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Metadiscourse Use in Popular and Professional Science: The Case of Hedges and Boosters

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Abstract

The present article shows that all scientific texts included in journals, magazines, and newspapers are vulnerable to the penetration of hedges and boosters. However, it was found that scientific texts in the three corpora tended to open up the possibilities of alternative voices rather than narrowing them down. The relatively higher frequency of occurrence of hedges in comparison with boosters indicates that regardless of whether the audience is expert or non-expert, their voices are seen as respected in the scientific texts. Similarly, boosters as means of narrowing down the alternative positions and developing a strong and certain authorial voices are equally disfavored in both expert and popularized scientific texts. Despite this similar pattern of the use of hedges and boosters in the investigated corpora, the means to achieve the mentioned objectives slightly differed and the informal style of language use dominating popular genres influenced the textual realizations of such functions.

Keywords: Booster, Hedge, Metadiscourse, Popular Science, Professional Science

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Introduction

In light of a large number of admirable attempts which look at writing from social, dialogic, and interpersonal points of view, the proposition which considers written discourse an interactive endeavor is now well-established (see, for instance, Duszak, 1994; Hunston, 1994; Hoey, 1988; Hoey, 2001; Knorr-Cetina, 1981; Martin, 2000; Mei & Allison, 2005; Miller & Charney, 2008; Nelson, 2008; Thompson, 2001; Widdowson, 1984). These attempts have helped us characterize written communication/written text in terms of features as:

- co-produced by authors and by readers to whom texts are directed;
- engaging writers and readers in a covert interaction;
- a physical record of a dialogue;
- a series of writer responses to anticipated reader reactions;
- collaboratively constructed, with communicative space left for the readers;
- a site for interaction;
- taking place under the principle of reciprocity;
- communicative homeostasis;
- an interactional act.

In fact, in light of such scholarly thinking, something which was once conceived of as an asocial and purely intrapersonal act of communication has come to be recognized as a social and interpersonal act in which negotiation of meaning without taking care of the anticipated reactions of the potential audience is impossible. However, in defining the same act in the sphere of science, our consciousness of this rhetorical, communicative and social character has long been suppressed. Due to a historical alienation developed towards the discourse of science, there has been a strong desire to wipe scientific communication in general and written scientific communication in particular off any social and interpersonal character. This alienation is strongly felt in advice such as the following given to writers of scientific prose (Bazerman, 1984, p. 163-5 as cited in Hunston, 1994, p. 192):

- the scientist must remove himself from reports of his own work and thus avoid all use of first person;
- scientific writing should be objective and precise, with mathematics as its model;
- scientific writing should shun metaphor and other flights of rhetorical fancy to seek a univocal relationship between word and object; and
- the scientific article should support its claims with empirical evidence form nature

This alienation, as Halliday (1993/2004) rightly argues, is the outcome of the picture that science represented: "… a universe regulated by automatic physical laws and of a vast gulf between humanity and the rest of the nature" (p.199). This vast

gulf has long dissociated scientific discourse form its historical, cultural, social and interpersonal origins and networks of meaning making, the outcome being a picture of a faceless, objective, impersonal and asocial discourse. This positivist conception of science defines knowledge as objective, individualistic, ahistoric and asocial, gives knowledge a data-driven and/or cognitively necessitated character beyond the control of people, and sees scientific formulation as the outcome of impersonal application of decontextualized, methodological rules.

Nevertheless, by the force of our social constructivist gyrations, we have been gaining glimpses of a few different dimensions in which the discourse of science operates. These glimpses have been showing show us how much the discourse of science is part of complex webs of human's social interaction. Research forming the social construction of knowledge has clearly shown us that scientific discourse is a social construct, and its success is at least partly accomplished through strategic manipulation of rhetorical features. This movement locates participant relationships at the heart of scientific discourse, assuming that every successful text must display the writer's awareness of its readers. Within social constructionism, the terms in which the world should be understood are considered as social artefacts, as the outcomes of historically situated interactions and interchanges among people. Defining the process of understanding in terms of active, cooperative enterprise of persons in relationships and on the basis of the vicissitudes of social processes (e.g. communication, negotiation, conflict, rhetoric), social constructionists characterize the concept of science in terms of the following features (for a full account of these features, see Gergen, 1985):

- Scientific discourse has revealed some of the ways non-scientific discourses have penetrated into. Social constructionism confronts the traditional western conception of objective, individualistic, ahistoric, asocial knowledge;
- Social constructionism removes knowledge from the data-driven and/or the cognitively necessitated domains and situates it in the control of the people in interaction and relationship;
- Social constructionism rejects the proposition that scientific formulation can be the outcome of impersonal application of decontextualized, methodological rules;
- Social constructionism sees the construction of knowledge as the responsibility of persons in active, communal interchange.

