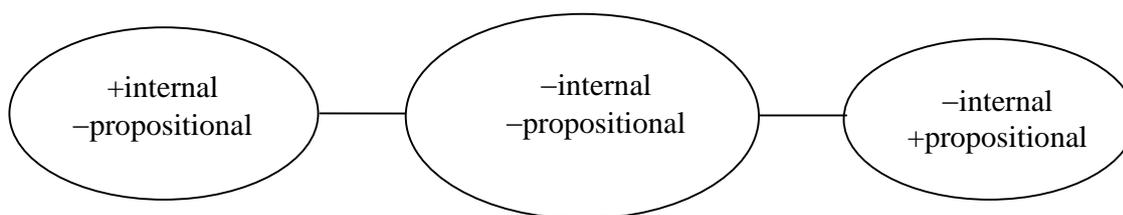


Figure 9: Feature map of modality minus deontic

Again, our point is not that modalities should necessarily be decomposed exactly in this way into binary features. Rather, given that modalities have certain properties, it is possible to define the structure of a semantic map, because the properties define how the meanings relate to each other. The line connects meanings that differ in one property or, conversely, share a property. In other words, similarity between meanings is based on what the meanings are like. Participant-external is in the middle because it shares a property with both participant-internal (being −propositional) and with epistemic (being −internal). With these three modalities of Van der Auwera & Plungian sorted out, let us now turn to the fourth, deontic modality.

3 The place of deontic modality

We saw that Van der Auwera & Plungian place deontic modality on the map as a *subtype* of participant-external modality. Their analysis is as follows: one way in which the circumstances can be the source of possibility or necessity is through permissions or obligations in those circumstances. Making deontic modality a subset of participant-external modality has a number of consequences. It suggests an implicational relation between participant-external and deontic: if an expression is used for participant-external (like *can*), then the map predicts that it is also used for deontic. Note that this is a different implicational relation from the one we get from the contiguity requirement: if an expression is used for participant-internal and epistemic, then also for participant-external, the meaning in *between* these two. There are reasons to believe that the implicational relation between participant-external and deontic is not true. In Van Ostaeyen & Nuyts (2004) it is argued that in Middle Dutch, *kunnen* ‘can’ only had the participant-internal and participant-external functions, and not the deontic and epistemic ones. This suggests that deontic and participant-external are indeed separate modal functions. A map based on this observation would look as follows:

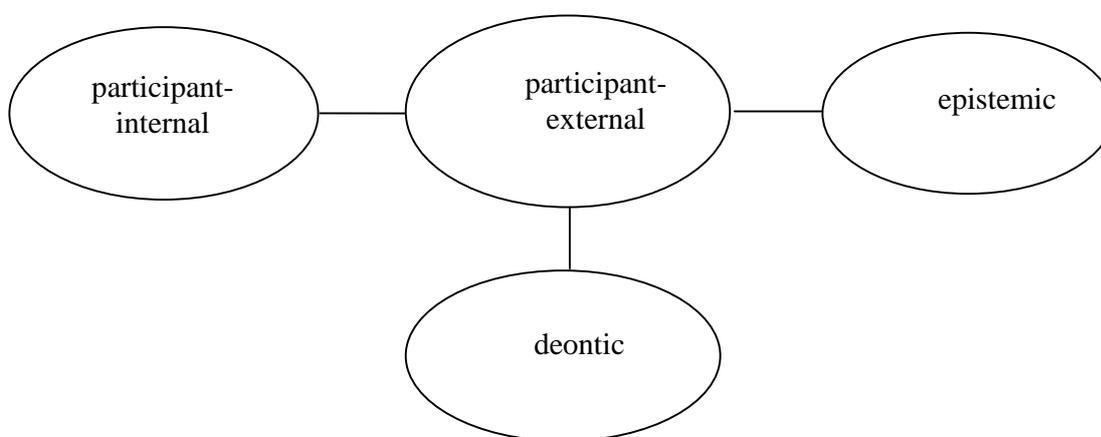


Figure 10: Semantic map of modality, including deontic

In Van der Auwera, Kehayov & Vittrant (this volume) it is acknowledged that there is a participant-external modality (or, as they call it, non-deontic participant-external modality) separate from deontic modality. Yet, they still portray a “super-function” in their semantic map, which encompasses both the participant-external and the deontic function. Why is such a super-function still needed?

Van der Auwera & Plungian (1998) originally used the inclusion relation to capture the diachronic phenomena of *specialization* and *generalization*. A word can specialize from

participant-external to deontic: it first used to cover the entire participant-external area and at a later stage only the deontic area. Instead of referring to external factors in general, the modal is then going to refer to those external factors that are based on authority, norms, morality. The opposite also exists: generalization from deontic to participant-external. We do not believe that the status of deontic modality and the phenomenon of specialization/generalization need to be portrayed on the map in a special way, different from the standard relation that holds between functions. The map in Figure 10 has the advantage of just allowing one type of connection between meanings (with the additional possibility of assigning a diachronic direction to connections), just like in other semantic maps (again, see Anderson 1982, Croft 2003, Haspelmath 2003, de Haan 2004, among others). A semantic map is then, mathematically speaking, a simple *graph* of meanings. The fact that participant-external and deontic together form a modal super-function need not be separately represented on the map. It is exactly the purpose of the map to define what groupings are possible on the basis of the underlying geometry of connections. The connection between deontic participant-external and non-deontic participant-external gives us the region on the map that encompasses both these meanings. In fact, every connected subnetwork on the map is in a sense possibly such a higher-order meaning or “super-function”. Specialization of meaning is also represented as a shrinking of the area covered by a particular item. Suppose that an item A first covers both participant-external and deontic and then at a later stage only deontic, then the area covered by A has shrunk and A has specialized in the deontic meaning. Again, we do not need a special relation of inclusion to capture this. We can already see this in the way the area corresponding to A has developed on the map.

