A CORPUS-BASED ANALYSIS OF HEDGES AND BOOSTERS IN ENGLISH ACADEMIC ARTICLES

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Abstract

The present study examined research articles from eight academic disciplines to measure the frequencies and functions of hedges and boosters. The quantitative results showed that hedges exceeded boosters, with philosophy articles showing a significant use of hedges and boosters. The natural science papers were underrepresented in the number of hedges and boosters. Moreover, the results indicated that the choices the writers make seem to be constrained by the discourse norms and rhetorical styles of each discipline and reflect the nature of different disciplinary characteristics. The humanities and social sciences are basically more interpretative and less abstract, a style that requires more hedges and boosters and opts for subjectivity, whereas natural sciences are typically more fact-oriented and more impersonal, which is accompanied by fewer hedges and boosters and opts for objectivity. This was confirmed by a further analysis that showed that the relative incidence of hedges of the possibility/probability category in adjectives and adverbs was the highest in humanities and the lowest in natural sciences. Moreover, the relative incidence of hedges of the tentative cognition category in nouns and verbs was the highest in humanities and social sciences and the lowest in natural sciences.

Keywords: hedge, booster, modality, writing

The concept of the hedge was popularized as a linguistic term by Lakoff (1972), who defined it as "words whose job it is to make things fuzzier or less fuzzy" (Lakoff, 1972, p. 195). Lakoff's basic concept is that hedges modify words or phrases within a proposition, making the border fuzzier or making the border less fuzzy. However, to date, the research tradition on hedges has focused more on the attenuation aspect (Fetzer, 2010; Fraser, 2010). Recently, though, because the concept of a hedge includes not only the modification of words or phrases within a proposition but also the modification of one's commitment to the propositional content, some researchers have begun to think it is necessary to distinguish between the two types of hedging. Writers express their judgments, opinions, and commitments toward the propositional content of the text and their readers through the use of hedges and boosters, modifying the truth-value of the whole proposition. While hedging devices reduce the strength or force of an expression by expressing tentativeness and possibility, boosting devices intensify or emphasize the force by expressing conviction and asserting a proposition with confidence (Holmes, 1995; Hyland, 1998).

The original notion of hedges and boosters was further developed to accommodate the approaches in which hedges and boosters are used to realize an interactional/ communicative strategy and in which hedges are also used to hide the writer's epistemic attitude (e.g., Your shoes are *a little bit* dirty) (Markkanen & Schröder, 1997). Furthermore, Markkanen and Schröder (1997) suggested that hedges can offer a possibility for textual manipulation in the sense that the reader is left in the dark regarding the truth value of what is being expressed and who is responsible for it. On the other hand, Hyland (1998) argued that boosters leave the reader little room for their own interpretations and are used to create interpersonal solidarity with the reader. Hyland (1998) also indicated that hedging and boosting are necessary ways for making scientific statements in social contexts, and they are not only accuracy-oriented but also writer-oriented and reader-oriented. Thus, hedges and boosters refer to the textual strategies of using linguistic means in a certain speech act for specific communicative purposes, and these pragmatic aspects of hedges and boosters are closely related to modality.

Modality, hedges, and boosters

There is a close connection among modality, hedges, and boosters. Modality is concerned with a speaker's/writer's attitude toward the truth-value or factual status of a proposition. Similarly, hedges and boosters are related to a subject's personal attitudes toward the propositional content. For example, in "It **may** be true," *may* is a hedge and in "It **must** be true", *must* is a booster, but also both expressions show epistemic modality.

Palmer (2007) considered epistemic and evidential modalities as a propositional modality that relates to the speaker's/writer's attitude toward the truth-value of the proposition. According to Palmer (2007), included under epistemic modality are three types of judgment: "One that expresses uncertainty (e.g., John *may* be in his office), one that indicates an inference from observable evidence (e.g., John *must* be in his office), and one that indicates inference from what is generally known (John

will be in his office)" (p. 24). In other words, epistemic modality concerns the way speakers or writers communicate their doubts, certainties, and guesses. These are identified as speculative, deductive, and assumptive and overlap with hedging and boosting.

Regarding evidential modality, Chafe (1986) defined evidential modality as "any linguistic expression of attitudes toward knowledge" (p. 271), whereas Palmer (2007) defined it as reported (general knowledge and hearsay) and sensory (visual and auditory evidence). According to Chafe (1986), knowledge refers to belief, induction, hearsay, and deduction, which are based on a different source. Most of the expressions that Chafe (1986) provided as examples of the realization of these

different modes are expressions that were included in hedges (Markkanen and Schröder, 1997) as well as boosters. However, Nuyts (2006) considered that Chafe's definition is too broad and that the speaker's evaluation of the possibility/probability of the state of affairs under Chafe's definition of evidential modality is related to epistemic modality (e.g., John *may* be unmarried[1]). As there are occasions when epistemic implications of hearsay or sensory information take place, it is difficult to draw a line between the epistemic modality and evidential modality under such occasions. In sum, the epistemic modality related to expressing speculation, deduction, and assumption largely overlaps with hedging and boosting. On the other hand, evidential modality

