Francisco Alonso Almeida and María Luisa Carrió Pastor

Variation and Function of Modals in Linguistics and Engineering Research Papers in English[1]

Abstract: This paper investigates modals in Linguistics and Engineering research articles. The study has two main objectives. The first one concerns the identification and categorization of modals used in research articles written in English by native speakers. The second objective is of a contrastive nature. We are much interested in measuring the use and function of modals according to register. For this study, we focus on material traditionally categorized as belonging to the realm of the humanities, e.g. linguistic research, and material categorized as belonging to the hard sciences, e.g. engineering research. Without further considerations as to the suitability of these categories, we want to explore on the motivations behind the use of modals in these branches of scientific thought. Our corpus was gathered for this purpose in mind with a selection of papers from the humanities and the hard sciences. Although corpus tools are fundamental for statistical representations, manual analyses are also important in order to detect pragmatic use of language denoting authority or lack of it. Our conclusions report on the motivations leading to the use of modals in relation to register.

Keywords: variation – modals – function – linguistics – engineering research papers – scientific thought – register.

Introduction

This paper investigates the use and functions of modal verbs in two fairly distinct scientific domains, namely Linguistics and Engineering. Our findings based on a corpus study are purposefully quantitative and qualitative since we seek to find out what semantic types of modal verb types prevail per register domain. Variation in the use of modal verbs will report on scholarship attitudes and intentions towards their presentation of scientific material. This is especially interesting in the case

---

of the fields selected for analysis because they represent two extremes in the traditions of scientific thought in terms of methods and approach of research inquiries. Our analyses will present data per register and article section to exactly pinpoint major differences between traditions.

Our classification of modality categories draws from van der Auwera and Plungian (1998) and Marín Arrese (2009). In general, studies on modality in research articles (RAs) analyse modality as one category of stance within a broad concept of modality (Pho 2013, Sayah/Hashemi 2014). Specific studies concern modals as a hedging device (Mauranen 1997; Hyland 1998). Recent research on modality as realised only by modals include Vázquez Orta (2010), Carrió Pastor (2012), Vázquez Orta and Giner (2010), Ortega Barrera and Quintana Toledo (2013), and Peacock (2014). All these studies contain corpora from different academic traditions and sizes. Peacock (2014) analyses modals in a corpus of RAs, which amounts to more than three million words. Our corpus is more manageable in size, as we compiled ca. 190,000 words. This allows for more detailed descriptions of the data excerpted for discussion.

Our paper is organised as follows. Section two describes modality and modal verbs. Section three describes the methodology of research and the criteria for the compilation of data. Section four and five present the results of our analysis of the texts, and the meanings and functions of modal verbs in RAs. Finally, the conclusions are drawn in the last section.

Modality and Modal Verbs

Modality can be broadly defined as the linguistic encoding of the speaker's or writer's beliefs and attitudes towards the proposition manifested (Biber et al. 1999: 966). In other words, modality refers to the status of the proposition in context. Palmer (1986: 2) refers to modality as a "vague" notion, but admits that "something along the lines of Lyons' (1977: 452) 'opinion or attitude' of the speaker is promising". Bybee et al. (1994: 176) emphasize the difficulty of defining modality. They conclude that a "definition often proposed is that modality is the grammaticization

of speaker's (subjective) attitudes and opinions" (Bybee et al. 1994: 176). There are several ways in which modality can be manifested in the language other than modal verbs. These can be lexical or grammatical. Palmer (1986: 33ff) describes modal verbs, mood, and particles and clitics as examples of grammatical marking of modality, including the contested concept of evidentiality as a grammatical device (Aikhenvald 2002). The lexical category includes adverbs and other related expressions that may show the speaker's attitude towards the proposition.

In general, scholars have tried to differently categorize modality, and despite the terminological maze there seems to be ample consensus which initially divides modality in the fashion of Lyons' (1977) two-fold distinction into epistemic and deontic modality (Palmer 1986:19). Epistemic modality is "concerned with matters of knowledge or belief on which basis speakers express their judgements about state of affairs, events or actions" (Hoye 1997: 42). Deontic modals refer to the "necessity of acts in terms of which the speaker gives permission or lays an obligation for the performance of actions at some time in the future" (Hoye 1997: 43).

Another way of looking at modality is the distinction between propositional modality and event modality (Palmer 2001). The former is concerned with the speaker's or writer's judgment regarding the proposition manifested. The latter is related to the speaker's or writer's attitude towards a likely event in the future. Propositional modality divides into epistemic (judgment about the factual status), and evidential (evidence for factual status is given). Evidentials can be both reported and sensory, and Willet (1988) has classified them accordingly as (a) direct evidence (visual, auditory, and sensory), (b) indirect evidence (reported or inferred from reason or results).

Event modality includes a further twofold distinction: deontic and dynamic. In deontic modality, conditions are external. Senses of obligation and permission depend on external factors rather than on internal ones. In dynamic modality, conditions are internal, and it involves senses of willingness and ability on the part of the speaker or writer. Dynamic modality refers to the potentiality of the speaker to develop an action, whether this potentiality be internally or externally motivated, as the enabling circumstances are external or internal.

Not all scholars identify a twofold distinction of modality. Bybee et al. (1994), for example, establish four types: (i) agent-oriented, (ii) speaker-oriented, (iii) epistemic, and (iv) subordinating. The first type of modality "reports the existence of internal and external conditions on an agent with respect to the completion of the action expressed in the main predicate" (Bybee et al. 1994: 177). Semantic notions in agent-oriented modality include senses of obligation, necessity, ability, root possibility, desire, willingness, and intention. In speaker-oriented modality, directives and other utterances in which the speaker "grants the addressee permission" are included (Bybee et al. 1994: 179). Speaker-oriented modality includes the following modal categories: imperative, prohibitive, optative, hortative, admonitive, and permissive.

The third type, i.e. epistemic modality, "applies to assertions and indicates the extent to which the speaker is committed to the truth of the proposition" (Bybee et al. 1994: 179). This includes senses of possibility, probability, inferred certainty, and counterfactuality. The distinction between possibility and root possibility is that, whereas the former refers to a proposition which is possibly true, the latter refers to certain conditions which enable the action. One example would be the following: *This purse may carry fifty coins*. In this case, our categorization of *may* would be root modality, as it does not indicate the chances of the proposition to be true, but the potentiality of the purse to carry the said number of coins.

The last type of modality is subordinating moods, and the "forms that are used to express the speaker-oriented and epistemic modalities are often also used to mark the verbs in certain types of subordinate clauses[…] restricted to those containing special finite verb forms" (1994:180).

In our study, we focus on modality as realised by modal verbs. In Present day English, there are nine central modal verbs, according to Biber et al. (1999: 483): *can, could*, *may*, *might*, *shall, should, will, would* and *must*. A further group of modals is the group of peripheral modals or marginal modals, also called semi-modals: *need (to), ought to, dare (to)* and *used to*. In our study, we only focus on the nine central modals. We consider the following meanings of modals, as described in van der Auwera and Plungian (1998) and Marín Arrese (2009: 30–33). These are summarised, as follows:

Table 1. Modal meanings.

Modality	Meaning
Epistemic modality	differing degrees of certainty concerning the realisation of events.
Deontic modality	expression of obligation, possibility (authorial enablement), advisability.
Participant-internal possibility & Participant-external possibility	the participant's capacity or the external circumstances to complete an event.
Participant-internal necessity & Participant-external necessity	the needs of the participants, or those externally motivated, to carry out an event.
Volitive modality	the author's intention concerning the realisation of an event.