With these characteristics being highlighted, social constructionism situates scientific meaning making within a social, cultural, and historical context, and encourages us to see the scientific meaning making as an at least partially humane act.

A significant implication of characterizing the discourse of science in terms of social constructivist position would be recognizing the *hybridity* of such discourse. In fact, being social, historical, and cultural necessarily implies that scientific discourse is in a constitutive relationship with other social, cultural and historical

discourses surrounding it. Recognizing the social, cultural, and historical nature of scientific discourse simply means that it cannot be a homogeneous means of transmission of knowledge; heterogeneity is an integral quality of such discourses. This heterogeneity and hybridity imply that scientific communication does not operate in a vacuum and its qualities are constantly shaped and reshaped by the qualities of other discourses. In the light of the empirical evidence from such research, we have developed deep insights on a few dimensions non-scientific discourses have penetrated scientific discourse. In Kuhi (2018), a detailed framework of such discourses including penetration of instructional/pedagogical discourse (see, for instance, Hanrahan, 2010) has been outlined, and it has been attempted to create a balance between theoretical positions and social realities and possibilities (see, for instance, Henderson, 2001), penetration of cooperative/dialogic discourse (see, for instance, Crismore & Farnsworth, 1989), accountability to shared experience (see, for instance, Kuhi & Alinejad, 2015), penetration of competitive discourse (see, for instance, Hoey, 2000), and penetration of commodification discourse (see, for instance, Fairclough, 1992a, 1992b, 2002; Kuhi, 2014; & Yakhontova, 2002), etc.

Review of Literature

Heterogeneity and Popularization of Science

One specific area of the influence of non-scientific discourses which has been elaborated upon in Kuhi (2018) is the way scientific discourses have been popularized. In his insightful discussion on the problem of negotiation between Linguistics (as a science) and practice of language teaching (where the findings of the science of Linguistics have been traditionally and conventionally been expected to be of some relevance and application to non-scientists), Widdowson (2003) argues that scientific representations are and should be necessarily remote from every day experience, and from the immediate awareness of ordinary people. To Widdowson, this abstraction and distance from real life concerns and everyday life discourse play a key role in the development of scientific knowledge. He claims that scientists' representations of phenomena do not need to be the replications of those phenomena as they occur in the real world – the terminology science uses, its discourse in general, will be correspondingly remote from every day experiences. In his opinion, what scientists do is to formulate their own version of reality on their own terms and in their own terms. Of course, Widdowson has been struggling to use this line of reasoning to persuade his readers of the justification for applied linguistics as a mediator between linguists and practitioners. However, we feel that this picture of science as something necessarily remote from the access of everyday life users and consumers has been fundamentally altered by the introduction of the so called "popularizing discourses". Popularizing discourses have been developed to bring the discourse of science down to the extent that non-scientist public audience can also access the findings of science.

In his detailed account of the popular science discourses, Hyland (2009) provides a very technical treatment of the concept of popularization by concentrating on the question "popular with whom?". The question and the way it has been answered shed light on the variations we find in popular science genres. For instance, *scientific TV documentaries* are characterized by the use of strongly narrative storylines in which shaping and reshaping reality often take the form of a detective story. Through this arbitrary adoption of a position on an issue rather than a variety of positions, the format suggests that the average viewer can only cope with one clear 'narrative' no matter how deceptive such a view of the world may be. Curtis (1994) believes that this detective narrative-like presentation of the realities emphasizes the human over scientific and promotes a particular normative view of science. However, in *popular science books*, the narrative structure of the documentaries is replaced by a more discursive presentation in which the confident assimilator (not a skeptical detective) provides a detailed understanding of a topic. This popular genre can be characterized by gradual reconstruction of a commonsense world into a technical one through recognizable cultural allusions, setting scientific work more clearly in historical contexts, emphasizing humanist and social elements, offering an ideological interpretation of the world, deploying the familiar academic signals of tentativeness and circumspection, and referring to relatively esoteric scientific knowledge as the common property of writer and audience. Hyland also deals with *science journalism,* as another mechanism of popularization of science, and discusses how the organizational patterns (foregrounding the main claim, focusing on the object of the study rather than the disciplinary procedures, the use of visuals), accommodation of readers (different ways of framing information for the non-expert audience, avoiding jargons, offering glosses, management of the cohesion by the writer, emphasizing the credibility of the source of information being reported) and expression of stance and attitude (hedging, abundant use of attitude markers, frequent use of personal pronouns and questions, considerable use of similes and comparisons) help the authors of journalistic science articles address a public reader community. This is a discourse which establishes the novelty, relevance and newsworthiness of topics which may not seem to warrant lay attention by making information concrete, novel and accessible. This discourse allows a non-specialist audience to recover the interpretive voice of the scientist.