Table 1. Categories and examples of adjectives and adverbs

	Possibility/ Probability	Indefinite frequency	Indefinite degree	Approximation
Adjectives	*probable*	*frequent*	*modest*	*approximate*
	possible	*general*	*moderate*	*rough*
	likely	*regular*	*reasonable*	
Adverbs	*perhaps*	*frequently*	*mainly*	*approximately*
	possibly	*often*	*primarily*	*roughly*
	probably	*sometimes*	*relatively*	

Table 2. Categories and examples of nouns and verbs

	Non-factive claim	Tentative cognition	Tentative likelihood
Nouns	*Claim*	*assumption*	*likelihood*
	Prediction	*hypothesis*	*tendency*
	Suggestion	*inference*	*uncertain*
Verbs	*Claim*	*anticipate*	*appear*
	Indicate	*assess*	*seem*
	Predict	*assume*	*tend*

occurs as hedges or boosters, but the chance of evidential modality being interpreted as hedges or boosters is specially contextualized in the case of modal verbs and adverbs, and in the case of modal adjectives, the chance is conditioned by impersonal syntactic structure.

Based on the close connection with modality and the models introduced by Hyland (1998) and Varttala (2001), adjectives, adverbs, nouns, and verbs are divided into the following categories in the Tables 1 and 2:
Studies in hedges and boosters of L1 academic writing
A number of studies in hedges have dealt with academic or scientific writing. Hedges are considered to be markers of uncertainty, and uncertainty is a fundamental characteristic of science writing. Grabe and Kaplan (1997) suggested that the motivation for expressing weak form negation with stronger pragmatic understanding involves the use of hedging or of politeness strategies. In addition, Hyland (1998) argued that in science writing, hedges play a critical role in gaining approval for writers' claims from readers by presenting statements with appropriate accuracy, caution and humility. Examples of studies in hedges include medical English written discourse (Salager-Meyer, 1994); comparison of

academic science writing and popular science writing (Crismore & Farnsworth, 1990); analysis of academic writing in the sciences, humanities and social sciences (Grabe & Kaplan, 1997; Hyland, 1998); and analysis of modal verbs in science writing (Butler, 1990).

Salager-Meyer (1994) looked into how the communicative purpose of the different rhetorical sections of research papers (RP) and case reports (CR) in medical English written discourse influences the frequency and category distribution of hedges in each section by analyzing a corpus of 15 articles from five leading medical journals such as *The British Medical Journal, Annals of Internal Medicine, The Lancet, Archives of Internal Medicine,* and *The New England Journal of Medicine*. The frequency and percentages of hedges in the different rhetorical sections were computed, and the hedges were classified into five pre-established categories, such as shields, compounds, approximators, emotionally charged expressions, and authors' insufficiency and doubt. The results showed that the three most frequently used hedging devices are shields, approximators, and compound hedges with the *discussion* (RP)/*comment* (CR) the most heavily hedged

and the *method/case report* the least-hedged.

Butler (1990) examined a corpus of 12 scientific texts, 4 from each of three subject areas, namely physics, botany and animal physiology, in a careful analysis of modal verb use. The results demonstrated that modal verbs account for approximately 10 in every 1000 words in the corpus and that the most frequent modal is *may*, followed by *can* and *will* with the density of modals highest in the discussion section and low in the method and result sections. Crismore and Farnsworth (1990) analyzed professional writing and popular writing on biology. Their findings indicated that hedges were used more extensively in both writings with more hedges than boosters used in the professional writing. In consideration of their findings, Crismore and Farnsworth (1990) concluded that hedging is the mark of a professional scientist. Similarly, Grabe and Kaplan (1997) examined patterns of linguistic variation across a range of expository texts consisting of 10 texts, each from five text types, such as professional natural science, popular natural science, newspaper editorials, annual business reports, and fiction narratives. The findings were fairly consistent with the results of Butler (1990) with regard to frequency of modal verbs and similar to the results by Crismore and Farnsworth (1990) in that professional science writing and popular science writing were not very different in terms of writers' use of modal verbs, hedges and boosters.

Meanwhile, Hyland (1998) analyzed 56 research articles, one paper from each of seven leading journals in eight disciplines: mechanical engineering, electrical engineering, marketing, philosophy, sociology, applied linguistics, physics, and microbiology. The results indicated that hedges exceeded boosters by nearly three to one. The most frequent hedges were *may*, *would* and *possible*, whereas the most frequent boosters were *will*, *show,* and *the fact that*. Modal lexical verbs, such as *suggest*, *indicate*, *assume,* and *seem* were also frequently used as hedges. There were substantial differences in the disciplinary results. That is, over 70% of all hedges occurred in philosophy, marketing, applied linguistics, and sociology, and they were over twice as frequent as in electrical engineering, mechanical engineering, and physics. Furthermore, Hyland explained that writers in humanities/social sciences relied on a personal

projection, while scientists and engineers showed their evaluation impersonally, constructing a context in which their claims appeared to arise from the research itself.