Modality may be used to fulfil a variety of functions. As we shall see in section 5.2, we have identified in our corpus-based research modals indicating (a) politeness, (b) attitudinal stance, and (c) a textual metafunction. Politeness, as described in Brown and Levinson (1987), may result from the mitigating effect lent by the use of epistemic modals in discourse (cf. Alonso Almeida 2015: 37ff). Politeness is associated with the concept of *face*, and this is defined as "the public self-image that every member wants to claim for himself" (Brown/Levinson 1987: 61). Certain rhetoric devices, such as modals, may encompass this mitigating function to minimise potential threats against an individual's *face*, i.e. to avoid the risk of *face-threatening acts* – FTAs. Attitudinal stance is concerned with the expression of "the speaker's attitudes, feelings, or value judgements" (Biber/Conrad 2000: 57). In this sense, deontic modals in scientific discourse, for example, would suggest the intention of the writers to guide readers through the text, effectively attracting their attention to specific chunks of information. Finally, by textual metafunction, we mean no less than Halliday's *textual metafunction*. This metafunction "can be regarded as an enabling or facilitating function, since the others – construing experience [ideational metafunction] and enacting interpersonal relations [interpersonal metafunction] – depend on being able to build up sequences of discourse, organising the discursive flow, and creating cohesion and continuity as it moves" (Halliday/Matthiessen 2014: 30–31). This nicely describes the organising function of modals in the development of ideas in our corpus.

Data and Methodology

This section presents the corpus of Linguistics and Engineering papers in English from which samples have been extracted. The first section contains a description of the research paper as a genre since register variables, e.g. topic, may impose a different organisation of contents. The second section reports on (a) the criteria followed in the selection of papers compiled for the corpus, and on (b) the methodology used in the analysis of modal verbs in this corpus.

The Article as Genre

The research article, or a section within it, has been studied from a genre perspective in order to describe its internal organisation of contents (Peng 1987; Swales 1990; Thompson 1993; Posteguillo 1999; Kanoksilapatham 2005; Ortega Barrera/Torres Ramírez 2010; Peacock 2011; Alonso Almeida 2012; Alonso Almeida/Adams 2012; Basturkmen 2012). This organisation of contents depends on register variables, e.g. topic and audience, and thus differences between the article sections have been reported, although a number of functional generic sections are common in all the articles regardless of their topic. Swales (1981) identified a number of sections in research articles, namely introduction, review of previous work, method, results, discussion and references. These rhetorical sections have been reduced to four in many studies: introduction, method, results and discussion (i.e. the IMRD model). Obviously, these section labels may be referred to in a variety of ways depending on the scholar's choice. This means that the section *review of previous literature*, for instance, may be called *theoretical framework* or, even, the less specific term *background* (Alonso Almeida 2012). In the case of the *method* section, Kanoksilapatham (2015: 78) mentions several other terms, namely *experiment, experimental runs and measurements, material and methods*, among others. There is a great deal of variability in the use of this rhetorical model, as suggested in Pho (2013) and Tessuto (2015: 14), since the model, as it stands, fails to reflect other potential rhetorical sections in the article. This is the case of the conclusion section, which regularly appears in linguistic research articles.

This section, however, may actually occur as an independent section or combined with the discussion section in the RAs. For practical reasons, we prefer to keep the discussion and conclusion sections as independent sections in our paper. As to terminology, we use the labels in Table 2 to identify the sections, which characterise RAs in our two subcorpora.

Table 2. Genre sections in RAs.

Section	Function of section
Introduction	Justification of paper, contextualisation, research objective, structure to paper.
Background	Theoretical tenets, and working definitions.
Method	Description of method and procedure of analysis, description of sample data.
Discussion	Analysis and discussion of data.
Conclusions	Recap of main contribution of paper; it may also contain prospects for further research.

The division shown in Table 2 follows from our own inspection of the texts. As already pointed out, we prefer to keep the discussion and the conclusions sections as two distinct stages in the overall rhetorical organisation. Another decision involves the inclusion of the results section in Swales' model in the discussion section. In our corpus and regardless of the register domain, RAs tend to present the results of inquiry within the discussion section. There are few cases of RAs (exactly 4 RAs), which adhere the canonical IMRD model with the addition of the conclusion section. In these cases, we have detected that either in-house editorial policies or a tendency to reproduce the textual patterns of already published articles might apply, and so the use of the IMRD model seems to be preserved, albeit unintentionally.

Another way of looking at the data would be by dividing the sections into Swales' *moves* (1990). These are functional subdivisions of genre sections that own a particular communicative goal within a rhetorical section (cf. Brett 1994, Peacock 2002). Move analysis applied to entire papers is not very common (cf. Posteguillo 1999, Kanoksilaptham 2005, Maswana et al. 2015, Tessuto 2015), and move analysis studies are more often concerned with particular generic sections (cf. Brett 1999, Peacock 2002). We have opted for using sections rather

than moves because we seek to compare data of different research disciplines. The division into moves is too specific and may offer results which are too particular to allow comparison. The division into sections is both specific and general for our purposes.

Data Sample and Methodology

The modals which are the focus of our study have been excerpted from a set of English RAs in Linguistics and Engineering amounting to 188,361 words, excluding bibliographical references, abstracts, authors' bios, and acknowledgements. This figure includes the subcorpus of Linguistics RAs (109,256 words) and the subcorpus of Engineering RAs (79,105 words). The length of the Linguistics RAs, between 6,000–8,000 words, almost double the length of the Engineering RAs, hence the numbers of words included in each subcorpus. For the analysis, data were normalised, as we explain in section 4, below.

All RAs meet the following criteria:

- They belong to any field either of Linguistics or of Engineering,
- they are authored by at least one English native speaker, preferably as first author,
- they have been published in 2014,
- they are listed in the Journal Citation Reports® database (JCR, Thompson and Reuters). This indicates that the journal's quality has been externally evaluated in terms of citation impact.

The journals selected for this study are:

- Linguistics: Journal of Pragmatics, Discourse Processes, Linguistics, Pragmatics, Discourse and Communication, Discourse and Society, Discourse Studies, Journal of Semantics, Journal of English Linguistics, Language in Society, Text and Talk.
- Engineering: Microelectronic Engineering; Journal of Wind Engineering and Industrial Aerodynamics; Engineering Optimization; ACM Transactions on Software Engineering and Methodology; Structure and Infrastructure Engineering; Journal of

Engineering Mechanics; ISH Journal of Hydraulic Engineering; Journal of Materials Engineering and Performance.

The articles have been downloaded as portable document files (PDF) and converted into text documents for the purposes of extracting sections of the RAs. Each section of each article was made into a file so that we were able to search modal verbs using computer means. The software for sample retrieval has been *CasualConc* by Yasu Imao.

Using *CasualConc*, we have interrogated the subcorpus per genre section using modal verbs as keywords. The results of our inquiries with sufficient right and left context words to be able to evaluate the meaning and function of the modals were copied in Microsoft Excel rows. In those cases in which context proved to be insufficient, we returned to the complete text for inspection. Each example was labelled according to modal type, meaning and function. This way we were able to obtain automatic statistics for the meanings of modals per genre section. The differences in the use, meaning and functions of modals verbs in the two samples analysed have been justified by carrying out a statistical analysis based on a chi-square test, which proves the hypothesized differences. The level of significance adopted for this study is $p < 0.05$ to calculate the significant difference between the texts analysed.