Illustrative and empirical evidence of this aspect of hybridity comes from Myers' (1994) investigation of *the narrative of science and nature in popularizing molecular genetics*. To show how the discursive structure of popular articles differ from scientific articles, the researchers compare the two genres on three levels – organization, syntax, and vocabulary. The comparison generally reveals that the different audiences not only set the facts out differently, but actually construct different views of science: while the professional article, written for a specialist scientific community, creates a narrative of science, following the arguments of the scientist's claim, the popularizing articles create a narrative of nature by focusing on the object of study rather than the scientific activity and endow the facts with much

greater authority and certainty. This contrast is clearly manifested in the three levels selected for the purpose of comparison/contrast in this research.At organizational level, for instance, the organization of each section of research articles involves juxtaposition of several related statements into a simultaneous order of argument, whereas in popularizing articles the statements are organized into a sequence. In syntactic level, research articles tend to use complex sentences, and complex phrases that bring a number of clauses into a single sentence while in popularizing articles the same content is expressed with a series of simple sentences. In terms of terminology, the researcher refers to examples in which the popularization substitutes for some scientific term an explanation or a rough equivalent in the general vocabulary. However, there are also cases which indicate that the writers of popularization often have to battle with editors to preserve some of their specialized terminology. The evidence provided by this research should be seen as part of my attempt to show that due to some social pressures (here the need to inform the public of the findings of science) scientific discourse may lose some of its essential qualities and bring in itself a number of discursive qualities belonging to other discourses.

Previous research on the differences between scientific and popular scientific discourses shows that these also differ in terms of the interpersonal system of meaning-making. A good example of such work which has concentrated upon interactive and interactional metadiscourse is Crismore and Farnsworth's (1990) study of professional and popular papers written by Stephen Jay Gould. The researchers reported a more frequent occurrence of interactive metadiscourse in the professional genre and assigned this difference to the difference in length of these two genres. They argued that since popularizations tend to be shorter than professional papers, writers of popular texts have less need of frame-markers to guide readers through a lengthy or complex text. Regarding the use of interactional metadiscourse, Crismore and Farnsworth found fewer hedges and boosters in the Gould popularization compared with the professional paper and more attitude markers and commentary. These differences were also explained by reference to different functions of epistemic devices in negotiation of knowledge claims with different audiences. The fact is that in negotiation of knowledge claims with an expert community, you are faced with a more skeptical audience and this requires an appropriate balance between scientific caution and assurance.

Fahnestock (1986) confirms this in her analysis of different degrees of tentativeness in an article from *Science* and the popularized transformations of that article in *Newsweek* and *Time*. Her findings show that the tentativeness found in the original scientific article was absent in its transformed versions; the transformed versions instead displayed a more amplified picture of certainty and claims. The elimination of hedges and boosters in popularization seemed to add to the significance and newsworthiness of the subject and glamorized the material for a wider audience.

In a recent study (Kuhi, in progress), we also looked at the way informal elements are penetrating into the discourse of science. Working on a corpus of scientific journal articles, scientific magazine articles, and scientific newspaper articles, the findings indicated that regardless of their generic qualities, communicative purposes and the target audience, all scientific texts included in the three corpora are vulnerable to the penetration of informal elements. However, the differences in terms of communicative purposes and target audiences affect the way informal elements are distributed in the three corpora. A close analysis of the individual features revealed very interesting patterns of frequency. For instance, while instances of contractions were used in magazine and newspaper articles, there was no single case of this feature in journal articles; similarly, direct questions appeared in both magazine and newspaper articles, while they did not appear in journal articles at all; features like direct questions, contractions, and exclamations which occurred more frequently in newspaper and magazine articles naturally belong to those scientific genres since they address the public audience and are published in sources which do not have that much strict conventions on avoiding such features while in more expert genres like journals the authors are usually advised to avoid these features. An interesting finding of this study was the more frequent occurrence of self-mention in the journal article – something which is vital for the survival of the member of academy in a commodified era. In fact, the high frequency of self-mention in journal research articles can be explained by reference to the key role of research articles in the promotion of both the writers and the associated academic institutions. This promotion plays a significant role in enhancing the access of the authors and academic institutions to more economic funds. This ambition may not be equally strong for those authors publishing in newspapers and magazines since magazines and newspapers are intertwined with other means of attracting financial income (e.g. advertisements). Hence, there is relatively less pressure on the authors to behave (discursively) in a manner which contributes to the development of financial income.