In sum, comparing hedges with boosters, hedges are more extensively used in academic articles, and they are densely located in the discussion section. This reflects the importance of the need for claims to be presented provisionally rather than assertively to gain ratification from powerful peer readers, especially in the discussion section. Moreover, Hyland (2012) explained that hedges are also used to invite the readers to get involved in open discussion about the nature of the propositions. The frequent use of hedges in discussion is a consequence of the fact that the authors don't seek to accomplish closure by reaching consensus on a particular issue but is more like a sign of the authors' willingness to continue conversation.

The studies (e.g., Crismore & Farnsworth, 1990; Grabe & Kaplan, 1997; Salager-Meyer, 1994) in hedges and boosters of L1 academic writing have compared the frequencies of hedges and boosters to find differences in the use of hedges and boosters. However, they didn't further analyze what sort of hedges associated with modality was used by reflecting on the nature of different disciplinary characteristics. Accordingly, the present study will look into the differences in the use of hedges more deeply by drawing on the different nature of eight different disciplines.

METHOD

The present study is inspired by the study by Hyland (1998). A corpus of published research articles provides the data for the present study. The text corpus consists of 56 research articles, one paper from each of seven leading journals in eight disciplines in the three study fields of cultural sciences, social sciences and natural sciences. The eight disciplines are linguistics and philosophy in the cultural sciences, marketing and sociology in the social sciences and physics, electrical engineering, mechanical engineering, and chemistry in the natural sciences. The articles were chosen at random from current issues and limited to ones written by native speakers of English. The articles were converted into an electronic corpus of 369,605 words and were searched for lexical expressions

Table 3. Hedges and boosters in the corpus of 56 academic articles

Category	Hedges	Boosters
Adjectives	1247 (3.37)	900 (2.44)
Adverbs	1669 (4.52)	650 (1.76)
Auxiliaries	1663 (4.50)	451 (1.22)
Nouns	1669 (4.52)	1207 (3.27)
Verbs	2595 (7.02)	1394 (3.77)
Totals	8843 (23.93)	4602 (12.45)
Items per 1000 words	23.93	12.45

Table 4. Most frequent hedges and boosters in the corpus of 56 academic articles

Hedges		Boosters	
Device	Frequency	Device	Frequency
May	666 (1.80)	Will	359 (0.97)
Would	423 (1.14)	Truth	291 (0.79)
Suggest	342 (0.93)	Evidence	254 (0.69)
Could	279 (0.76)	Show	209 (0.57)
Consider	249 (0.67)	Determine	167 (0.45)
Possible	235 (0.64)	Finding	159 (0.43)
Indicate	231 (0.63)	Fact	155 (0.42)
Theory	228 (0.62)	Demonstration	105 (0.28)
Might	181 (0.49)	Reveal	99 (0.27)
Rather	171 (0.46)	Always	91 (0.25)

Table 5. Disciplinary differences in hedges and boosters

Category	Hedges	Boosters
Linguistics	1181 (23.46)	599 (11.9)
Philosophy	1860 (40.40)	1326 (28.8)
Marketing	1681 (25.98)	753 (11.6)
Sociology	1382(25.58)	573 (10.6)
Physics	868 (21.20)	397 (9.7)
Electrical Engineering	362(13.79)	236 (9.0)
Mechanical Engineering	949 (17.62)	473 (8.8)
Chemistry	560(16.78)	245 (7.3)
Totals	8843	4602

Note. The figures in the parentheses show the numbers per 1000 words.

of hedging and boosting using AntConc 3.4.3 (Anthony, 2014). All cases of hedges and boosters were checked by a native speaker of English[2] to ensure that they expressed doubt or certainty.

RESULTS AND DISCUSSION
Quantitative results
The normality assumption was verified through SPSS, which did not show a violation of the normality assumption in the data shown in Tables 3 and 4. The results of the *t*-test in Table 3 show that hedges exceeded boosters by nearly 2 to 1, $t(4) = 4.56$, $p = .010 < .05$, which reveals that tentative claims were made more than conclusive ones.

Table 4 shows the most frequently occurring hedges and boosters in the corpus with *may* and *would* accounting for almost 12% of the hedging devices and *will* and *truth* 14% of the boosting devices in the corpus.