In this sense, quantitative data have been essential to address our research questions:

- RQ1: How do modals appear in RAs from two fairly distinct disciplines in research, namely Linguistics and Engineering?
- RQ2: Are there major differences in the use of modal verbs in these two disciplines? If so, which modal types and meanings are then preferred in each research domain?
- RQ3: Are different academic traditions reflected in the way modals are used in the same genre, i.e. a research article?

The next sections present the results obtained and the distribution of modal types and meanings in our corpus. A discussion concerning the use and function of modal follows.

Results

We have detected a total number of 1,684 modal verbs in our corpus. These occur thus: 974 cases in Linguistics RAs and 710 cases in Engineering RAs. These are raw figures, but, from now, we will use normalised data to be able to compare results among sections and topic domains. We have normalised data to 10,000 words per genre section. This allows comparison of the data between the two specialised domains as well as comparison among sections of a same domain.

Modal verbs occurring in our corpus are given in Tables 3 and 4, below (raw data in grey shading; letters I B M D C stand for introduction, background, method, discussion and conclusion):

Table 3. Modal verbs, Linguistics RAs (distribution per section).

	CAN	COULD	MAY	MIGHT	MUST	SHOULD	WILL	WOULD	HAVE/ HAS TO	OUGHT TO
I	40.72	0.93	9.25	5.55	0.93	3.70	27.76	5.55	0.00	0.93
	44	1	10	6	1	4	30	6	0	1
B	28.98	3.76	12.88	8.05	8.59	4.29	15.56	12.34	0.00	0.00
	54	7	24	15	16	8	29	23	0	0
M	21.61	17.29	8.64	4.32	2.88	7.20	4.32	7.20	0.00	0.00
	15	12	6	3	2	5	3	5	0	0
D	27.54	6.46	14.92	7.54	7.23	3.85	3.85	7.85	0.92	0.00
	179	42	97	49	47	25	25	51	6	0
C	30.45	12.69	39.33	22.84	12.69	6.34	3.81	25.37	2.54	0.00
	24	10	31	18	10	5	3	20	2	0
	149.30	41.12	85.03	48.30	32.31	25.39	55.30	58.32	3.46	0.96

Table 4. Modal verbs, Engineering RAs (distribution per section).

	CAN	COULD	MAY	MIGHT	MUST	SHOULD	WILL	WOULD	HAVE/HAS TO
I	36.33	2.20	14.31	9.91	3.30	1.10	13.21	3.30	1.10
	33	2	13	9	3	1	12	3	1
B	44.30	11.66	6.99	12.82	0	9.33	9.33	18.65	0.00
	38	10	6	11	0	8	8	16	0
M	26.40	12.43	8.54	13.20	1.55	6.21	10.10	6.21	0.78
	34	16	11	17	2	8	13	8	1
D	28.04	3.19	12.54	6.16	4.33	8.21	13.45	11.40	0.46
	123	14	55	27	19	36	59	50	2
C	40.42	0.00	8.51	0.00	2.13	14.89	4.25	17.02	0.00
	19	0	4	0	1	7	2	8	0
	175.49	29.48	50.90	42.09	11.31	39.74	50.34	56.58	2.34

Table 5 shows the chi square statistics and the predetermined alpha level of significance (p= <0.05) of the modals. The p value indicates that the results are significant and can be extrapolated to other similar texts:

Table 5. Chi square statistics of modals verbs extracted from RAs.

Mod. verbs	CAN	COULD	MAY	MIGHT	MUST	SHOULD	WILL	WOULD	HAVE/HAS TO	OUGHT TO
X^2	14.45	2.08	0.38	0	0.01	0.41	0	0.28	-	-
P	0.006	0.149	0.537	1	0.920	0.522	1	0.596	0.000	-

To calculate the chi-square test, at least 80% of the cells must have an expected frequency of 5 or greater, and no cell may have an expected frequency smaller than 1.0. It was used the Fisher Exact Probability Test for frequencies lower than 5.

The figures in Tables 3 and 4 reveal that the modal verb most widely used in both subcorpora is *can*, and this appears significantly more frequently in the domain of Engineering. The modals *may, will*, *might*, *would* and *could* follow in frequency with figures between 85 and 41 cases every 10,000 words in the Linguistics subcorpus. *Must*

and *should* are the other most frequently used modals in this domain, with 32 and 25 occurrences. The presence of *have to*, *has to* and *ought to* is highly occasional. In the case of the Engineering RAs, along with *can*, the modals *would*, *will*, *may*, *might* and *should* occur in this order with a frequency between 56 and 39 cases. *Have to* and *has to* are very infrequent, and *ought to* is not attested in this Engineering sub-corpus. The modal *shall* does not appear in any of the subcorpora. These results lead us to predict authorial reliance on the potentiality of objects, processes and events in the construction of knowledge in RAs of both subcorpora. It also appears that, in the case of Linguistics, epistemic senses would prevail over deontic usage of modals, and this same situation seems to transpire from the type of modals deployed in Engineering papers.

One important conclusion from our analysis of modals is their distinct distribution per genre section in both subcorpora, as evinced in the pie charts in Figure 1:
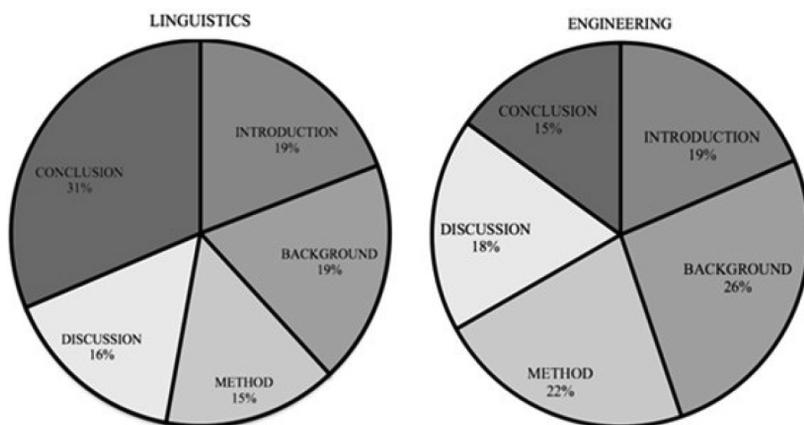

Figure 1. Distribution of modals per section in the two corpora.

Similarities exist in the use of modals in the introduction sections which share the same distribution in the two subcorpora (19%) and in the discussion sections with comparable figures for Linguistics (16%) and Engineering (18%). The Linguistics background (19%) and method (15%) sections present fewer modals than the same sections

of Engineering articles; to be precise, 7% higher in both sections. The major difference between both subcorpora is found in the conclusion sections. While Linguistics articles contain 31% of cases of modals, Engineering articles show half the cases in this section. This certainly indicates that information in the Linguistics conclusion section is weightily appraised with respect to other sections of the Linguistics paper, as the use of the modals *may*, *can*, *might*, and *would* seems to suggest. This stands in sharp contrast with the Engineering conclusion section, which presents very high frequency of *can* followed at a distance by *should* and *would* with much fewer than half of the cases, as seen in Table 4, above.