Hybridity and Stylistic Heterogeneity of Scientific Discourses

What we have developed above on the nature of scientific discourse and the way it is influenced by other discourses can also be approached form an intertextual perspective. We find this perspective significant in that it would facilitate our understanding of some related concepts like scientific genre, scientific register, and scientific style and would help us deal with the challenges we face in characterizing these terms. The French scholar Kristeva (1986) who introduced Bakhtin's work to Western societies has offered a very useful distinction between 'horizontal' intertextuality and 'vertical' intertextuality. She reserves the term 'horizontal' to define the way texts build on texts with which they are related sequentially (or syntagmatically), while the term 'vertical' intertextuality is used to characterize the way texts build on prototypical texts that are paradigmatically related to them. Using this distinction, we can argue that the non-scientific discourses we outlined above are in a kind of paradigmatic relationship with the discourse of science. This

paradigmatic relationship forces scientific discourse to re-adjust its generic, registeral, and stylistic features so that the expectations emerging from other contexts can be appropriately met (instances of this readjustment were reviewed in previous sections). This is the very outcome of a paradigm shift in the discourse of science: a shift from an objective, faceless, impersonal, positivist nature to a constructivist, social and interpersonal paradigm. This shift has encouraged the discourse of science open its doors to the influence of other discourses. We have tried to characterize this shift in Figure 1.

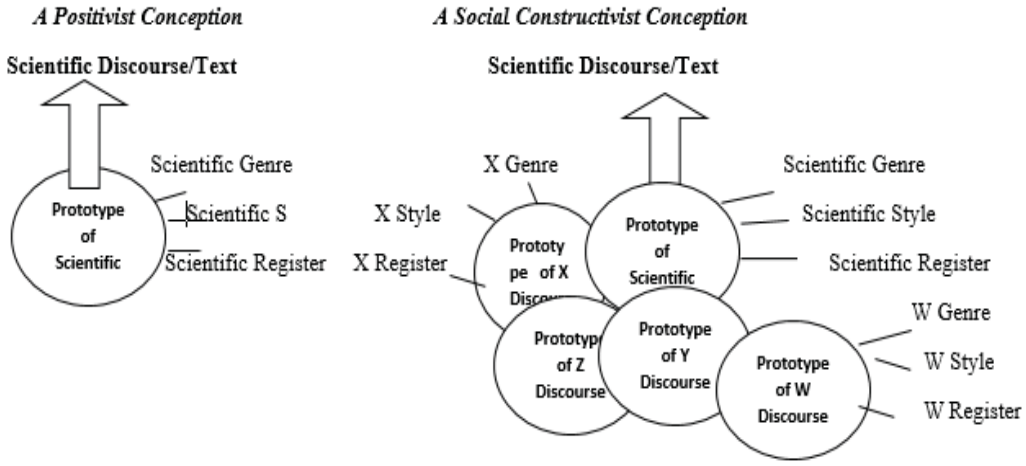

Figure 1. An Intertextual Representation of the Hybrid Nature of the Discourse of Science

Such an approach to the intertextual dimension of hybridity would enable us to perceive relations between the functions of one discourse and those of other relevant discourses. It could be argued that these relations jointly contribute to the development and maintenance of what we call 'scientific discourse'. It seems that scientific discourse in general and its generic and stylistic features in particular are loosely arrayed in an intertextual network as they interact with, draw upon, and respond to other discourses and their generic, registeral and stylistic features. This *constitutive intertextuality* (or what Fairclough calls 'interdiscursivity'), involves borrowing generic, stylistic, and rhetorical conventions and forms to create a scientific text, "thus merging what may be originally distinct orders of discourse to create new discourses" (Hyland, 2006, p. 57). This is the way the meaning making system of scientific discourses works. Through the interaction between academic discourse and other discourses, which implies a process of drawing upon and responding to other orders of discourse, scientific discourses are adjusted and adapted to the *social*, *cultural*, *historical, pedagogical,* and *ideological* expectations of scientists/authors and their intended audiences, and this ensures the continuity of scientific institutions. As Hatim and Mason (1990) argue, this hybridity and intertextuality is a force which extends the boundaries of meaning and meaning making. In *S/Z* (1970), Barthes describes texts [and discourse] undergoing this force as displaying a limitless perspective of fragments, of voices from other texts [and discourse], other codes. Indeed, the whole process may be characterized as a process