Table 5 shows disciplinary differences in hedges and boosters, with philosophy containing almost 5.3 times as many hedges and boosters as electrical engineering. Hedges exceeded boosters in all disciplines, $t(7) = 9.49$, $p = .000 < .05$, and approximately 70% of all hedges and boosters occurred in humanities and social sciences, with philosophy papers evidencing considerable use of hedges and boosters. Hyland (2012) mentioned that philosophers spell out their arguments from personal reflection rather than empirical evidence in

more discursive detail with a greater use of hedges and the inclusive *we*, working harder to establish solidarity and taking great care to create an understanding with their readers. The natural science papers were underrepresented in the number of hedges and boosters, although the discrepancies were not so large. Leech (1999) described that the most definite and assured statement is an unmodified assertion and any modification creates doubt and undermines the strength of the claim. The natural sciences deal with numerical data, which is more likely to generate a more precise picture of their findings, and it may seem that the authors in the natural sciences consider that using hedges and boosters distorts the fact from the empirical evidence.

Hedges and boosters in academic articles
Hedges and boosters are interactional strategies for increasing or reducing the force of propositional statements. The concept of hedges and boosters includes the modification of words or phrases within a proposition and also the modification of one's commitment to the propositional content. Hedges and boosters alter the state of affairs by indicating some markedness with respect to class membership of a particular item within a proposition or by changing the relationship between the propositional content and the writer by inserting the writer's uncertainty or certainty. For instance, *somewhat* (e.g., That's **somewhat** what I thinking about) and *precisely* (e.g., That's **precisely** what I am thinking about)

Table 6. Disciplinary differences in the use of approximative adverbs, *approximately* and *nearly*

	Humanities	Social Sciences	Natural Sciences
approximately	4 (0.04)	3 (0.03)	72 (0.5)
nearly	2 (0.02)	11 (0.09)	20 (0.13)

Note. The figures in the parentheses show the numbers per 1000 words.

within a proposition will affect the class membership of a particular item, while *I suppose* (e.g., **I suppose** she will come), and *I know* (e.g., **I know** she will come) will alter the writer's commitment to the propositional content. As hedges and boosters are concerned with the writer's personal attitudes toward the propositional content, hedges and boosters belong to the semantic domain of modality. With modality, it is very clear that certain lexical and grammatical environments constitute a metaphorical realization of modality. The lexical metaphor is viewed as a variation in the use of words or a variation in their meaning. In this aspect, a lexeme with a certain literal meaning can have metaphorical meanings. According to conceptual metaphor theory by Lakoff & Johnson (1999; Grady, 1999), humans use their understanding of the physical world as a framework for representing more abstract concepts.

With respect to class membership of a particular item within a proposition, although there were not many differences in the types of hedges and boosters used among humanities, social sciences, and natural sciences, a greater use of approximative adverbs, *approximately* and *nearly,* was found in natural science papers. In natural sciences, empirical evidence is usually provided with numerical data and writers need to take great care to highlight more precise information:

(1) The barotropic kinetic energy should be <u>approximately</u> five times larger than the total baroclinic energy at each wavenumber. (*Journal of Computational Physics, 271*)
The two species are present in <u>nearly</u> equal quantities, although the peaks were not sufficiently resolved to integrate or quantify. (*Bioorganic & Medicinal Chemistry, 22*)

In these examples, the purpose of using hedges like approximative adverbs was not to dilute their certainty but, instead, to present a real picture of how far their measurement varies from standard disciplinary norms and to create shared understandings with the readers.

In the following examples, the writers use lexical verbs as hedges to carry the writers' uncertainty and as boosters to show their certainty in the truth of their propositions.

(2) Our results <u>suggest</u> bidirectional mapping, from source to target domain, as well as from target to the source domain. (*Cognitive Linguistics, 23*)
Our studies <u>indicate</u> that a parodic ad can undermine consumers' attitudes toward these entities. (*Journal of Consumer Psychology, 24*)
We <u>expect</u> that this linear response is quite general. (*Nuclear Physics A, 927*)
Together these cases <u>show</u> that the letter of the Intuitive Thought is wrong. (*Erkenntnis, 79*)
We <u>know</u> that comparatively differentiated and complex social contexts encourage increasing interaction, while

simultaneously devaluing traditional and affective action orientations. (*Annual Review of Sociology, 39*)
We <u>find</u> that the PSD of the residual phase fluctuations is totally negligible, as compared to the mixer contribution. (*IEEE Transactions on Microwave Theory and Techniques, 62*)

The above examples draw attention to the contents of propositions and the writers' doubt or confidence about the propositions as well as to the readers' doubt or confidence. Hyland (2012) explained that the writers adjust the level of their commitment depending on the nature of the accredited facts or interpretations about the propositions and also on the anticipated effect the writers' commitments are likely to have on the readers' reactions. These considerations play very important roles in writing academic articles because they contribute to negotiating with the readers, persuading them that the writers' claims are valid, and helping the writers to obtain acceptance for their work in their disciplines. For instance, hedges are used not only as a strategy to get writers' provisional statements accepted by the readers but also as the writers' invitation to the readers to get involved in an open discussion about the nature of the propositions and the writers' views. The following sample provides an example of this:

(3) In response to the first question,<u> it seems plausible</u> to <u>suppose</u> that fundamental truths can only ground other truths. (*Inquiry, 57*)