Meanings and Functions of Modal Verbs in Linguistics and Engineering RAs

Meanings found in the two subcorpora fall into the categories of epistemic modality, internal and participant external possibility, volition, deontic modality and evidentiality. The last meaning, we will see in due course, occurs very sparingly, although it is also true that there are many modal verbs which appear to own evidential overtones given certain syntactic contexts. In the following sections, we discuss the meanings of modals first in terms of variability with respect to the register domain of topic, and then we focus on aspects concerning the functions of these modals in both subcorpora.

Variation across Register and Article Sections

In this section, we will comment on selected examples excerpted from the two subcorpora under examination following the rhetorical organisation of the RA. Modal meanings are dealt with in terms of frequency in any of the two disciplines.

Introduction

The frequency of modals in the introduction sections is slightly higher in the case of the Linguistics RAs. The chi square statistics and the predetermined alpha level of significance (p= <0.05) of the meaning of modals in the Introduction section was calculated and the p value of the results was 0.000, being the X^2 value 32.02. The p value indicates that the results are significant and can be extrapolated to similar texts. Table 6, below, shows the distribution of modal meanings in the introduction sections of both subcorpora. Internal and participant external possibility stand as the most used modal meaning in both registers, with some overuse in the case of the Linguistics subcorpus (Linguistics: internal 28.69 + external 15.73; Engineering: internal 15.41+ external 19.82). Epistemic modality is clearly higher in Engineering articles, i.e. 34.13/12.03. This stands as a significant difference between the two fields analysed. Volitive modality appears in both subcorpora with a distinctive 21.29 in Linguistics and an occasional 1.10 in Engineering. The presence of modals with a deontic sense is similar in both subcorpora, being slightly higher in the case of Linguistics (17.58/14.31).

Table 6. Meanings of modals in introductions per domain.

	epistemic		participant internal		participant external		volition		deontic	
LING	12.03	13	28.69	31	15.73	17	21.29	23	17.58	19
ENG	34.13	31	15.41	14	19.82	18	1.10	1	14.31	13

Internal and external possibility modality is widely used in both subcorpora, but internal possibility senses are more frequent in Linguistics. In the following instances, internal and external possibility is realised with the verb *can* in all cases:

(1)   *ENG: The results of our empirical analysis confirm that, as demonstrated by previous empirical studies, EVOSUITE can **[participant internal possibility]** indeed achieve high branch coverage—but only on certain types of classes. In practice, dependencies on the environment (e.g., files, network, databases) seem to inhibit high branch coverage, a point in case being that experimental results can diverge depending on whether the aim is to show scientific advance or practical relevance* (Fraser)

(2)   *LING: Structures like I got to Paris can **[participant internal possibility]** teach us much about the semantics of directional PPs* (MacIntyre)

(3)   *ENG: However, it has the disadvantage that communication with the SUT is asynchronous and so there can **[participant external possibility]** be a loss of information regarding the relative order of inputs and outputs* (Hierons)

(4)   *LING: As in this example, by virtue of the work they do in checking preconditions, pre-requests may get immediate granting of the desired action, without an overt request being produced. That is, if the preconditions addressed by the pre-request are met, then the recipient can **[participant external possibility]** move immediately to granting the request* (Fox)

Participant internal possibility in (1) reflects EVOSUITE's own capacity to complete the action described. The same happens in (2), and so the author relies on the nature of certain linguistic structures to show a particular semantic behaviour. In Linguistics, the categorisation of *can* as participant internal modality may indicate a systemic consideration of a grammatical form as opposed to participant external modality that may reflect a contextual meaning. Example (3) poses an internal characteristic of SUT communication, i.e. asynchrony, to set up the context for enabling the loss of information. This sense of *can* is reinforced by the discourse feature *and so*, which implies a consequence of the condition of communication being asynchronous. The use of *can* in (4) indicates that enablement depends on the fulfilment of the condition expressed in the protasis of the clause.

Deontic modality is realised in both subcorpora by means of *should, will* and *must*, besides *ought to* in the case of the Linguistics RAs. Deontic force in introductions indicates attitudinal meaning and seeks to express advisability concerning caveats of research and desirability to carry out a particular event (cf. Van linden/Verstraete 2011: 152), as in the following instances:

(5)   *LING: It **should** be noted, however, that for the languages studied here, it is more accurate to say that the reflexively marked (a)-sentences simply have an especially weak meaning, relative to their English counterpart in (1a)* (Cable)

(6)   *ENG: Due to the kinetic nature of the governing strengthening mechanisms, the residual mechanical properties **must** be characterized in terms of both exposure temperature and heating rate* (Summers)

Epistemic modality is expressed in the corpus by means of *may, might, could,* and *would*. In examples (7) and (8), the modals refer to the probability of the actions to occur, and so the authors convey specific authorial degrees of certainty. In the case of *would* in (9), the modal is embedded in an effective communicative evidential in the sense in Marín Arrese (2009). The use of the modal owns a hedging function in this case, as it seeks to minimize imposition on readers.

(7)   *ENG: In most cases, the titration process is monitored directly by the exper-
        imentalist and the appearance of the cloud point is judged by the naked eye.
        This, however,* **may** *introduce an uncertainty and the final result* **may** *vary with
        the experimentalist doing the measurement* (Williamson)

(8)   *LING: By tracking the use of these conventions, companies can monitor cus-
        tomers' talk about their brand, service or products. If a customer's post is neg-
        ative (for example, containing a complaint), then this* **may** *pose a risk to the
        company's reputation and require a remedial response* (Page)

(9)   *LING: However, the struggle to identify and explicate points of contact and
        of tension is useful; it acts as a heuristic which, I* **would** *argue, has a value in
        shedding light on both approaches without necessarily achieving a confluence
        of ideas* (Hunston)

Volitive modality is prototypically realised by the form *will* in both subcorpora in introductions. The instances in (10) and (11) illustrate this sense of *will*, which is justified in the nature of this section in which planned objectives and method are described ahead. The example in (12) is the only one detected in the Engineering RAs. These examples indicate the intention of the writers to carry out a particular task. The sense of futurity is suggested in the desire to do the specified action, which implies a time later than the moment of speaking. Note, for instance, the use of the present simple in *I focus* in (11) in contrast with the preceding *I will use*, also indicating atti-tudinal meaning.

(10)   *LING: For the purposes of this paper, I* **will** *put aside these issues, and for sim-
        plicity's sake I* **will** *focus on interpretations akin to that in (2b), interpretations
        often labeled 'weak reciprocity'* (Cable)

(11)   *LING: Given that terminology is a central concern here, I **will** use the neutral term 'Initial Requesting Utterance' to describe the first utterance engaged in requesting in the sequence. Due to limitations of space, I focus on interrogatively formatted requesting utterances* (Fox)

(12)   *ENG: The residual strength degradation mechanisms **will** be discussed in terms of the microstructural changes in the alloys* (Summers)

Background

Epistemic modality prevails over the rest of meanings of modals in the background sections, especially in the case of Engineering RAs with a frequency of 47.80, as shown in Table 7.

Table 7. Meanings of modals in background sections per domain.

	epistemic		participant internal		participant external		volition		deontic		evidential overtones	
LING	32.74	61	12.34	23	18.78	35	9.66	18	19.32	36	1.61	3
ENG	47.80	41	16.32	14	30.31	26	6.99	6	11.66	10	0.00	0

The chi square statistics and the predetermined alpha level of significance (p= <0.05) of the meaning of modals in the background section was calculated and the p value of the results was 0.119, being the X^2 value 7.32. As the p value is higher than 0.05 the results are not significant.