of *discourse-switching* and *discourse-mixing* in which we obviously see a shift form one sign system (one meaning making system) to another *in response to a variety of socio-psychological circumstances dictated by particular communicative needs and requirements*. Such features, in fact, confirm the very basic claim of social constructivism that science is not a 'given' in the sense of a monolithic entity always understood in the same way; it is a social construct created by different groups and of course for different groups with different interests and different expectations.

The Concept of Metadiscourse

The awareness that success of academic communication is partly accomplished through strategic manipulation of interpersonal and rhetorical elements has stimulated a fresh wave of studies exploring the interactive, interpersonal, evaluative, persuasive, and rhetorical dimensions of academic discourse. Many of these studies can be clustered under the uniting umbrella of metadiscourse — an intuitively attractive concept as it seems to offer a principled way of collecting under one heading the diverse range of linguistic devices writers use to explicitly organize texts, engage readers, signal their own presence, and signal their attitudes to their material and their audience. The concept of metadiscourse brings to the fore qualities of academic written communication, such as non-topical linguistic material that may be irrelevant to topic development but key to understanding discourse as a whole (Lautamatti, 1987); linguistic material that does not add propositional information but signals the presence of an author (Vande Kopple, 1985); author's intrusion into the discourse to direct rather than inform (Crismore, 1983); and non-referential aspects of discourse that help to organize prose as a coherent text and convey a writer's personality, his or her awareness of readers, and his or her stance toward the message (Hyland, 1998). Studies that have developed a cross-cultural perspective (e.g., Adel, 2006; Breivega, Dahl, & Flottum, 2002; Dahl, 2004; Mauranen, 1993; McEnry & Kifle, 2002; ThueVold, 2006) have revealed that metadiscourse is not uniform across languages; studies that have looked at metadiscourse form cross-disciplinary point of view (e.g., Charles, 2006; Harwood, 2005; Hewings & Hewings, 2001; Swales et al., 1998) have shown how metadiscourse use is sensitive to the ways texts are written, used and responded by individuals acting as members of academic discourse communities; and studies that have adopted communicative purpose (Swales, 1990) as the major focus—genre-based studies of metadiscourse—have also contributed to awareness of how different communicative purposes and different audiences can influence the use of metadiscourse. Different academic genres have been investigated both individually and in comparison with other genres. While due to its significance in the life of academy, the research article (RA) has been studied more extensively (e.g., Hyland, 1996a, 1996b, 2002c, 2007), other academic genres like textbooks (e.g., Hyland, 1994), dissertations (e.g. Bunton, 1999), and undergraduate essays (e.g., Myers, 2001) have also been investigated. Other studies have compared two or more academic genres: Hyland's (1999) study of research articles and textbooks; Hyland's (2002a) study of textbooks, research articles, and student reports; de Oliveira and

Pagano's (2006) study of research articles and science popularization articles; Hyland's (2004) investigation of master's and PhD dissertations; Hyland's (2002b) investigation of expert and non/less expert writers; and Hyland and Tse's (2005) investigation of research articles and dissertations.

Amongst the studies on metadiscourse in written texts, there is a well-established tradition which has concentrated on the use of interpersonal features in seminal scientific texts. Here, it is sufficient for us to refer to two typical and representative studies belonging to this tradition: Henderson (2001) has concentrated on one such metadiscourse feature (i.e. examples) in Adam Smith's *Wealth of Nations* – a classic, seminal work in economics. Henderson's (2001) investigation of examples in Smith's scientific prose results in the identification of three broad categories: current examples – drawn from contemporary economic experience and written about in the present tense; historical examples – which refer to economic conditions in the classified world or in medieval England; hypothetical examples – which may or may not have an authentic existence in the world beyond Smith's texts. Henderson interprets the frequent use of examples in Smith's scientific prose as an attempt to appeal to the active reasoning power of the implied reader, fundamental to the development and justification of the proposition being presented, to help the reader activate the knowledge of certain working environments and to secure the cohesion of the chapters. According to Henderson, the recurrent use of examples creates a balance between theoretical propositions and social possibilities; mingled with the spoken language sense hidden in Smith's work, this gives his scientific discourse a systematic and teacherly approach. Henderson sees smith's work as packed with exemplification, presented within a wider pedagogical strategy that could be thought of as "planned repetition" or even "extensive familiarization technique".