Employing markers of evidential modality with inclusive pronouns (e.g., *we*) or indefinite pronouns (e.g., *one*) enables the writers to produce more interpersonal signals to the readers, which may allow the writers to share contexts with the readers and draw on their assumed belief specific to a particular field of study (Hyland, 1998):

(4) <u>One might think </u>that pressing this slippery slope argument is straightforward.
(*Journal of Philosophy of Education, 47*)
<u>One could argue</u> that, while this measure captures the positive and most obvious idea of mestizaje (mixture), mestizaje is a more complex belief structure that includes, and hides, the idea of black and indigenous assimilation or disappearance. (*American Journal of Sociology, 118*)
If, without in any way disturbing a system, <u>we can predict</u> with certainty the value of a physical quantity, then there exists an element of physical reality corresponding to this physical quantity. (*Annals of Physics, 338*)

On the other hand, boosters are used not only as a strategy to persuade the readers of the writers' confident assertion but also as a strategy to restrict the negotiating space available to the readers. The following sentence gives an example of this:

(5) The fact that a belief was caused in this way rather than some other can play a crucial role in a special kind of coherentist justification. (*Mind, 122*)

Boosters such as *of course, obvious(ly), clear(ly), well-known* and so on also function to indicate a mutual understanding between the writers and the readers based on shared community membership, and they assist the writers in leading the readers to the same reasonable inferences or conclusions (Hyland, 1998). By including the readers in this way, the argument about the propositions and the solidarity with the readers that leads them to the same inferences or conclusions are strengthened:

(6) Of course, I am not merely hearing the noises you make, or merely seeing the movements you perform. (*Philosophy, 89*)

These findings clearly contradict our hypothesis 1, in which we predicted widespread denial of inequality's structural basis, including discrimination. (*American Journal of Sociology, 118*)

Geometric instability is not always obvious when grinding because lobing builds up slowly. (*International Journal of Machine Tools & Manufacture, 82*)

This section examined hedges and boosters from the standpoint of lexical metaphor, and the view can be complemented by grammatical metaphor, as shown in the next section.

Subjectivity and objectivity

The starting point of the grammatical metaphor is a particular meaning, and it extends the different ways in which this meaning can be expressed or realized. From this point of view, the grammatical metaphor is defined as a variation in the expression of meanings. Halliday & Matthiessen (2014) explained that the semantic domain of modality is extended through interpersonal grammatical metaphor to include explicit indications of subjective and objective orientation. The tendency of interpersonal metaphor is to upgrade the domain of grammatical realization. For example, the metaphorical realization is a clause that projects (e.g., *I think* …) or embeds (e.g., *it is probable* …) the clause to which a modal value is allotted, whereas the congruent

Table 7. Subjective/objective dimension of grammatical metaphor

		Subjective	Objective
Explicit	Hedge	I suppose that …	It is likely that …
	Booster	I know that …	It is certain that …

realization of modality is a group serving within the clause. They subcategorized two layers of modality (modalization and modulation) into four complex dimensions of meaning with respect to the writer's modal responsibility (how much explicit responsibility the writer takes for his/her attitudes along the axes of subjective-objective and explicit-implicit). Both the subjective explicit orientation (e.g., *I am certain that* ….) and the objective explicit orientation (e.g., *It is certain that* ….) are based on grammatical metaphor because expressions of modality are extended from vocabulary to clauses by adding a projecting clause. With the examples of the subjective explicit orientation and the objective explicit orientation, the writer is explicitly stating the source of the conviction, but they are different along the subjective/objective dimensions. In the subjective explicit orientation case, the writer suggests that he/she alone knows the evidence and draws a conclusion from it, assuming strictly personal responsibility for the epistemic judgment (epistemic modality), whereas in the objective explicit orientation case, the writer indicates that the evidence is accessible to a larger group of people who share the conclusion based on it, assuming a shared responsibility for its judgment (evidential modality).

Although there were no significant differences among disciplines from a numerical point of view, the writers in humanities and social sciences were more likely to emphasize subjectivity, whereas the ones in natural sciences were inclined to stress objectivity when they modified statements. This indicates that the authors in humanities and social sciences were more likely to assume personal responsibility for their epistemic judgment by a more frequent use of cognitive verbs such as *think* and were more willing to be involved in their judgment by using personal attribution.

Table 8. Disciplinary differences in the use of cognitive verb, *think*

	Humanities	Social Sciences	Natural Sciences
Think	128 (1.3)	82 (0.7)	5 (0.03)

Note. The figures in the parentheses show the numbers per 1000 words.

This result coincides with those reported by Hyland (1998, 2002) with more cases in humanities and social sciences in which the writers chose to link themselves with their ideas more explicitly to avoid a personal intervention:

(7) I think I probably follow that format most of the time. (*TESOL Quarterly, 48*)

I think that it is right, and assume it is for the purposes of this paper. (*Erkenntnis, 79*)

I think he would have been quite pleased with the idea that at some point I would be doing this now. (*The Sociological Review, 61*)

Hyland (2012) suggested that this tendency reflects the contents of textbooks by Day (2006) and Swales & Feak (2004) that scientists are encouraged to make their own voice clear by the use of personal attribution in science papers.