Examples of epistemic modality are (13) and (14), below. Epistemic modals in the Engineering RAs are meant to hedge propositional content in the description of processes, as shown in (13). In the linguistic example in (14), tentative probability is clearly expressed with *might*, and this idea is later reinforced with the epistemic adverb *perhaps* hedging the author's own view of what Biber, in this case, would say. The use of epistemic modality in this section of the RA seems to emerge from the need to refine and comment on theoretical issues while avoiding potential threats against the author's own face. It could be also a face-saving strategy to avoid further criticism.

(13)   ENG: *If this code interacts with its environment, then not only **may** achieving high branch coverage be difficult, but also unexpected or undesirable side-effects **might** occur. For example, the code **might** access the file system or network, causing damage to data or affecting other users on the network* (Fraser)

(14)   LING: *Biber **might** disagree with Gardner's final point here, arguing perhaps that it is unnecessary to posit a particular social theory in order to account for register differences* (Hunston)

Participant external possibility is also more frequent in the case of the Engineering subcorpus with a third more cases than the Linguistics subcorpus. It appears that authors take advantage of the meaning of potentiality expressed by *can* in the examples in (15) and (16) as a way to evaluate the positive outcomes of the designated events without exactly claiming them. Deontic meaning and volition do not show much difference in terms of variation in this section of the RA. In example (17), the form *will* is embedded within a textual metafunction comment contributing to the organisation and distribution of contents within the RA. In the case of the instance in (18), the negative does not take a scope over the volitive modal, and the meaning still indicates a deliberate intention to carry out the described activity. Deontic modals in (19) and (20) refer to obligation and desirability, respectively. In (19), the use of *straight-away* strengthens the idea of obligation to complete the event.

(15)   ENG: *Product line optimization **can [participant external possibility]** be traced back to Green and Krieger (1985)* (Foster)

(16)   LING: *Pragmatic and rhetorical approaches **can [participant external possibility]** thus be regarded as complementary perspectives that can be brought to bear on similar phenomena (here, the corporate apologies posted on Twitter)* (Page)

(17)   ENG: *We assume that these channels are first-in-first-out (FIFO); the use of non-FIFO channels is a topic for future work and **will [volitive modality]** be discussed further in Section 7* (Hierons)

(18)   LING: *I **will not [volitive modality]** be attempting to account for all uses of these forms, mainly because, as Pichler & Levey (2011: 470) demonstrate, most of the forms, including or owt like that, are used only rarely in their substantial database, while a small number of forms are used a lot* (Overstreet)

(19)   *ENG: For the experiments in this article, we first analyzed all possible permissions that can be requested during the execution of the CUT. For each permission, we decided whether: (1) it was safe enough to grant it, (2) we* **should [deontic modality]** *deny it straight-away (a clear example is deleting files), or (3) grant it but apply some techniques to "reset" the environment after a test case is executed* (Fraser)

(20)   *LING: In bringing these methods together, I am positing that these two phenomena—linguistic processing and social evaluation—are both components of the perception of grammatical variation; we* **must [deontic modality]** *know how people comprehend variation (processing) as well as how they socially categorize it (evaluation)* (Squires)

Modals with evidential overtones appear only in Linguistics RAs. In our opinion, the epistemic reading of *would* in example (21), below, would be insufficient for an exact account of this verbal form, since, rather than expressing probability alone, would seems to convey conclusion. In this context, *would* shows some inferential nuances. The categorisation of modals which show logical conclusion as an evidential device has been defied, and so these modals are included as a subcategory of epistemic modality, as pointed out in Marín-Arrese (2015: 217): "The above caveats on the categorization of must as an evidential marker warrant our position in conceiving must as an E[pistemic] M[odal], with evidential nuances derived from its conclusional force and including it in a subcategory of epistemicity distinct from that of evidentiality (Boye, 2012)". Still, we prefer to keep them as two distinct entries in our analyses in order to evaluate their presence in the rhetorical sections of our RAs.

(21)   *These are what Agha* **would** *call "historically inherited social ideologies" which set the "boundary conditions" that link meaning to form* (Meachan)

Method

Linguistics RAs and Engineering RAs score very differently for the epistemic category, with a higher frequency in the case of Engineering articles. Participant internal modality also marks a difference with more cases found in the Linguistics subcorpus. Participant external modality and deontic modality show similar figures in Table 8. The rest of the categories are not representative. The chi square statistics and the

predetermined alpha level of significance (p= <0.05) of the meaning of modals in the Method section was calculated and the p value obtained was 0.005, being the X^2 value 14.49. As the p value is lower than 0.05 the results are significant.

Table 8. Meanings of modals in the method sections per domain.

	epistemic		participant internal		participant external		volition		deontic	
LING	18.73	13	17.29	12	23.05	16	0.00	0	14.41	10
ENG	41.16	53	5.44	7	21.74	28	1.55	2	15.53	20

Epistemic modals in the method sections are *may, might, could* and *would* in the Engineering corpus and *may, might* and *would* in the Linguistics one, and they have a clearly mitigating role (cf. Alonso Almeida 2015) in the discussion of aspects pertaining methods and procedures, as in the following examples (22) and (23):

(22)   *ENG: Ablett et al. [13] have previously suggested that the growth of MnSiO3 layers on low-j dielectrics **may** be affected by the presence of adsorbed hydroxyl species* (Bogan)

(23)   *LING: It **might** be thought that because this paper critiques Pallen's text I disagree with his ideas. I do not* (Hunston)

Participant internal modality, which is signalled with *can*, is used in this section to indicate the potentiality of the research tools and procedures for the purposes of the authors' research inquires as shown in examples (24) and (25):

(24)   *LING: Concordances **can** show what news values are discursively associated with it* (Potts)

(25)   *ENG: The types of testing considered in this article introduce implementation relations, which state whether testing **can** distinguish an SUT process N from a specification process M* (Hierons)

Deontic modals are *will*, *should*, *must* and *has to*. Example (26), below, indicates an obligatory step in the procedure described, and *must* in (27) indicates advisability.

(26)   *ENG: Next, the designer **must** select a search algorithm to solve for the configuration of the targeted design* (Foster)

(27)   *LING: One **must** be mindful that the aim of this deconstruction is not to reveal the falseness of ideologies, but to uncover the production of 'truthful' discourses* (Burroughs)

Volitive modals appear only in the Engineering subcorpus and with a very low frequency. In the following instance, the modal form is used to express the authors' intention to take the action described (example 28):

(28)   *ENG: However, we **will** assume that a complete test takes the SUT to a quiescent state since any output produced will eventually be observed* (Hierons)

Discussion

Table 9, below, shows the distribution of modality in the discussion sections. Unlike the previous sections, the discussion sections of the Linguistics RAs score slightly higher than Engineering ones for epistemic modality. Participant internal modality is more frequent in the Linguistics RAs but the Engineering RAs have more cases of participant external modality and deontic modality. There are very few cases of volitive modality in both subcorpora. The chi square statistics and the predetermined alpha level of significance ($p = <0.05$) of the meaning of modals in the Discussion section was calculated and the p value obtained was 0.000, being the X^2 value 55.26. As the p value is lower than 0.05 the results are significant.