Interesting in this light is a proposal by de Haan (2004) who states that a function should not be represented as a point on a semantic map, if it can be divided into more specific functions itself. In de Haan’s terminology such a function is not *primitive*:

‘a function X is not primitive if it can be subdivided into two (or more [...]) functions that are expressed by two separate morphemes in some language.’ de Haan (2004:5)

This proposal would indeed show why a super-function of deontic and participant-external modality combined should not be allowed, but on the other hand it poses a big problem for the map in Figure 10 as well. As already noted by Van der Auwera & Plungian (1998) and Van der Auwera, Kehayov & Vittrant (this volume), any of the four modal functions can be divided into submeanings. Following de Haan’s proposal this would mean that these

submeanings are the primitives of the semantic map, and therefore that the original four meanings should no longer be represented. We agree with de Haan that scholars should try to split their functional categories into primitive functions that cannot be split up any further. However, we like to stress that in some cases it might be opportune to present a map in which the categories are not fully decomposed. In other words, we think that the map in Figure 10 is sufficient for present purposes.

We can now turn to the question what the addition of deontic modality does for our comparison between the semantic map approach and the semantic feature approach. For the feature approach we simply introduce a feature +deontic that the other modalities are obviously lacking, see Figure 11. We take the feature ‘deontic’ to stand for whatever semantic property is characteristic for this meaning and what distinguishes it from non-deontic meanings. This does not reveal anything new about what deontic modality is, of course, but allows us to define the way this modality fits on the map.

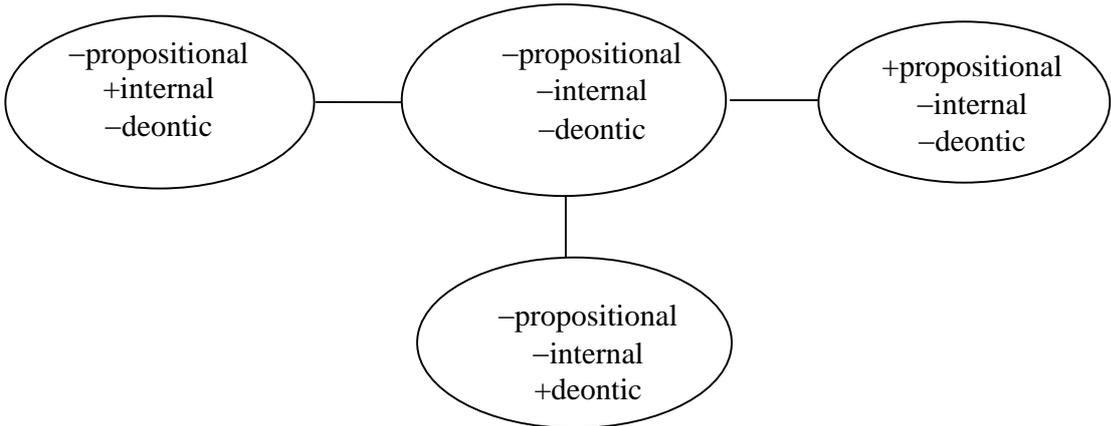


Figure 11: Feature map of modality, including deontic

This map lists four possible combinations of properties, the four original modalities. Why are the other four combinations absent? Concerning the combination with + propositional it is plausible that this feature can only combine with –internal and –deontic. A modality with the properties +internal or +deontic takes scope over a state of affairs, while a +propositional modality will take scope over entire propositions. This means that +propositional cannot combine with +internal or +deontic in the same modality. The only other possible combination, [–propositional, +internal, +deontic], cannot be dismissed on similar grounds. In the next section we will investigate if there are indeed elements with such a feature combination.

4 Raising and control and modality's map

We have seen that the primary distinctions on the semantic map concern internal and non-internal modality (\pm internal) and propositional and non-propositional modality (\pm propositional). The distinction has been made on conceptual grounds, following Van der Auwera & Plungian and much earlier work. An additional dimension was added by the deontic modality. Following Van der Auwera & Plungian, we have made a four-fold distinction in modality, and described it in feature terms, namely \pm internal, \pm propositional, and \pm deontic. Finally, the question was raised whether there exists a modality with features [+internal +deontic], since this modality could not be excluded on principled grounds.