By contrast, the writers in the natural sciences tended to opt for assuming a shared responsibility for their judgments with people who were accessible to the evidence and shared

the conclusion based on it. By emphasizing author invisibility with a more frequent use of discourse-oriented verbs such as *indicate*, which carry fewer subjective connotations than cognitive verbs, the authors were able to produce more accurate depictions of the real discovery and allow the facts to speak for themselves more clearly.

Table 9. Disciplinary differences in the use of discourse-oriented verb, *indicate*

	Humanities	Social Sciences	Natural Sciences
Indicate	14 (0.15)	17 (0.14)	122 (0.8)

Note. The figures in the parentheses show the numbers per 1000 words.

The objectivity intention can be more easily realized by resorting to impersonal strategies such as faceless subjects, abstract subjects, agentless passives and dummy *it*, and this effect is more reinforced by the use of an embedded clause with an anticipatory or dummy *it* in place of a human agent as the subject (Hyland, 1998):

(8) It is believed that these higher order correlations capture the intrinsic flow contributions and reduce the effects of

fluctuations. *(Nuclear Physics A, 927)*

It does not appear that the assumption of thermodynamic equilibrium used in developing them is valid for extreme reacting flows. (*Proceeding of the Combustion Institute, 34*)

LC–MS/MS analysis confirmed that the modification was localized to either Cys60 or Asp61, both of which could act as nucleophiles to displace the bromine. (*Bioorganic & Medicinal Chemistry, 22*)

These studies together indicate that the effect of cations on LPS structure and aggregate formation is an important factor that should be considered when studying the manifestation of endotoxic shock. (*Biophysical Journal, 106*)

The above discussion suggests that the lengthy time historically required to develop advanced environmental technologies tends to diminish the probability of commercial success, as more mature technologies gain initial market share. (*Progress in Energy and Combustion, 38*)

It was evident that one needed to introduce lowpass filters to ensure that the laser energy does not overwhelm the TR signal. (*Microelectronics Journal, 45*)

It is likely that stronger Bragg grating effects will be seen than for current open 'plasmonic photonic crystal' structures due

Table 10. Disciplinary differences in personal and impersonal strategies

		Humanities	Social Sciences	Natural Sciences
Subjective Explicit	Hedges	64 (0.7)	34 (0.3)	20 (0.1)
	Boosters	37 (0.4)	27 (0.2)	24 (0.2)
	Totals	101 (1.0)	61 (0.5)	44 (0.3)
Objective Explicit (with dummy *it*)	Hedges	57 (0.6)	19 (0.2)	57 (0.4)
	Boosters	29 (0.3)	5 (0.04)	43 (0.3)
	Totals	86 (0.9)	24 (0.2)	100 (0.6)
Faceless subjects (e.g., The result indicates …) , A bstract subject (e.g., To learn sh ows …), Agentless passives (e.g., Many of the troops may have been injured …)	Hedges	98 (1.0)	159 (1.3)	187 (1.2)
	Boosters	74 (0.8)	113 (1.0)	180 (1.2)
	Totals	172 (1.8)	272 (2.3)	367 (2.4)

Note. The figures in the parentheses show the numbers per 1000 words.

to the better confinement of the optical field close to the metal surface. (*Journal of Lightwave Technology, 15*)

Table 10 shows disciplinary differences in personal and impersonal strategies. Hyland (2012) indicated that the textbooks by Gong & Dragga (2001) and Lester (2004) advise scientists to avoid personal interventions and to comment impersonally on the validity of their propositions. Hyland (1998) further argued that writers use boosters such as *establish* and *show* to emphasize the strength and suggest the efficacy of the relationship between data and claims:

(9) This shows that the heat flux is a difficult statistic to correctly predict in a coarse - resolution simulation at weak supercriticality. (*Journal of Computational Physics, 271*)

This established that collector heating resulted from direct radiation heating rather than greenhouse effect within the chamber. (*Microsystem Technologies, 19*)

Adjectives, adverbs, verbs and nouns as hedges associated with modality

As the previous sections show, hedges outnumber boosters in academic articles and play important roles in contributing to negotiating with the readers and persuading them of the validity of the writers' claims and helping the writers to obtain acceptance for their work in their disciplines. Accordingly, the present section further examines the use of hedges in line with the categories associated with modality. However, modal auxiliaries were excluded from further investigation because they express one type of epistemic meaning (possibility/probability). Although there were no significant differences among disciplines, the present study looks into the nature of different disciplinary characteristics from a numerical point of view.

