Response to Hilpert

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1. Introduction

In his contribution to this issue, Martin Hilpert documents a shift over time in the collocational preferences of the modal auxiliary *may*. Hilpert's paper is interesting beyond the empirical tools he brings to bear on this topic, as he also pleads for another shift, a theoretical one. In his treatment of *may*'s changing collocates, Hilpert (this issue, p. 82) proposes that we move away from conceiving constructions as "schemas with slots" towards seeing them as "networks of connections": "a constructional view needs to pay close attention to the mutual associations between modal auxiliaries and the lexical elements with which they occur" (this issue, p. 67).

As Hilpert argues, the topic of modal verb constructions is a challenging one for Construction Grammar, since it is not immediately obvious that such constructions exist at all. Modal verbs do not seem to enter into configurations that are semantically non-compositional, exhibit unpredictable formal properties or are subject to unexpected constraints. The only clear motivation for a constructional view is the observation that a modal verb combines with some infinitives much more frequently than could be expected (and with other infinitives much less frequently than expected).

We agree with Hilpert that a structure such as [*can* + infinitive] is not semantically or formally abnormal and has no special restrictions. This is also the case for an inverted structure such as [*should* + subject NP + infinitive], which falls naturally from the general grammatical pattern common to all core modals. Nevertheless, if we add more elements to such kernel structures, extending them to the left, right or in both directions, we may find modal verb idioms which do have idiosyncratic semantic or formal properties and constraints. In our own contribution (Cappelle and Depraetere, this issue), we have discussed some examples of such longer sequences, such as the idiom *Not if I can help it*, which is routinely interpreted as a closed conditional ('I *can* help it'), is relatively fixed in form (*?This won't happen if I can help it*) and does not permit standard permutations (**If I can help it, then not*).

In this response to Hilpert's paper, we will both support and extend his main claim. On the one hand, we will argue that Hilpert is right in stressing the importance of collocations in describing speakers' knowledge of language. We will do so by taking the modal verb *must* as a case, although we will not compare the collocational preferences of present-day *must* with those of *must* as used in previous periods. Rather, we will only use contemporary data. On the other hand, we will argue that Hilpert's emphasis on a modal's collocational preferences need not – and in fact should not – be restricted to the following lexical infinitive. In short, we aim to adopt Hilpert's focus on the collocational profile of a modal verb, showing that we can obtain further descriptive benefits by widening this focus so as to include several collocating elements at a time.

2. How can we find strong collocates of *must*?

Taking seriously Hilpert's claim that collocational preferences are part of speakers' knowledge of language, we will here demonstrate a simple corpus methodology for identifying stored sequences containing a modal verb, beginning with two-word sequences (i.e. *must* followed by one lexical item). Just like Hilpert, we aim to get a better grip on the meaning of the modal verb by looking at the words it combines with. As Firth (1957: 11) famously put it, "You shall know a word by the company it

keeps". Our approach is also inspired by De Haan's (2012) discussion of a wide variety of constructions with *must*. De Haan (2012: 703) points out that *must* is like most other modals in exhibiting polysemy: it has at least an epistemic and non-epistemic meaning (cp. *There must have been some kind of mistake here* vs. *We must all stand together*). He then argues that the constructions around this modal "are part of the grammatical information speakers and hearers have that they can draw on to disambiguate between the various meanings of *must*" (De Haan 2012: 722). These constructions can either be located at (what he refers to as) the *micro-level* or the *macro-level*. This does not entirely correspond to that of Traugott (2008) between *micro-constructions* and *macro-constructions* (between which there are also what she calls *meso-constructions*). For De Haan, micro-level constructions are "constructions involving specific lexical elements". Examples of micro-level *must* constructions are deontic *must* constructions like *I must admit…* and *I must confess…*, which functions as "pragmatic markers of hedging for the sentence as a whole" (De Haan 2012: 725). At the macro-level, we find "a more abstract set of constructions based on a combination of *must* with grammatical categories such as person or tense/aspect" (De Haan 2012: 722-723). Examples of macro-level *must* constructions are *must* + perfect (with evidence of fusion: *musta* + past participle) and *must* + progressive, which are "solidly interpreted as epistemic" (De Haan 2012: 725; see also Wärnsby (2006 and this issue) for detailed analysis of the impact of tense and aspectual markers on modal interpretation).