Table 9. Meanings of modals in the discussion sections per domain.

	epistemic		participant internal		participant external		volition		deontic	
	N	R	N	R	N	R	N	R	N	R
LING	34.31	223	17.08	111	11.23	73	0.31	2	17.23	112
ENG	33.06	145	6.38	28	22.34	98	2.05	9	23.94	105

Epistemic modals in this section are *may, might, could* and *would* in the two subcorpora. These modals indicate (tentative) probability in the description of steps of logical processes and in the elaboration of

preliminary and/or partial concluding remarks, as shown in the following instances (examples 29, 30, 31 and 32):

(29)   *LING: There are two possible interpretations. First, we **could** say that granting a request such as this one is a multi-step process, not in the sense explored in Lee (2009), but in the sense that there are multiple embodied actions that the Seller must engage in, in order to complete the request* (Fox)

(30)   *LING: Some instances **may** result from the business news stories in the corpus, as explained earlier.*

(31)   *ENG: Therefore, it **may** be concluded that the observed hardened depth measurement variation at deeper case depths is primarily due to the reduced slope of hardness versus depth coupled with poor Gage R&R resulting from the equipment accuracy limitation and the limitation of the linear interpolation technique* (Rowan)

(32)   *ENG: This therefore **may** lead to design organisations selecting people based on their emotional intelligence* (Love)

Participant internal modality and participant external modality are introduced with *can* in the two RA domains as can be seen in examples (33), (34), (35) and (36). These types of modality play a fundamental role in the development of the discussion since internal and external circumstances of things and events are invoked to justify part of the logical reasoning, as evinced in the examples below. The use of devices, such as *furthermore, also* and *as a result*, reinforces the idea of logical reasoning. Note that epistemic modals in (29), (31) and (32), above, also contain logical operators flanking the modulated propositions, namely *first* and *therefore*.

(33)   *ENG: Furthermore, lower branch coverage **can [participant internal possibility]** also reduce the chances of hitting code related to environmental interactions if such code is inside blocks that are not executed due to unsolved constraints (e.g., if statements with nontrivial predicates that would hardly be satisfied with random data)* (Fraser)

(34)   *ENG: The underlying cause of any mistake **can [participant external possibility]** only be identified with open attitudes and appropriate disclosure* (Love)

(35)   *LING: While the past tense **can [participant internal possibility]** construct events as recent (the news value of Timeliness), this depends on specific explicit or implied temporal reference (e.g. yesterday vs. last year)* (Potts)

(36)   *LING: As a result, between 2002 and 2009 four distinct place-based 'control' narratives **can [participant external possibility]** be identified* (Burroughs)

Deontic modals are more frequent in Engineering RAs. The forms in this subcorpus are *should*, *will*, *has to*, *have to* and *must*. In Linguistics, the forms used are *should, have to, cannot* and *must*. Deontic force draws from desirability or obligatory conditions for the events to happen, as shown in examples (37) and (38):

(37)   *ENG: An error reporting system **should** provide adequate scope to critically review and analyse incidents of errors that have been committed* (Love)

(38)   *LING: In the analysis of how general extenders come to be used with expressive meaning in spoken interaction, more attention **has to** be paid to the influence of the addressee and the effect of recipient design on how utterances are constructed* (Overstreet)

Conclusion

Table 10 gives the modal meanings identified in our texts. The chi square statistics and the predetermined alpha level of significance ($p = <0.05$) of the meaning of modals in the Conclusion section was calculated and the p value obtained was 0.003, being the X^2 value 15.73. As the p value is lower than 0.05 the results are significant:

Table 10. Meanings of modals in the conclusions sections per domain.

	epistemic		participant-internal		participant-external		volition		deontic	
	N	R	N	R	N	R	N	R	N	R
LING	98.96	78	12.69	10	17.76	14	1.27	1	25.37	20
ENG	27.65	13	14.89	7	23.40	11	4.25	2	17.02	8

Epistemic modality appears as the most distinctive type in our texts. Epistemic modals occur far more frequently in the Linguistics RAs than in the Engineering RAs, and this modality is also more frequent than in any other section of the two subcorpora. The use of epistemic modals indicates tentative probability. These modals appear as hedges of propositional content, which are either conclusions drawn from the

research conducted or ideas presented as future research, as evinced in the following instances (examples 39, 40, 41, 42 and 43):

(39)   *LING: It **would** seem that making an offer of repair as a form of corrective action may not be enough to repair the company's reputation or rapport with their customers: additional strategies may be needed* (Page)

(40)   *LING: This study suggests that all tested methods **could** provide useful insights into the construction of newsworthiness in a large corpus* (Potts)

(41)   *LING: This activation **may** even begin before the pronoun is encountered, because comprehenders anticipate reference and the most likely entity to be mentioned* (Arnold)

(42)   *LING: While these features **might** appear to show a rapport-enhancing orientation of individual attention, within the conventions of Twitter, use of personal names is more likely to signal social distance* (Page)

(43)   *ENG: First, while we know that it is generally undecidable whether there is a test case that is guaranteed to force an IOTS into a particular state or to distinguish two states, it **would** be interesting to explore conditions under which these problems become decidable. There **may** also be other useful conditions under which the Oracle problem can be solved in polynomial time* (Hierons)

The Functions of Modality in RAs

The modal verbs fulfil different functions in the subcorpora examined. These fall mainly in the categories of interpersonal and textual functions. The interpersonal has to do with (a) politeness and (b) affective strategies. The textual function of modals greatly contributes to the presentation of ideas in discourse.

Politeness

The use of modality expressions has been already reported as a characteristic feature of scientific prose to indicate politeness. This strategic function of modality seeks to avoid imposition of ideas on the reader in all sections of the research article, as in (44) below, excerpted from the subcorpus of Engineering RAs, or to avoid negative criticism from scholars in the field, as in (45) from the Linguistics subcorpus.

(44)   *ENG: This therefore **may** lead to design organisations selecting people based on their emotional intelligence* (Love)

(45)   *LING: Biber's MDA provides an excellent example of patterns seeking explanation which raise future challenges for SFL theory. Indeed I **would** argue that without the contextual work on text types or SFL analysis into genre families, it would be difficult to make sense of the MDA results* (Hunston)

In the discussion sections (example 46), epistemic modality appears to soften the illocutionary force of the propositional content of partial and/or preliminary concluding remarks:

(46)   *LING: However, it **could** be, if there is preference organization at work in these sequences, that it is a preference for progressivity of the sequence – that is, moving as quickly as possible from initial requesting utterance to granting of the request – rather than having anything to do with social solidarity or face that is operative in these sequences* (Fox)

Epistemic modals also occur in statements concerning future research work in conclusions. Modals in this context seem to indicate academic courtesy and politeness rather than tentative probability, as in example (47), below, from a conclusion section of the Engineering corpus.

(47)   *ENG: Unambiguous identification of barrier layer formation **would** require further investigation by complementary characterization techniques which have the capability to uniquely identify compound formation, such as X- ray absorption spectroscopy* (Bogan)

We have identified cases of participant internal and participant external possibility modality functioning as a face-saving strategy. The expression of enablement may be taken as a supporting device, since internal and circumstantial features may be regarded as valid motivations in the conceptualisation of an idea, as in (48).

(48)   *There are fewer types of exceptions, and the number of classes with exceptions is also lower. To some extent, this is because not all security exceptions will actually propagate to the output. Furthermore, lower branch coverage **can** also reduce the chances of hitting code related to environmental interactions if such code is inside blocks that are not executed due to unsolved constraints (e.g., if statements with nontrivial predicates that would hardly be satisfied with random data).*

Attitudinal Stance

Attitudinal stance is especially shown through the use of volitive and deontic modals in our corpus. There are certain quasi-routinized expressions in academic discourse that are used to attract the readers' attention. This is the case in the example in (49), which also reports on the authors' authoritative voice. Volitive modals are also an indication of affectivity in texts, as structures with volitive modals can be categorised as promises in which the authors commit themselves to complete a particular task in the article or to follow a particular theoretical framework or to use certain terminology. An example of this affective meaning is (50), below. When the volitive modal relates to the expression of a promise to deal with a particular aspect of the research conducted later in the article, this is also a textual metafunction, as we shall explain in section 5.2.3. These functions are not exclusive to a particular register domain.