Adjectives and adverbs

Possibility/probability. A variety of adjectives and adverbs are closely linked to modality (Perkins, 1983), and this category indicates tentative epistemic modality. With respect to adjectives, 46 different adjectives were identified, amounting to a total of 996 instances of hedging. *Possible* (n = 235), *likely* (n = 165), and *potential* (n = 148) were the top three in terms of frequency in all disciplines. The relative incidence of hedges of this type was the highest in humanities and the lowest in natural sciences. Regarding adverbs, 17 different nouns of this type were detected as hedges with a total of 281 occurrences. The items most commonly employed as hedges were *perhaps* (n = 72) and *potentially* (n = 44) and they were the top two in all disciplines. As with adjectives, humanities was more heavily hedged with this type of adverb and natural sciences was less heavily hedged.

Indefinite frequency. The second category, indefinite frequency, is used for hedging purposes due to its inherent indefiniteness. Regarding adjectives, there were seven different adjectives identified, with a total of 216 instances of hedging. *General* (n = 130) and *common* (n = 52) had the highest frequency in all disciplines. The relative incidence of hedges of this type was similar across the three academic fields. Concerning adverbs, 13 different adverbs of this type were detected as hedges with a total of 523 occurrences. The items most commonly employed as hedges were *often* (n = 161), *generally* (n = 72) and *typically* (n = 123) and they were the top two in all disciplines. Humanities and social sciences were more heavily hedged with this type of adverbs than natural sciences.

Indefinite degree. The third category, indefinite degree, indicates epistemic qualifications, and they make the writers' statements less absolute. Regarding adjectives, four different adjectives were identified, amounting to a total of 87 instances of hedging. *Most* (n = 38) and *reasonable* (n = 21) were the two most frequent in all disciplines. The incidence of hedges of this type was

Table 11. Adjectives as hedges associated with modality

	Humanities	Social Sciences	Natural Sciences
Possibility/ Probability	394 (4.1) 13.0%	267 (2.2) 8.7%	280 (1.8) 10.2%
Indefinite frequency	63 (0.7) 2.1%	72 (0.6) 2.4%	78 (0.5) 2.8%
Indefinite degree	29 (0.3) 1.0%	21 (0.2) 0.7%	32 (0.2) 1.2%
Approximation	0	0	8 (0.05) 0.3%

Note. The figures in the parentheses show the numbers per 1000 words and percentage of all hedges in each of the three study fields.

Table 12. Adverbs as hedges associated with modality

	Humanities	Social Sciences	Natural Sciences
Possibility/ Probability	115 (1.2) 3.8%	94 (0.8) 3.1%	95 (0.6) 3.5%
Indefinite frequency	160 (1.7) 5.3%	220 (1.9) 7.2%	172 (1.1) 6.3%
Indefinite degree	187 (1.9) 6.1%	225 (1.9) 7.3%	242 (1.6) 8.8%
Approximation	35 (0.4) 1.2%	42 (0.4) 1.4%	83 (0.5) 3.0%

Note. The figures in the parentheses show the numbers per 1000 words and percentage of all hedges in each of the three study fields.

similar in all disciplines. With respect to adverbs, 20 different adverbs of this type were detected as hedges with a total of 610 occurrences. The items most commonly employed as hedges were *rather* (n = 171) and *relatively* (n = 89) and they were the top two in all disciplines. Like with adjectives, there was not a great difference in the incidence of hedges of this type across the disciplines.

Approximation. The last category, approximation, is commonly used to manipulate precision in quantification, and adverbs of this type are also used to hedge the effect of the predicate, reducing the force of the verb. With respect to adjectives, there were only two different adjectives with a total of nine occurrences, which belong to this category. They were *approximate* (n = 6) and *rough* (n = 3). The relative incidence of hedges of this type was observed only in natural sciences. Regarding adverbs, six different adverbs of this type were

detected as hedges with a total of 182 occurrences. The items most commonly employed as hedges were *approximately* (n = 79) and *almost* (n = 40), and they were the top two in all disciplines. There was not a great difference in the incidence of hedges of this type across the disciplines. **Verbs and nouns**

Non-factive claim. Non-factive devices are useful in constructing claims by other researchers or in tentatively asserting the authors' ideas. Regarding full verbs, there were 11 different full verbs with a total of 924 occurrences that belong to this category. *Suggest* (n = 342), *indicate* (n = 231), and *predict* (n = 126) were the top three in terms of frequency in all disciplines. The relative incidence of hedges of this type was the highest in social sciences, and it includes more variety of the verbs employed. Concerning nouns, nine different nouns of this type were detected as hedges with a total of 286 occurrences. The items most commonly employed as

hedges were *proposition* (*n* = 126), *prediction* (*n* = 65), and *implication* (*n* = 47) and they were the top three in all disciplines. Unlike with full verbs, humanities was more heavily hedged with this type of nouns and included more variety of this type.