Several scholars have distinguished a type of deontic modality that resembles these features (e.g. Barbiers 1995). The Dutch sentence in (5a) corresponds to a [+internal, +deontic] modality, while the sentence in (5b) corresponds to a sentence with [–internal, +deontic] modality:

- (5) a. Het comité mag Jan nomineren
The committee may John nominate
'The committee may nominate John'
- b. Jan mag genomineerd worden
John may nominated become
'John may be nominated'

In (5a) the deontic modality is internal to the subject *het comité* 'the committee', in the sense that the committee is the moral agent that receives the permission to do the action that is under its control. In (5b) the deontic modality is external to the subject *Jan*, because Jan is not in control of the action and does not receive the permission himself, but the implicit agent. We have used a passive to make this clearer here, although non-passive sentences can have this external deontic modality too.

This distinction corresponds to the grammatical distinction between *raising* and *control* verbs in generative syntactic terms. It has been assumed in the literature that verbs that select an infinitival complement must be either raising or control verbs (Chomsky 1981, Postal

1974). Raising verbs are verbs that do not assign a thematic role to their subject, see (6a) and its underlying structure in (6b):

- (6) a. John seemed to like me
b. [seemed [John to like me]]

Because a finite sentence nevertheless needs a subject, *John* in (6b) is raised to the matrix subject position, as seen in (6a). Control verbs are verbs that do assign a thematic role to their subject. The infinitival complement also has a subject and this subject is the same as the matrix subject (or sometimes another argument in the matrix predicate). Therefore it is assumed that the infinitive has a PRO-element *controlled* by the matrix subject, see (7a) and (7b).

- (7) a. John tried to like me
b. [John tried [PRO to like me]]

Regarding modals, it may be claimed that the modal verb in a sentence like (5a) is a control verb, while the modal verb in a sentence like (5b) is a raising verb, see Eide (2005). In other words, the difference between the two sentences is that in (5a) the matrix subject gets a special kind of theta-role from *mag* ‘may’ and in (5b) it does not get a theta-role. In (5a) the subject is directly granted the permission to do something, but in (5b) the derived subject is only indirectly granted such a permission, namely through the implicit agent. Following Barbiers (1995) we will call modals like the one in (5a) *directed deontic* and modals like the one in (5b) *non-directed deontic*. The role that a directed deontic assigns to a participant we will call the *grantee* role.

In the approach presented here the difference between directed deontic and non-directed deontic can be represented by the feature [\pm internal]: non-directed deontic is [–internal] and directed deontic is [+internal], because a participant in the states of affairs is directly involved in the modality. We would like to show that the [\pm internal] distinction is reflected in the grammatical raising/control distinction, not only in the [+deontic] modality but in the [–deontic] modality as well. The prediction would then be that [–deontic, –internal] modal verbs are raising verbs and that [–deontic, +internal] modal verbs are control verbs.

For epistemic modality ([–deontic, –internal, + propositional]) the claim that it involves a raising verb is undisputed. For participant-internal ([–deontic, +internal, – propositional])

and participant-external modality ([–deontic, –internal, –propositional]) the status is less clear (see Ross 1967, Pullum & Wilson 1977, Brennan 1993, Thrainsson & Vikner 1995, Wurmbrand 1999, Eide 2005, among others), but this might be because these two modalities were always lumped together. Eide (2005) cites several well-known tests for raising and control that she uses to back up the distinction between directed deontic and non-directed deontic. Let us now consider how these tests can be used to elucidate the status of participant-internal and participant-external modality in general.³

A first test to distinguish between raising and control is the pseudo-cleft construction, as shown in the following Dutch examples (from now on the following abbreviation will be used: PI = participant-internal, PE = participant-external, DD = directed deontic, NDD = non-directed deontic, E = epistemic):

- (8) a. Wat Jan probeert is (te) begrijpen hoe de oorlog is ontstaan [Control]
 what John tries is to understand how the war is arisen
 ‘John tries to understand how the war came about’
- b. Wat Jan kan is zwemmen [PI]
 what John can is swim
 ‘John can swim’
- c. Wat zij mogen is Jan nomineren [DD]
 what they may is John nominate
 ‘They may nominate John’
- d * Wat Jan kan is bus 66 nemen om bij het station te komen⁴ [PE]
 what John can is bus 66 take for near the station to come
 ‘John can take bus 66 to get to the station’

³ We would like to stress that we do not expect the distinction between directed and non-directed deontic to be encoded in every language in the world, because a language can easily do without the directed deontic category (see Bhatt 1997). Our main point is that there are languages where this encoding does exist. We have left out one test that did not give clear results, the existential scope test. According to this test an indefinite subject of a control sentence always has wide scope, while an indefinite subject of a raising verb also allows narrow scope because of reconstruction. Since it was too difficult to get clear intuitions about the scope properties of subjects of modal verbs, we decided not to include this test at this stage.

⁴ An anonymous reviewer pointed out that *kunnen* (and also *mogen*) here is possible in the pseudo-cleft construction in certain special uses:

- (i) Weet je wat jij kunt/mag?? Doodvallen!!
 know you what you can/may drop.dead
 ‘You know what you can do? Drop dead!’

To the extent that these examples represent PE or NDD meanings, they are still quite marked and possibly restricted to certain expressive contexts.