(49)   It **should be noted** here that many interactions in the data[…] (Fox)
        It **should be noted**, however, that Biber and Conrad[…] (Hunston)
        It **should be noted**, however, that for the languages[…] (Cable)
        […] it **should be noted** that (as the reviewer observes)[…] (Cable)
        It **should be noted** that even hysterical callers orient to[…] (Raymond)
        It **should be noted** that the reflexive anaphor themselves[…] (Cable)
        […] it **must be noted** that on occasion[…] (Burroughs)
        It **must be noted**, though, that Timeliness[…] (Potts)

(50)   *LING: We* **will** *show how a 2-port IOTS MT M can be constructed such that deciding whether there is a test case guaranteed to take MT M to a particular state hM is equivalent to deciding whether T M halts, a problem that is known to be undecidable* (Hierons)

Textual Metafunction

Modals are used (a) to organise the text and (b) to introduce ideas, as illustrated in the following instances from the corpus analyzed:

(51)   *LING: In this paper, I* **will** *first describe some of the documented changes in the most common linguistic forms used as general extenders. I* **will** *then shift the focus from the analysis of the formal features of general extenders to their increased use with expressive meaning, developing pragmatic functions as hedges on expectations of informativeness and accuracy and as indicators of*

*positive and negative politeness strategies. I **will** include examples from my own research on American English* (MacIntyre)

(52)   *ENG: Work on using a centralised tester also assumes that observations are made in quiescent states […]and we now explain how an implementation relation (that we call diococ) **can** be defined[…] Work on asynchronous testing used the notion of a delay operator that **can** be defined in the following way […] The idea is that if a trace σ is one that **can** be produced by an IOTS that we are communicating with through asynchronous FIFO channels then the output **can** be observed later than it was produced by the IOTS; it **can** be delayed sufficiently to be observed after later input is sent* (Hierons)

In both cases, a same modal is used in each excerpt, and this has an obvious linking effect. The example in (51) belongs to the introduction section of a Linguistics paper, and the modal verb *will* is used first to introduce the author's ideas at this stage of his paper concerning its structure, and later to lexically link the text through the reiteration of this modal form. Similarly, example (52), extracted from an Engineering article, contains the repetition of a same modal verb, i.e. *can*. Each time it is used, dynamic *can* introduces ideas in relation to the research the author has carried out, and thus the repetition of this form contributes to the organization of the flow of discourse and lends unity to the text.

There are certain modulated statements, which have a metacomment function, and indicate where in the article a particular aspect of the research is developed. This is the case of *we will discuss in Section 4.1* in (53):

(53)   *ENG: The reason we chose Randoop out of all other tools (which we **will** discuss in Section 4.1, Table XII) is that it is fully automated (i.e., it does not require manually written test drivers or parameterized unit tests), it is popular and highly cited, freely available, and has been applied to many software systems in the past* (Fraser)

Conclusions

This article has explored variation and functions of modality as realised by modals in a corpus of English Linguistics and Engineering research articles. In the Linguistics subcorpus, 50% of the modal verbs occur in the

introduction and the conclusion sections, while ca. 50% of the modals in
the Engineering subcorpus occur between the background and the method
sections. The form *can* is the most preferred in both subcorpora, followed
by *may* and *would*. As to the meaning of modals, the major difference is the
use of modals showing epistemic meaning in the conclusion section of Lin-
guistics papers. Indeed this type of modality outnumbers any other in any
section in the RAs of the two traditions. Participant internal and external
possibility modality appears as a useful resource in justifying ideas. Deon-
tic meaning tends to appear with an attitudinal force to indicate advisabil-
ity and desirability, especially in introductions. Modals showing volition
appear more frequently in the introduction section of Linguistics RAs, and
this also marks a difference with the Engineering RAs, which show a very
low frequency of volitive modals in introductions.

Epistemic modality, as already pointed out, is the most recursive
modal meaning deployed in our subcorpora. While the Engineering sub-
corpus scores higher for this modality type in the introduction, background
and method sections, the Linguistics subcorpus presents a similar behav-
iour in the discussion and conclusion sections of the RAs. This tendency
in Linguistics may be justified by the authors' intention to mitigate the
strength of their claims. This does not mean, however, that this mitigat-
ing effect follows from the authors' uncertainty concerning the accuracy
of their findings, but as a desire to avoid imposition on their readers, espe-
cially in a domain where the use of new corpora may lead to a different set
of conclusions. It might be also the case that the presence of modals with
a mitigating function comes as a result of an editorial demand during the
revision process prior to acceptance for publication in an academic journal.
In Engineering articles, authors also use epistemic modals but the weight of
tangible evidence may reduce the number of these modals in the discussion
and conclusion sections with respect to the Linguistics subcorpus.

This last idea would also explain the specific use of participant
internal and external modality in both subcorpora. There are more
occurrences of internal participant modality in the Linguistics subcor-
pus than in the Engineering subcorpus. However, the opposite occurs in
the case of external participant modality. We think that the higher fre-
quency of internal participant modals in Linguistics would indicate that
the object of research and its contexts relate to more mental and sys-
temic processes. The higher frequency of external participant modality

in the Engineering subcorpus would indicate that the object of research and its contexts refer to more physical and material processes. In fact, both types of participant modality appear to justify the authors' logical reasoning paths by invoking the set of circumstances involved in the processes described. This allows authors to show their view of the state of affairs without exactly imposing it. In this context, the use of participant internal and external possibility modality as well as epistemic modality suggests some degree of politeness to avoid imposition and further criticism, clearly as a face-saving strategy.

In the case of deontic and volitive modality, their use follows from an attitudinal force (a) to attract the reader's attention and (b) to commit themselves (authors) to tasks to be carried out in the development of the RA. In general, deontic modality is not deployed to designate authorial imposition. Another outstanding function identified in our two subcorpora is the use of modals, regardless of their meaning, to signal the structure of the text, and to organise ideas in the development of research. This has an obvious linking effect in discourse.

References

Aikhenvald, Alexandra 2004. *Evidentiality*. Oxford: Oxford University Press.

Alonso Almeida, Francisco 2012. Sentential evidential adverbs and authorial stance in a corpus of English computing articles. *Revista española de lingüística aplicada* 25/1, 15–31

Alonso Almeida, Francisco / Adams, Heather 2012. Sentential evidentials in English and Spanish medical research papers. *Revista de lingüística y lenguas aplicadas* 7, 10–21.

Alonso-Almeida, Francisco 2015. On the mitigating function of modality and evidentiality. Evidence from English and Spanish medical research papers. *Intercultural Pragmatics* 12/1, 33–57.

Basturkmen, Helen 2012. A genre-based investigation of discussion sections of research articles in dentistry and disciplinary variation. *English for Academic Purposes* 11/2, 134–144.

Biber, Douglas / Johansson, Stig / Leech, Geoffrey / Conrad, Susan / Finegan Edward 1999. *Longman Grammar of Spoken and Written English*. London: Longman.