So, how can we find the most strongly collocating lexical elements around the modal, in order to identify stored *must* constructions? There are at least two possibilities to measure collocational strength of a combination. One simple method involves the raw frequency of the combination. Based on this measure, one could argue that the set of *must* constructions should include *must be*, *must have*, *must not*, *must also*, *must go* and the like, which rank high in a frequency-based list generated by a collocation search in a large corpus such as the BNC or COCA (Davies 2008-). A problem of this method is that it yields combinations which, though very frequent, may not actually be stored. For instance, *must also* might be nothing but a *construct*, that is, an attested but non-memorized instantiation of the pattern [*must* + adverb] and/or of the pattern [auxiliary + *also*]. A more insightful method makes use of Mutual Information (MI), which measures how often two items co-occur as a proportion of their separate occurrence. If we order a collocation search in a large corpus by MI score, we retrieve combinations such as *must confess*, *must perforce*, *must admit*, *must precede*, *must notify* and the like. Such a list is more 'relevant' because it reveals which words combine with the modal more often than could be expected on the basis of the frequency of those words in other environments. This method, too, has a disadvantage, namely that it tends to give too much weight to infrequent collocates. For instance, in the BNC, *must carbon-date* has a very high MI score, but this is for no other reason than that there is just one occurrence of *carbon-date* in this corpus, which happens to be after *must*. A solution to this problem is imposing a frequency threshold of, say, 5 (or 10 or 50, depending on the size of the corpus – the larger the corpus, the higher one may want to set the threshold).

Construction Grammarians often make use of collostructional analysis (Stefanowitsch and Gries 2003), which is a set of methods to measure the strength of attraction (or repulsion) of lexical items to one or more positions in a construction, taking into account the frequency of these items in the corpus as a whole (or in one or more alternative constructions). One method in the family of collostructional analyses is collexeme analysis, which aims at ranking items according to their strength of attraction to an open slot in one construction. We used this method to see which items are attracted to the post-modal slot of the schema [$must_{\text{used as a modal}}$ + __] in the BNC, for which we used Mark Davies's interface (Davies 2004-). An important drawback of the collexeme method is that it cannot tell us which lexical items *in the entire corpus* are most strongly associated with modal *must* in that slot; it can only tell us which of the items *in a list of good collocate candidates* score best. In

other words, we first have to establish a set of lexical items which we suspect are good collocates for *must* and subsequently perform a collexeme analysis on those items that indeed co-occur with *must*.[1]

This is how we compiled such a list. First, we looked up the fifty most frequent combinations of *must* (used as a modal auxiliary) and any following lexical item in BYU-BNC. Next, we added the fifty highest MI-scoring combinations of modal *must* and a following word with a minimum joint frequency of 10. We thereby excluded all combinations that already occurred in the high-frequency list, but added combinations to the list until we had fifty additional items, thus obtaining a combined list of hundred potential collocates.

On this combined high-frequency plus high-MI-score list, we ran a collexeme analysis in the statistical environment R, using Gries' (2007) script. This analysis requires looking up the frequencies of the individual items, which have to be fed into a table on which the computation is based. The need to look up frequencies of items one by one means that the collexeme analysis is a rather laborious method. It would therefore be interesting to know whether it really provides better results than the other two methods mentioned above. Fortunately, given the nature of our input list used in executing the script for collexeme analysis, we can compare the output of that analysis to the results obtained by the raw frequency measure and the Mutual Information score. Table 1 contains the 40 strongest collexemes after *must*. The list does consist exclusively of combinations of *must* with the infinitive of a lexical verb. There are also combinations of *must* with an adverb (e.g. *always*, *therefore*, *not*). In boldface are the items which also appear in the top 40 high-frequency combinations and underlined are the items which also appear in the top 40 combinations with a high MI score. Note that we weeded out high MI-scoring items that already occurred on the high-frequency list and while a few items in Table 1 are nonetheless both in boldface and underlined. That is because we here use the top 40 MI-scoring combinations prior to removal of doubles.