- e * Wat Jan mag is genomineerd worden [NDD]
 what John may is nominated become
 ‘John may be nominated’
- f * Wat Jan kan is de trein gemist hebben [E]
 what John can is the train missed have
 ‘John may have missed the train’
- g * Wat Jan schijnt is een misdadiger te zijn [Raising]
 what John seems is a criminal to be
 ‘John seems to be a criminal’

In a pseudo-cleft construction some element of a sentence is put in focus by making it the predicate of a copula and putting the rest of the original sentence in a subject element headed by a free relative. In (9a-b), (9b) is the pseudo-cleft counterpart of (9a).

- (9) a. John ate a herring
 b. [what John ate *e*] was [a herring]

With the sentences in (8a-g) the element in focus is the infinitival complement of the finite verb. This means that for (8b), for example, the structure is (10b), with (10a) being the structure of its non-pseudo-cleft counterpart.

- (10) a. Jan kan zwemmen
 DP [V_{fin} VP_{nonfin}]
- b. Wat Jan kan is zwemmen
 [Rel DP V_{fin} *e*] Cop [VP_{nonfin}]

In our free English translations the cleft is not reflected. What we see in the pseudo-cleft sentences in (8a-g) is that indeed the [-internal] modals pattern with raising verbs and the [+internal] modals pattern with control verbs. This is expected because in the pseudo-cleft construction the free relative pronoun (*wat* ‘what’) can be analyzed as the object of the finite verb. Because raising is not possible out of a pronoun, pseudo-cleft constructions of the kind in (10b) should be incompatible with raising verbs.

Related to the pseudo-cleft construction is the *pronoun substitution* construction. In this construction the verbal complement is substituted by demonstrative pronoun *dat* ‘that’, which

is topicalized in these examples. There are two ways to do this, leading to a two-argument answer (that we have given first) or a one-argument answer (given between parentheses):

- (11) a Probeert Jan te begrijpen hoe de oorlog is ontstaan? [Control]
 tries John to understand how the war is arisen
 ‘Does John try to understand how the war came about?’
- a’. Ja, *dat* probeert hij. (*Ja, dat probeert.)
 yes, that tries he (yes, that tries)
 ‘Yes he does.’
- b Kan Jan zwemmen? [PI]
 ‘Can John swim?’
- b’. Ja, *dat* kan hij. (*Ja, dat kan.)
 yes, that can he (yes, that can)
 ‘Yes he can’
- c Mogen zij Jan nomineren? [DD]
 may they John nominate
 ‘Are they allowed to nominate John?’
- c’. Ja, *dat* mogen zij. (Ja, dat mag.)
 yes, that may they (yes, that may)
 ‘Yes they may’
- d Kan Jan bus 66 nemen om bij het station te komen? [PE]
 can John bus 66 take for at the station to come
 ‘Can John take bus 66 to get to the station?’
- d’. Ja, **?dat* kan hij. (Ja, dat kan.)
 yes, that can he (yes, that can)
 ‘Yes that is possible.’
- e Mag Jan genomineerd worden? [NDD]
 may John nominated become
 ‘May John be nominated?’
- e’. Ja, **?dat* mag hij. (Ja, dat mag.)
 yes, that may he (yes, that may)
 ‘Yes, that is allowed.’

- f Kan Jan de trein gemist hebben? [E]
 can John the train missed have
 ‘Is it possible that John has missed the train?’
- f’. Ja, **dat* kan hij. (Ja, dat kan.)
 yes, that can he (yes, that can)
 ‘Yes, that is possible.’
- g Blijkt Jan een misdadiger te zijn? [Raising]
 appears John a criminal to be
 ‘Does John appear to be a criminal?’
- g’. Ja, **dat* blijkt hij. (Ja, dat blijkt.)
 yes, that appears he (yes, that appears)
 ‘Yes, that appears to be the case’

For the two-argument answers, the results are essentially the same as with the pseudo-cleft construction; demonstrative *dat* replaces the predicate, which is compatible with control verbs, but not with raising verbs, because pronouns do not have subjects that can be raised. One-argument answers are okay for raising verbs, but not for control verbs because they need two arguments.

A remark is in order about the nature of the grantee role that directed deontic modals assign. Bhatt (1999) notes that in the case of deontic modality this special role does not necessarily have to be assigned to the subject or to any other argument in the sentence. In that case the subject does not receive a theta-role from the modal and is raised from the lower predicate. If sentence (12) for example is uttered to John’s caretaker at the day-care, it is the caretaker that has the grantee role.