Tentative cognition. The second category of verbs and nouns is the tentative cognition category, which is related to the mental processes of the writers or speakers. Regarding full verbs, 38 different full verbs were

identified, amounting to a total of 1263 instances of hedging. *Consider* (*n* = 249), *assume* (*n* = 165), and *expect* (*n* = 160) were the top three in terms of frequency in all disciplines. The relative incidence of hedges of this type was that humanities and social sciences were more heavily hedged than natural sciences. Concerning nouns, 31 different nouns of this type were detected as hedges with a total of 923 occurrences. The items most commonly employed as hedges were *theory* (*n* = 228) and

Table 13. Nouns as hedges associated with modality

	Humanities	Social Sciences	Natural Sciences
Non-factive claim	267 (2.8) 8.8%	102 (0.9) 3.3%	106 (0.7) 3.9%
Tentative cognition	269 (2.8) 8.8%	370 (3.1) 12.1%	147 (0.95) 5.4%
Tentative likelihood	200 (2.1) 6.6%	80 (0.67) 2.6%	123 (0.80) 4.5%

Note. The figures in the parentheses show the numbers per 1000 words and percentage of all hedges in each of the three study fields.

Table 14. Verbs as hedges associated with modality

	Humanities	Social Sciences	Natural Sciences
Non-factive claim	219 (2.3) 7.2%	332 (2.8) 10.8%	373 (2.4) 13.6%
Tentative cognition	444 (4.6) 14.6%	414 (3.5) 13.5%	413 (2.7) 15.1%
Tentative likelihood	157 (1.6) 5.2%	120 (1.0) 3.9%	110 (0.7) 4.0%

Note. The figures in the parentheses show the numbers per 1000 words and percentage of all hedges in each of the three study fields.

hypothesis (*n* = 152), and they were the top two in all disciplines. Like full verbs, humanities and social sciences were more heavily hedged with this type of noun than natural sciences.

Tentative likelihood. The third category is similar to the previous two categories discussed so far as it refers to tentativeness concerning either the ideas put forth by the writers or those expressed in the sources referred to. Regarding full verbs, there were five different full verbs with a total of 387 occurrences that belonged to this category. *Appear* (*n* = 160), *seem* (*n* = 141), and *tend* (*n* = 80) were the top three in terms of frequency in all disciplines. The relative incidence of hedges of this type was the highest in humanities. With respect to nouns, 16 different nouns of this type were detected as hedges with a total of 376 occurrences. The items most commonly employed as hedges were *feasibility* (*n* = 79), *possibility* (*n* = 73), and *trend* (*n* = 55), and they were the top three in all disciplines. Like full verbs, the discipline of humanities was more heavily hedged with this type of noun.

CONCLUSION

The present study conducted an analysis of research articles from eight academic disciplines to see the frequencies and functions of hedges and boosters. The quantitative results showed that hedges exceeded boosters by nearly 2 to 1, and 70% of all hedges and boosters were found in humanities and social sciences, with philosophy articles evidencing a significant use of hedges and boosters. The natural science papers were

underrepresented in the number of hedges and boosters. Using hedges and boosters in a text might be to some extent seen as the discourse choice of individual researchers influenced by individual personality, writing style preferences, and experiences in the field. However, in academic writing, the choices writers make seem to be constrained by the discourse norms and rhetorical styles of each discipline and reflect the nature of different disciplinary characteristics. The humanities and social sciences are basically more interpretative and less abstract, which requires more hedges and boosters and opts for subjectivity, whereas natural sciences are typically more fact-oriented and more impersonal, which is accompanied by fewer hedges and boosters and opts for objectivity. This is evidenced by the further analysis of hedges, showing that the relative incidence of hedges of the possibility/ probability category in adjectives and adverbs was the highest in humanities and the lowest in natural sciences. Moreover, the relative incidence of hedges of the tentative cognition category in nouns and verbs was the highest in humanities and social sciences and the lowest in natural sciences. Whatever the case may be, regardless of discipline, hedges and boosters work together to balance subjective evaluation and objective information with anticipated reactions from readers and aim to persuade readers to accept their claims. Nevertheless, no research is conclusive, leaving some room for uncertainty, and research cannot be reported with the same confidence of shared beliefs across disciplines. Thus, research has to be expressed with more hedges than boosters.

The present study found frequencies and functions of hedges and boosters in the academic articles of the

humanities, social sciences, and natural sciences by native speakers of English, but it is not clear whether the tendency that the present study found can be applicable to articles from other disciplines or those by non-native speakers of English. Accordingly, for future research, it would be interesting to look into how hedges and boosters are dealt with in other disciplines and by non-native speakers of English. In this way, we will be able to grasp differences and similarities in the use of hedges and boosters by native and non-native speakers of English and provide learners of English with guiding principles regarding the use of hedges and boosters in academic articles.

Acknowledgments

NOTES

1. In this case, just as in the situation in which one knows that John belongs to a community of ninety of which thirty are unmarried, the epistemic judgment is based on some kind of evidence (perceived evidence, hearsay evidence, inferences from other knowledge, etc.).
2. A native speaker of English is defined as a person who speaks English as their first language and has not learned it as a foreign language.

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