Table 1. The 40 strongest *must*+collexeme pairs, based on BYU-BNC; in boldface: items among the 40 most frequent *must*+word combinations; underlined: items among the 40 highest MI-scoring combinations (with min. frequency of 10)

1. **must be**	11. **must therefore**	21. **must decide**	31. **must now**
2. **must have**	12. **must surely**	22. **must learn**	32. **must keep**
3. **must not**	13. **mustn't**	23. **must pay**	33. must accept
4. **must also**	14. **must get**	24. **must consider**	34. **must find**
5. **must go**	15. **must come**	25. **must remain**	35. must contain
6. **must take**	16. **must remember**	26. **must ask**	36. must include
7. **must make**	17. **must know**	27. **must tell**	37. must wait
8. **must say**	18. must confess	28. **must look**	38. **must do**
9. **must admit**	19. **must ensure**	29. **must give**	39. must satisfy
10. **must always**	20. **must provide**	30. **must try**	40. **must recognise**

The predominance of items in boldface suggests that the collexeme analysis favours frequent combinations rather than ones with a high Mutual Information score. Nevertheless, we find that some of the latter are included. Note, for instance, that *confess* is in the top twenty strongest collexemes but is not even among the forty most frequently used words following *must*. (In fact, it ranks sixtieth on the raw frequency list.) If we compare the list of items in Table 1 with the forty highest-ranking

[1] This objection is only fully valid if one uses a web interface such as the one for the COCA corpus or the BNC corpus via Mark Davies's website. If one downloads the entire corpus, one could write a script that first retrieves all sequences of *must* tagged as a modal verb followed by an item, then looks up the corpus frequencies of those post-*must* items and finally uses all these data to conduct a collexeme analysis producing scores of attraction or repulsion of each of these items. Obviously, this requires that the corpus be fully available and that the researcher have some programming skills.

combinations sorted by MI score whose minimum joint frequency is fifty (instead of ten), we find that twenty-three (rather than eight) items in Table 1 occur in that top 40 MI-based list. So, we can produce a fairly reliable list of collocates, which overlaps to a large extent with the output of a rather time-consuming collexeme analysis, by simply sorting search results by MI score in Davies's (2004-) interface – this is called sorting by "relevance" there – and setting a quite high minimum frequency for the retrieved combinations. Since such a procedure gives an output not altogether dissimilar to that of a collexeme analysis (which is based here on frequent combinations complemented with high MI-scoring combinations in the first place), we will in the next section keep using MI scores as a measure for collocational strength.

3. Looking at more than two words

A list of strong collexemes – or, for that matter, high MI-scoring combinations – does not seem to give us that much direct insight into modal meaning. It just points towards some likely stored combinations, including such micro-constructions (cf. p. 87) as *must say*, *must admit*, *must confess* and some (parts of) macro-constructions (cf. again p. 87), such as *must be* and *must have*. The latter may or may not be followed by a past participle – we just cannot know this from the collexeme analysis alone. In other words, the *must*+word combinations we have retrieved so far do not necessarily capture complete constructions. To see what we mean by this, consider the combinations *must continue*, which is a quite frequent combination – it's in place 51 on a frequency-based ranking – and which has an MI score above 3 (a standard threshold), namely 4.05. On the basis of this high frequency and considerable collocational strength, we could be led to assume, as apparently does Constantine the Russian frog in the film *Muppets Most Wanted*, that this combination can effortlessly be combined with a subject NP such as the show:

(1) Constantine: "As the saying goes, the show must continue in a timely fashion" (*The Muppets Most Wanted*)

Needless to say, Constantine here misuses a familiar sequence (*The show must go on*). Such a comical deviation from a standard formulation highlights the need to look at more than two co-occurring word, when it comes to identifying modal verb constructions. But is *The show must go on* really a construction? Given that its form is fixed, it certainly is. The fact that only a non-native speaker of English would manage to change the wording is proof that competent speakers of English have memorized the form associated with the meaning. And there is also something semantically non-compositional about the combination: not the non-spatial meaning of *go on*, which is used as synonym for *continue* elsewhere as well, but the use of *the show* to refer to any activity which demands some prolonged effort. The saying has an entry in the *Cambridge Advanced Learner's Dictionary*, where it is aptly explained as something "said to encourage someone to continue with what they are doing, even if they are experiencing difficulties". What we need, then, is a procedure to find such longer modal verb constructions, going beyond two-word combinations.

In his search for a semantic characterization of *may*, Hilpert also looks at more than two words. Using a sophisticated statistical technique, he groups *may*'s co-occurring lexical infinitives by the degree to which these infinitives share collocates in a text window of four words to the left and to the right. This eventually allows him to construct a visualisation of the 'semantic landscape' of *may*, where lexical infinitives that have many neighbouring words at similar frequencies in common are placed close to each other. This does give us some insight in the semantic profile of *may*, as semantically similar verbs cluster together. Moreover, Hilpert shows how such clusters may wax or wane over time. For instance, the semantic cluster made up of *may depend*, *may indicate* and *may involve*, in which *may* is used epistemically, has grown in frequency since the early nineteenth century: despite a visible lull in growth or even decrease in the middle period, this cluster has now absorbed collocations such as *may affect* and *may contribute*. By contrast, while non-epistemic

combinations such as *may say* and *may thank* were quite frequent in the first half of the nineteenth century, we now combine *may* much less often with these speech act verbs.

Hilpert's methodology makes explicit specific mini-constructions of *may* with an infinitive and it results in interesting insights in collocational shifts. With respect to the former, the lexical proximity of the verbs following *may* seems to fall out of their shared collocates. If we take again the case of *say* and *thank*: in Hilpert's semantic landscape they are placed in close proximity to each other, on the basis of their shared occurrence with *like* (as in *I would like to say/thank*…), *please* (as in *Please don't say that* and *Oh, yes please! Thank you*)[2] and several dozens of other lexical items that are often used in their immediate environment (even, as is obvious from the examples above, sometimes in rather different ways). *May say* and *may thank* are arguably two-word constructions, the functional pole of which can be characterized in large part in term of the shared lexical meaning of the infinitives (verbs of saying). However, this is probably not the end of the story. A crucial difference between *may say* and *may thank*, if we look more closely at their use in COHA (Davies 2010-), is that *may say* is predominantly used with *I* and only sporadically with *you* as a subject, whereas the reverse pattern holds for *may thank*. This difference is important, as it reflects (previous generations of) speakers' stored knowledge of how these combinations function pragmatically. In other words, it will be useful to expand the methodology so as to include the left-hand context of the modal as well in order to arrive at an all-encompassing semantic network of constructions.

We would like to present another, admittedly more manual method to retrieve interesting longer sequences containing a modal verb, which takes into account the context preceding the modal verbs as well.

1. In Mark Davies's BYU-BNC interface, we look for items to the left or right of *must* (used as a modal), setting a minimum frequency of 50 occurrences for these word pairs and keeping combinations with a minimum MI score of 3. This gives as output combinations such as *must confess*, *must admit*, *must surely* and so on. In total, we can thus extract 70 combinations from BYU-BNC.
2. We enter these word pairs as new search items and look again for collocating items to the left or to the right, in the way described in the previous step. For the pair *must admit*, for example, this yields the three-word sequences *I must admit* and *must admit that*. Some pairs do not have any strong collocates (e.g. *must satisfy*, *must contain*), others have several (especially *must be* and *must have*). In total, we can thus obtain 98 three-word sequences.
3. We continue the procedure until no more collocating words can be added to either the left or the right of any of the sequences already obtained. We extracted 19 four-word sequences (e.g. *you must be joking*) and 4 five-word sequences (e.g. *it must be remembered that*).