(12) John has to eat an apple today

In other words, just because there is the wish that a certain someone does a certain thing, it is not automatically so that this someone receives the responsibility for bringing it about. Consider also the following examples, in which (b), (c), and (d) are potential answers to the question in (a):

- (13) a. Jan: Mag de kleine Tim mee naar het strand?
 may the little Tim along to the beach
 John: ‘May little Tim come along to the beach?’
- b. Moeder: Dat mag.
 that may
 Mother: ‘He may.’ [permission granted to John: “You can take him with you”]
- c. # Moeder: Dat mag jij.
 that may you.
- d. Moeder: Dat mag hij.
 that may he
 Mother: ‘He may.’ [permission transferred to Tim: “He can come if he wants”]

If the b-sentence is the answer to the a-sentence, the mother grants the responsibility over Tim to John, the addressee of the sentence. This means that in the b-sentence the verb *mogen* ‘may’ only needs to assign one theta-role, which goes to the situation for which permission is granted (let us say that this theta-role is a Theme role, for matters of convenience). The grantee theta-role is not specified in this context. If it would be specified (see the c-sentence) there would be a semantic clash because the subject of the answer is not the subject of the question. Instead, if *hij* ‘he’ is used as in the d-sentence the permission/responsibility is granted to little Tim himself, and the verb *mogen* assigns two theta-roles, one for what is allowed (going along to the beach) and one for the person who is allowed to do that (little Tim). In sum, the argument structure of a deontic modal can have the following two schematic argument structures. Non-directed deontic modals have the structure in (14a), directed deontic modals the structure in (14b).

- (14) a. AUX_{deon} [VP DP [V’ ...]]
- b. DP_{Grantee} AUX_{deon} [VP PRO [V’ ...]]

So it seems that the grantee theta-role that deontic modals may assign to their subjects is optional: a speaker can also leave it to the context to clarify who has this role, in which case the theta-role has no syntactic status. This is in contrast with regular subject theta-roles, like the agent role with transitive verbs, which always has to be assigned. On the other hand, there are deontic modal sentences in which the subject can not get the grantee theta-role. These sentences typically include a verbal complement that is a passive or stative verb. This

suggests that grantee theta-roles always correspond to an agent theta-role in the infinitival complement (but not vice versa as we have seen in example (12)).

The last test we will present is the *dummy subject* test. Control verbs are said to be incompatible with dummy subjects, because dummy subjects may not take a theta-role, and control verbs obligatory assign a theta-role to their subject. This test provides straight-forward results (cf. Hackl 1998):

- (15) a. * Het probeert hier al tijden te regenen [Control]
 it tries here already times to rain
 * ‘It often tries to rain here’
- b. * Het kan hier flink regenen [PI]
 it can here heavily rain
 * ‘It is able to rain heavily here’
- c. * Het mag hier best eens regenen van mij [DD]
 It may here well once rain of me
 * ‘It is allowed to rain here as far as I’m concerned’
- d. Het kan hier flink regenen [PE]
 it can here heavily rain
 ‘It can rain heavily here’
- e. Het mag hier best eens regenen van mij [NDD]
 It may here well once rain of me
 ‘I’d like it to rain here’
- f. Het kan vanmiddag regenen [E]
 it can this.afternoon rain
 ‘It may rain this afternoon’
- g. Het schijnt hier regelmatig te regenen [Raising]
 it seems here regularly to rain
 ‘It seems to rain here regularly’

Notice that the asterisk in (15c) only applies to the interpretation where the dummy subject is granted permission directly.

The results of all the tests are summarized here in a Table⁵:

⁵ Tests with passive auxiliaries show that modals always precede the passive auxiliary. This would suggest that modals pattern with raising verbs, but on the other hand it may be the case that the passive is incompatible with a

	Control	PI	DD	PE	NDD	E	Raising
Pseudo-cleft				*	*	*	*
Pronoun substitution	*	*	*				
Dummy subjects	*	*	*				

Table 3: Raising/Control test results for modal verbs in Dutch

This shows how the [+internal] modalities (participant-internal and directed deontic) pattern with control verbs, which corresponds with the thematic role that these modal auxiliaries assign to the subject. The consequence is then that one half of the map (namely the [+internal] modalities) has raising properties and the other half (the [–internal] meanings) has control properties. So, the meanings on the modal map do not just correspond to words, but also to syntactic *constructions*. However, they do so in a way that crucially depends on the semantic properties of these meanings, as revealed in our sketchy analysis. Notice that the control/raising distinction is not itself part of the map, but it correlates with a modal distinction that *is* part of the map.

5 Conclusions: Connectivity and modal properties

As can be seen in Table 3 above, there are good reasons to assume the existence of two different deontic modalities, one with the attribute +internal (directed deontic) and one with the attribute –internal (non-directed deontic). If we incorporate these two different modalities in our feature structure we get the following result:

[+internal] feature:

- (i) ?? Kunnen deze paddestoelen gegeten worden? Ja dat kunnen ze.
 can these mushrooms eaten become yes that can they
 Intended: ‘Can these mushrooms be eaten? Yes they can.’