Boye, Kasper 2012. *Epistemic Meaning: A Crosslinguistic and Functional-Cognitive Study*. Berlin: Mouton de Gruyter

Brett, Paul 1994. A genre analysis of the results section of sociology articles. *English for Specific Purposes* 13/1, 47–60.

Brown, Penelope / Levinson, Stephen C. 1987. *Politeness. Some Universals in Language Usage*. Cambridge: Cambridge University Press.

Bybee, Joan L. / Perkins, Revere / Pagliuca, William 1994. *The Evolution of Grammar: Tense, Aspect and Modality in the Languages of the World*. Chicago: The University of Chicago Press.

Carretero, Marta 2002. The influence of genre and register on epistemic modality in spoken English: a preliminary study. *Estudios Ingleses de la Universidad Complutense* 10: 11–41.

Carretero, Marta 2004. The role of evidentiality and epistemic modality in three English spoken texts from legal proceedings. In Marín-Arrese, Juana I. (ed.) *Perspectives on Evidentiality and Epistemic Modality*. Madrid: Editorial Complutense, 25–62.

Carrió Pastor, María Luisa 2012. A contrastive analysis of epistemic modality in scientific English. *Revista de lenguas para fines específicos* 18, 115–132.

Conrad, Susan / Biber, Douglas 2000. Adverbial Marking of Stance in Speech and Writing. In Hunston Susan and Thompson, Geoff (eds) *Evaluation in Text. Authorial Stance and the Construction of Discourse*. Oxford: Oxford University Press, 56–73.

Halliday, Michael A.K. 2014. [1985]. An Introduction to Functional Grammar. 4rd edn. Revised by Christian Matthiessen. London and New York: Routledge.

Hoye, Louis 1997. *Adverbs and Modality in English*. London: Longman.

Hyland, Ken 1998. *Hedging in Scientific Research Articles*. Amsterdam/Philadelphia: John Benjamins.

Imao, Yasu 2014. *Casual Conc. Version 1.9.8*. Software. Available at <https://sites.google.com/ site/casualconc>.

Lyons, John 1977. *Semantics* Vol. 2. Cambridge: Cambridge University Press.

Kanoksilapatham, Budsaba 2005. Rhetorical structure of biochemistry research articles. *English for Specific Purposes* 24/3, 269–292.

Kanoksilapatham, Budsaba 2015. Distinguishing textual features characterizing structural variation in research articles across three Engineering sub-discipline corpora. *English for Specific Purposes* 37, 74–86.

Marín-Arrese, Juana I., Hidalgo-Downing, Laura / Molina-Plaza, Silvia 2004. Evidential, epistemic and deontic modality in English and Spanish: The expression of writer stance in newspaper discourse. In Facchinetti, Roberta / Palmer, Frank (eds) *English Modality in Perspective. Genre Analysis and contrastive Studies*. Frankfurt: Peter Lang, 121–40.

Marín-Arrese, Juana I. 2009. Effective vs. epistemic stance, and subjectivity/intersubjectivity in political discourse. A case study. In Tsangalidis, Anastasios / Facchinetti, Roberta (eds) *Studies on English Modality In Honour of Frank R. Palmer*. (Linguistic Insights. Studies in Language and Communication 111). Bern: Peter Lang, 23–52.

Marín-Arrese, Juana I. 2015. Epistemicity and stance: A cross-linguistic study of epistemic stance strategies in journalistic discourse in English and Spanish. *Discourse Studies* 17/2, 210–225.

Maswana, Sayako / Kanamaru, Toshiyuki / Akira Tajino, Akira 2015. Move analysis of research articles across five Engineering fields: What the share and what they do not. *Ampersand* 2, 1–11.

Mauranen, Anna 1997. Hedging in language revisers' hands. In Markkanen Raija / Schröder Hartmut (eds) *Hedging and Discourse. Approaches to the Analysis of a Pragmatic Phenomenon in Academic Texts*. Berlin: Walter de Gruyter, 115–134.

Nuyts, Jan 2001. Subjectivity as an evidential dimension in epistemic modal expressions. *Journal of Pragmatics* 33/3, 383–400.

Ortega Barrera, Ivalla / Quintana Toledo, Elena 2013. *May* and *must* as inferential evidential markers in a corpus of English scientific texts. *Estudios ingleses de la Universidad Complutense* 21, 11–29.

Ortega Barrera, Ivalla / Torres Ramírez, Amelia 2010. Estudio sobre los abstracts de artículos de investigación informáticos: evidencialidad y modalidad textual. *Revista de lingüística y lenguas aplicadas* 5, 141–153.

Palmer, Frank 1986. *Mood and Modality*. Cambridge: Cambridge
    University Press.
Palmer, Frank 2001. *Mood and Modality* (2nd ed.). Cambridge: Cambridge
    University Press.
Peacock, Matthew 2002. Communicative moves in the discussion section
    of research articles. *System* 30/4, 479–497.
Peacock, Matthew 2011. The structure of the methods section in
    research articles across eight disciplines. *The Asian ESP Journal*
    7/2, 99–122.
Peacock, Matthew. 2014. Modals in the construction of research articles:
    A cross-disciplinary perspective. *Ibérica* 27, 143–164.
Peng, Jingfu 1987. Organizational features in chemical engineering
    research articles. In Dudley-Evans, Tony (ed.) *Genre analysis
    and ESP*. University of Birmingham: ELR Journal 1, 79–116.
Pho, Phuong Dzung 2013. *Authorial Stance in Research Articles. Examples
    from Applied Linguistics and Educational Technology.* New York:
    MacMillan.
Posteguillo, Santiago 1999. The schematic structure of computer science
    research articles. *English for Specific Purposes* 18/2, 139–160.
Sayah, Leila / Reza Hashemi, Mohammad 2014. Exploring stance and
    engagement features in discourse analysis papers. *Theory and
    Practice in Language Studies* 4/3, 593–601.
Swales, John 1981. *Aspects of Article Introductions* (Aston ESP research
    rep. no. 1). Birmingham, England: The University of Aston, Lan-
    guage Studies Unit.
 Swales, John 1990. *Genre Analysis. English in Academic and Research
    Settings*. Cambridge: Cambridge University Press.
Tessuto, Girolamo 2015. Generic structure and rhetorical moves in
    English-language empirical law research articles: Sites of inter-
    disciplinary and interdiscursive cross-over. *English for Specific
    Purposes* 37, 13–26.
Thompson, Dorothea 1993. Arguing for experimental facts in science.
    Written Communication 10/1, 106–128.
Van der Auwera, Johan / Plungian, Vladimir 1998. On modality's
    semantic map. *Linguistic Typology* 2, 79–124.
Van linden, An / Verstraete, Jean-Christophe 2011. Revisiting deontic
    modality and related categories: A conceptual map based on the

study of English modal adjectives. *Journal of Pragmatics* 43, 150–163.

Vázquez Orta, Ignacio 2010. A contrastive analysis of the use of modal verbs in the expression of epistemic stance in Business Management research articles in English and Spanish. *Ibérica* 19, 77–96.

Vázquez Orta, Ignacio / Giner, Diana 2008. Beyond Mood and Modality: Epistemic Modality Markers as Hedges in Research Articles. A Cross-Disciplinary Study. *Revista alicantina de estudios ingleses* 21, 171–190.

Willet, Thomas 1988. A cross-linguistic survey of the grammaticalization of evidentiality. *Studies in Language* 12, 51–97.