These longer strings (also known as lexical n-grams) allow us to get a better grip on the meaning of modal *must* and how it is formally manifested. One of the form-function generalizations we can draw is that deontic *must* is often used with a passive infinitive (cf. (2)) or with periphrastic modal expressions of ability or willingness (cf. (3)):

(2) *care must be taken, must be exercised, must be accompanied by, must be based on, must be regarded as, must be seen as, must be understood*
(3) *must be able to, must be capable of, must be prepared to*

This means that pedagogical or descriptive grammars of English would more aptly provide sentences containing *Care must be taken (not) to…* or *The candidate must be capable of…* as representative

[2] In COHA, the use of *thank* in *thank you* is tagged as a lexical verb.

examples of the standard deontic use of *must* than, say, *You must go now*, which, though clearly not ungrammatical, may not be stored as a construction and does not reflect how *must* is more typically used.

A second form-function generalization concerns a separate deontic use of *must*, with verbs of concession. In this use, *must* can still be used with a passive infinitive (e.g. *it must be admitted…*), but we more commonly find *I* as a subject (e.g. *I must admit…*, *I must confess…*). That this is a separate construction is supported by the observation that the verb *say* acquires a concessive meaning by being used in this pattern (*I must say that…* = 'I must admit that…').[3]

Thirdly, another stored deontic use involves verbs of remembering or (mental) observing and serves to stress a particular point. Some of the sequences we retrieved are given in (4) share this function:

(4) *must be recognized, must be noted, we must remember, you must remember, must remember that, it must be remembered that, it must be stressed that, must be borne in mind*

These sequences are part of what might be considered to be some kind of evidential expression or an expression of 'de-subjectification', as the underlying idea seems to be, 'This is not just my opinion; it's a generally accepted one'.

Finally, as had already been noted earlier, there is an epistemic use of *must*, which involves non-passive *be* (used instead as an existential verb, as a copula or a progressive auxiliary) or the perfect infinitive (often of a verb of cognition, perception, sensation or appearance). In (5) and (6) we illustrate this with some of the multi-word sequences we retrieved with the method described above:

(5) *there must be something, there must be some, must be mad, you must be joking*
(6) *someone must have, must have known, must have seen, must have heard, must have felt, must have looked, must have seemed, must have been*

We have shown here that *must* does not have a single meaning/use, nor even just two meanings/uses, a deontic and an epistemic one. Rather, there are several more specific functional 'hotspots' in the semantic network where we find expressions clustering together. Although we adopted a rather different methodology, the picture sketched here corresponds to what Hilpert (this issue, p. 80) found for *may*: "the semantic landscape of *may* is pluricentric. Instead of a single group of verbs acting as a solitary attractor, there are several peaks that reflect the varied and heterogeneous meaning potential of *may*."

4. Some conclusions and further outlook

We fully agree with Hilpert that by looking at the lexically specific environments of a modal verb we can get a better understanding of what that modal verb means, that is, what its functions are. Linguists working outside the framework of Construction Grammar may object that these functions are simply the product of combining what the modal inherently means and what these environments mean. However, as we have argued more fully in our main paper (Cappelle and Depraetere, this issue), we believe that some of the strings we identify by applying the sort of collocation-based methods shown in Hilperts paper and our response are *directly* associated with a certain interpretation, in spite of their apparent compositionality. We hope to have shown in this response that Hilpert's focus on collocational preferences is extremely valuable and that it can even lead to a better identification of