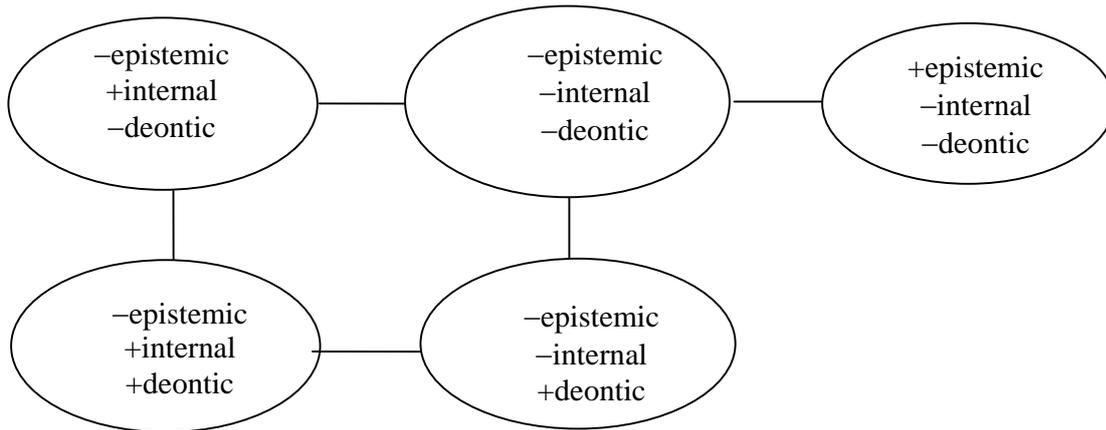


Figure 12: Feature map of modality, including two types of deontic

The semantic map counterpart of this representation would look like this:

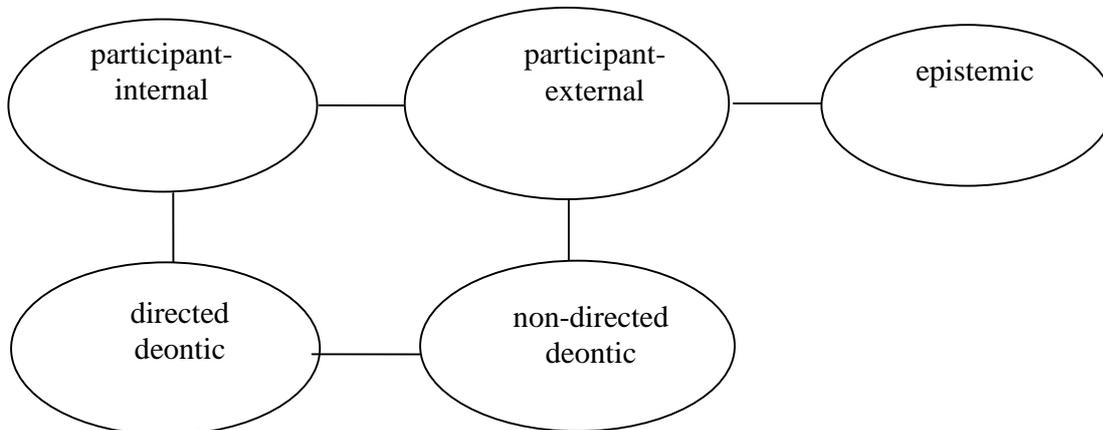


Figure 13: Semantic map of modality, including two types of deontic

These two representations may look the same, but because of their underlying principles they predict different variational patterns in languages (concerning non-epistemic modality, that is). As we stated in section 2, the semantic map approach and the semantic feature approach differ in their predictions when four functions are ordered in a square-like fashion. The map approach predicts that a certain linguistic element can have a set of three functions out of four, while the feature approach predicts that such sets are not possible. Therefore, one way to find out which approach is right, is to look for modal elements that can express three out of four non-epistemic modalities.

A quick glance at Germanic modality suggests that it is hard to find modal elements that express three out of four non-epistemic modalities. The only modal element that might meet this definition is the Dutch verb *kunnen*. *Kunnen* has without any doubt all three [-deontic]

modalities, participant-internal, participant-external, and epistemic. The deontic possibilities of *kunnen* are more marginal. Yet, a sentence like (16a) probably has a deontic interpretation.

- (16) a. Kan Jan bij ons komen wonen
 can John by us come live
 ‘Can John come live with us?’
- b. Ja dat kan
 Yes that can
 ‘Yes he can’
- c. ? Ja dat kan hij
 Yes that can he

The sentence in (16a) can have (16b) as a possible answer, but (16c) is less acceptable. This suggests that deontic *kunnen* is better in its non-directed deontic reading, in the light of the tests of the previous sections. The answer in (16c) shows that *kunnen* with two theta-roles is less fortunate under a deontic reading, which means that directed deontic modality is less fortunate for *kunnen*. Yet, the unacceptability is not very strong, so *kunnen* is not that convincing as an example. Also, it must be said that deontic modality for *kunnen* is marginal in general (Van Ostaeyen & Nuyts 2004). More languages should be investigated to check whether Dutch *kunnen* is an anomaly or a fine example of the workings of modality.

As yet we have not found good examples of linguistic elements with three out of four non-epistemic modalities, but of course, a much wider survey of languages would be necessary to determine which of the two approaches is more adequate. In the semantic map approach, every contiguous (connected) set of nodes in Figure 13 is possible, but in the feature approach, the following sets are predicted to exist:

- (17) a. the single modalities:
- | | |
|------|---------------------------------------|
| PI: | [–propositional, +internal, –deontic] |
| PE: | [–propositional, –internal, –deontic] |
| DD: | [–propositional, +internal, +deontic] |
| NDD: | [–propositional, –internal, +deontic] |
| E: | [+propositional, –internal, –deontic] |
- b. combinations of two modalities:

- | | |
|---------|-----------------------------|
| PE+E: | [-internal, -deontic] |
| PI+PE: | [-propositional, -deontic] |
| DD+NDD: | [-propositional, +deontic] |
| PE+NDD: | [-propositional, -internal] |
| PI+DD: | [-propositional, +internal] |
- c. combinations of three modalities:
- | | |
|-----------|-------------|
| PI+PE+E: | [-deontic] |
| PE+NDD+E: | [-internal] |
- d. combinations of four modalities
- | | |
|---------------|------------------|
| PI+PE+DD+NDD: | [-propositional] |
|---------------|------------------|
- e. combination of all five modalities:
- | | |
|-----------------|----|
| PI+PE+DD+NDD+E: | [] |
|-----------------|----|

The number of sets here is smaller than the number of sets under a semantic map approach, because under such an approach the only criterion regarding a possible set is the notion of contiguity: all functions in a set should be connected. In fact, the number of sets that actually appear in languages is probably even smaller than the number of sets in (18a-e) above. One aspect in this matter is that the two deontic modalities are never expressed by different elements to our knowledge. The reason for this is probably that a grantee theta-role does not have to be assigned syntactically, but can also be inferred pragmatically (Bhatt 1997).

Because of this, the difference between the two deontic modalities is not that sharp.

The fact that the two modalities always go together has the effect that participant-external gets the status of central modality. If a linguistic element has a participant-internal function it can only gain the deontic functions if it first gains the participant-external function. If it directly gained the two deontic functions this could not be represented by a single valid feature combination. This is represented in the following hypothetical sequence of stages:

- (18) a
- | | | |
|---------|-----------|-------------------------------------|
| Phase1 | functions | PI |
| | features | [+internal -deontic -propositional] |
| Phase 2 | functions | PI + DD + NDD |
| | features | * |

b	Phase1	functions	PI
		features	[+internal –deontic –propositional]
	Phase 2	functions	PI + PE
		features	[±internal –deontic –propositional]
	Phase3	functions	PI + PE + DD + NDD
		features	[±internal ±deontic –propositional]

In (18a) the situation is represented in which a participant-internal modal element directly gains the two deontic modalities. Under the semantic feature approach it is predicted that this development can not happen, because there is no single set of features that describes the combination of PI + DD + NDD ([+internal ±deontic –propositional] describes PI + DD, and [±internal ±deontic –propositional] describes PI + PE + DD + NDD). Therefore, if the two deontic modalities are to be acquired, first the [±internal] feature must be set, which automatically leads to an additional PE meaning (18b).

Also, if there is another combination of modal meanings, the central participant-external meaning has to be part of it. If an element that has a participant-internal function gains an epistemic function, it first has to gain the participant-external function.⁶ And if an element with the two deontic functions wants to gain the epistemic function (or the other way around),

⁶ An anonymous reviewer notes that a Dutch verb like *willen* ‘to want’ may have a participant internal and an epistemic reading, but not an participant external one. We do not think that *willen* has an epistemic reading. Syntactically, this reading has the properties of a participant external reading:

- (i) Het kan hier geregend hebben. [epistemic]
it can here rained have
‘It may have rained here.’
- (ii) ??Het wil hier geregend hebben.
it wants here rained have
- (iii) Het heeft hier altijd flink kunnen regenen. [participant external]
it has here always severely can to.rain
‘There has been heavy rainfall here.’
- (iv) Het heeft hier altijd flink willen regenen.
it has here always severely want to.rain
‘There has been heavy rainfall here.’

See Van Gerrevink (2008) for the nature of the modality in (iii) and (iv).

it first has to gain the participant-external function. All in all it seems that participant-external modality plays a central role in the extension of modal functions.

Notice now that because of this the representation in Figure 12 gets an interesting *radial* structure. In the centre we find a kind of unmarked modality ([–propositional, –internal, –deontic]), from which more specific modalities branch out in different directions. These modalities have a clear identity: they are internal, epistemic and/or deontic. It is relatively easy to recognize these four specific modalities and to keep them apart. The modality in the middle is like an unspecified middle ground. This is where we put sentences that have a modal meaning, but without the nature of the modality being specified or being clear. Also, we suspect that an important empirical hypothesis can be brought forward about the central, unmarked modality. As far as we can see, there does not seem to be any modal expression specifically used for participant-external modality *only*. Every modal expression has to include in its meaning at least one of the four clear extremes.

We compared two ways to analyze the polyfunctionality of modal expressions (and ignored a third one in which polyfunctionality results from the interaction between a general meaning and contextual or syntactic factors). We can analyze them as regions on a semantic map of unanalyzed modal meanings with the extra constraint that these regions are connected, but we can also characterize these polyfunctional modal expressions as defined by semantic features, by particular combinations of underlying modal properties. We have indicated how these two approaches could lead to clearly different empirical results, because the semantic map approach allows, by its property of connectivity, for non-classical categories of meanings.