[3] Fraser (1976) uses the concept of 'hedged performative' to refer to the combination of *I must* with verbs like *admit* and *confess*. Combinations with verbs other than those which express an act of assertion are also discussed in this paper.

actual constructions if collocational ties between the modal and other clause elements than the following lexical infinitive are considered. In that respect, we agree with Boogaart (2014), who claims:

> "Within construction grammar, collexeme analysis at the level of the lemma and the attracted infinitive is still rather abstract. To establish 'modal constructions', we need to differentiate according to at least
> - Specific form of the verb (person, number, tense)
> - Other elements besides infinitives (negation, adverbs/particles)
> - Genre/register" (Boogaart 2014)

Boogaart made this claim with respect to Dutch, where different inflectional forms of the same modal/temporal auxiliary *zullen* 'will', namely *zullen* itself, *zal*, *zult*, *zou* and *zouden* each have rather distinct collocational preferences. English is inflectionally less rich than Dutch, but it would be interesting to compare in full detail *may* and *might*, especially since Hilpert's paper has shown how the collocational profile of *may* has moved surprisingly close to that of *might* (and also to those of *must*, *should* and *could*) over the last couple of centuries: which differences still exist between these two modals? In our response, we did pay attention to other elements besides infinitives, but for future research, it would be worthwhile to look at which expressions are genre- or register-neutral and which ones are restricted to a particular genre and/or register. It could be expected that *it must be borne in mind that…* is typical of academic or in any case formal language use, while *you must be joking* is used in informal conversations.

Charting the elements that frequently and 'relevantly' combine with modal verbs may have interesting pedagogical applications. If it is our aim to teach learners really common chunks of language, then we should not present examples that are rather loosely knit together and which therefore do not capture the most typical uses of a modal. For instance, on the *Learning English* website of the British Council, we find examples such as those in (7), which illustrate that "we use *must* to say that it is necessary to do something":[4]

(7) a. You **must stop** at a red light.
b. Everyone **must bring** something to eat.
c. You can wear what you like, but you **must look** neat and tidy.
d. I'm sorry, but you **mustn't make** a noise in here.

Observe that the examples on the British Council website put in boldface just the modal and the following infinitive, while we feel that the learner's attention should also be directed to other elements, especially the subject. Note also that the examples do not include any of the highly typical uses we identified, such as *I must admit…* (i.e., a concessive use with *I* as subject) or *Children must be accompanied by an adult* (i.e., a passive example). One way in which we can exploit corpora for language learning purposes is by extracting common structural strings that underlie sequences of five or so words (cf. Cappelle and Grabar 2016). Ideally, we may want to optimize the approach used here along the lines proposed Forsberg et al (2014), where part-of-speech categories and specific lexical items jointly make up a large table of data from which an intelligent computer algorithm extracts hybrid n-grams of the right grain size. It is then left to pure statistics to identify linguistically or didactically pertinent micro-level constructions (e.g. *You must be joking!*), macro-level constructions (e.g. X *must* + perfect infinitive) and blends of these (e.g. *It must have been* Adj(P) *for you*). And whatever the role of the linguist may then be in sifting out noise from automatically generated construction candidates, in interpreting the results and in manually providing further semantic or

[4] http://learnenglish.britishcouncil.org/en/english-grammar/verbs/modal-verbs/ability-permission-requests-and-advice, last accessed 30 September 2015.

pragmatic annotations to them, we foresee that these endeavours will ultimately lead to natural language processing applications such as sentence disambiguation and automatic text classification, aimed at setting apart, for example, emotionally neutral, instructive sentences or texts from ones that are persuasive or betray strong sentiments.

In the end, conceiving of constructions *either* as schemas with slots *or* as nodes in a vast lexical network may turn out to be choice we need not make. Both perspectives are interesting and necessary: they tie in, respectively, with the generative, creative potential of language to convey new ideas and with its role as grab bag of familiar formulae for expressing one's feelings or making people do things as fast as possible.

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