What we found is that, in the existing modal map of Van der Auwera and his colleagues, there is no region that cannot be analyzed in the second, ‘classical’ way, namely through a combination of necessary and sufficient modal properties. Strictly speaking, when we have the features, the map of connections is not necessary to *explain* the range of modal expressions that we find. This is a somewhat disappointing result, because it means that the modal map as it stands does not really give us anything extra over and above what we already could get from a ‘classical’ analysis of modal expressions as ‘feature sets’. The interesting thing about semantic maps is they allow us to define linguistic categories that are non-classical (i.e. cluster categories, family resemblance categories), while at the same time restricted in a non-trivial way (by the property of contiguity). However, for the map of modal meanings that we have now this cannot yet be convincingly shown.

Our purpose was not to propose the classical approach as a serious alternative to the semantic map approach to modality and show its empirical superiority by giving a range of new data. Our main point is that it is essential to think about the semantic motivations for the geometry of the modal map. Only then can we really determine what this geometry entails for the empirical range of the contiguity property. Obviously, a much deeper empirical study of modal polysemy might come up with non-classical extensions of modal expressions, showing that a classical analysis does not suffice. There are also semantic maps for other domains where a similar approach might be taken. In this way we can hope to empirically confirm the intuition that polyfunctionality in the grammar and the lexicon is constrained by the property of connectivity.

References

- Anderson, Lloyd B. (1982). The 'perfect' as a universal and as a language-particular category. In Hopper (ed.) *Tense-aspect: between semantics and pragmatics*, 227-64. Amsterdam/Philadelphia: John Benjamins.
- Barbiers, Sjef (1995). *The Syntax of Interpretation*. Doctoral dissertation, HIL, Amsterdam.
- Bhatt, Rajesh (1997). Obligation and possession. In Heidi Harley (ed.), *Papers from the UPenn/MIT roundtable on argument structure and aspect*. (= MIT Working Papers in Linguistics 32)
- Brennan, Virginia (1993). *Root and epistemic modal auxiliary verbs*. Ph.D. diss., UMass Amherst.
- Bybee, Joan, Perkins, Revere, and Pagliuca, William (1994). *The evolution of grammar: tense, aspect and modality in the languages of the world*. Chicago: University of Chicago Press.
- Chomsky, Noam (1981). *Lectures on Government and Binding*, Foris, Dordrecht.
- Croft, William (2003). *Typology and Universals, second edition*. Cambridge: Cambridge University Press.
- Cysouw, Michael (2001). *The paradigmatic structure of person marking*. Ph.D. diss., Radboud University Nijmegen.
- Haan, Ferdinand de (2004). On Representing Semantic Maps. In: *Proceedings of E-MELD Language documentation conference 2004: Workshop on linguistic databases and best practice*. Wayne State University, Detroit, Michigan, July 15th - 18th.

- Haan, Ferdinand de (2005). *Typological Approaches to Modality* in: William Frawley (ed.) *Modality*. Berlin: de Gruyter.
- Eide, Kristin Melum (2005). *Norwegian Modals* (= Studies in generative grammar 70) Berlin: de Gruyter.
- Fleisher, Nicholas (2006). The syntax of possession-obligation modals: Evidence from expletives. Paper presented at the LSA Annual Meeting, Albuquerque, N.M.
- Gerrevink, Richard van (2008) "I should have been ill": The interaction of tense, aspect and modality in Dutch. MA thesis, Nijmegen University.
- Hackl, Martin (1998). On the Semantics of "Ability Attributions". Ms., MIT.
- Haspelmath, Martin (2003). The geometry of grammatical meaning: semantic maps and cross-linguistic comparison. In M. Tomasello (ed.) *The new psychology of language: cognitive and functional approaches to language structure, vol. 2*. Mahwah, NJ: Lawrence Erlbaum, 211-42.
- Kratzer, Angelika (1977). What 'must' and 'can' must and can mean. *Linguistics and Philosophy* 1, 337-355.
- Palmer, Frank R. (2001). *Mood and Modality, second edition*. Cambridge: Cambridge University Press.
- Postal, Paul M. (1974). *On Raising: One Rule of English Grammar and its Theoretical Implications*. Cambridge: MIT Press.
- Pullum, Geoffrey, and Deirdre Wilson (1977). Autonomous syntax and the analysis of auxiliaries, *Language* 53, 741-788.
- Ross, John R. (1969). Auxiliaries as main verbs. In W.Todd (ed.) *Studies in Philosophical Linguistics*, 77-102, Great Expectations, Evanston, Illinois.
- Thrainsson, Höskuldur and Sten Vikner (1995). *Modals and Double Modals in the Scandinavian Languages* (= Working Papers in Scandinavian Syntax 55), 51-88. Department of Scandinavian Linguistics, Lund University.
- Van der Auwera, Johan, Petar Kehayov and Alice Vittrant. Acquisitive modals. This volume.
- Van der Auwera, Johan and Vladimir Plungian (1998). Modality's semantic map. *Linguistic Typology* 2, 79-124.
- Van Ostaeyen, Gert and Jan Nuyts (2004). *De diachronie van kunnen* (= Antwerp papers in linguistics 109). Wilrijk: Universiteit Antwerpen.
- Wurmbrand, Susi (1999). Modal verbs must be raising verbs. In Sonya Bird, Andrew Carnie, Jason D. Haugen and Peter Nordquest (eds.) *Proceedings of the 18th West Coast Conference on Formal Linguistics* (= WCCFL18), 599-612.