Crismore and Farnsworth (1989) have concentrated on Darwin's use of hedges, boosters, attitude markers, and commentary in his text. An interesting finding of this research is that it has resulted in identifying 890 instances of such metadiscourse markers in Chapter One of the *Origin of Species*, which sets out a framework for the book, and Chapter Four, which presents the theory of natural selection. The significance of this research lies in the fact that what used to be seen as an influential scientific text and still counts as a typical representative of pure hard science is nothing, but the voice of a cautious scientist who resorts to metadiscourse resources such as hedges, boosters, and attitude markers to indicate the relative uncertainty of his claims. Crismore and Farnsworth's work develops an image of a scientist which fundamentally differs from the impressions developed by dominant alienations: "the tentative, cautious, naturalist; the modest, gentleman naturalist; non-assertive, tactful presenter of ideas; the trustworthy expert, the childlike human being given to wonder – in short, the nonthreatening, endearing Mr. Darwin" (1980, p. 101).

Methodology

The present research was motivated by the assumption that the generic character of a scientific text (more particularly the audience targeted by a scientific text) would

influence the way metadiscoursive elements are utilized by the authors of these texts. From among a large number of metadiscoursive features developed in the existing taxonomies, we focused upon two significant ones, i.e. hedges and boosters. The objective was investigating the way scientific discourses included in the present research vary in terms of incorporating different degrees of tentativeness and certainty. Hence, we developed a corpus based on a continuum of scientific texts ranging from professional to popular. This corpus consisted of three sub-corpora: free articles published in scientific journals, articles published in magazines and articles published in newspapers.

To meet the objective of the present research, a corpus of 356,625 words was designed. This corpus included three sub-corpora: 30 journal articles (155,668 words), 150 magazine articles (99,230 words), and newspaper articles (101,727 words). A thematic homogeneity principle was observed in the collection of the articles: all articles were about climate change. Also, in order to control any possible chronological effect, the articles published in 2016-2017 were included in the corpora. Detailed information about the corpora appears in Table 1. Moreover, full bibliographical information about the articles included in the corpora can be found in Appendix 1.

Table 1. Detailed Information About the Articles Included in the Corpora

Article	Number of Articles	Source	Theme	Number of Words	Year
Journal	30	Nature Communications Plos One Scientific Reports	Climate Change	155,668	2016
Magazine	150	Discover New Scientist Scientific American	Climate Change	99,230	2016-17
Newspaper	150	Daily Mail The Guardian The Telegraph	Climate Change	101,727	2016-17

For the purposes of the present research, *hedges* were defined as metadiscourse devices which

> … indicate the writer's decision to recognize alternative voices and viewpoints and so withhold complete commitment to a proposition. Hedges emphasize the subjectivity of a position by allowing information to be represented as an opinion rather than a fact and therefore open that position to negotiation. (Hyland, 2005, p. 52)

Boosters were defined as metadiscourse features which

> … allow writers to close down alternatives, head off conflicting views and express their certainty in what they say. Boosters suggest that the writer

> recognize potentially diverse positions but has chosen to narrow this diversity rather than enlarge it, confronting alternatives with a single, confident voice. (Hyland, 2005, p. 53)

A comprehensive list of the search items investigated in the present research appear in Appendix 2.

Results and Discussion

As Table 2 clearly demonstrates, among the three corpora selected for the present investigation, magazines provided a generally more interpersonal atmosphere for their authors in terms of the possibilities of enlarging and/or closing down potentially diverse positions (17.08 per 1000 words) while journal authors and newspaper authors depicted a similar tendency in this regard (13.93 and 14.85 per 1000 words respectively). The interesting (and probably unexpected) finding to be acknowledged here is that even though popular genres (magazines and newspapers) do not seem and even might not be expected to be addressing an expert community of readers, the overall tendency among their authors for altering the different degrees of certainty is stronger than what we observe among the authors of journal articles (who are normally engaged with negotiation with a more expert community of readers with stronger critical approach to what appears in the text).

Table 2. Total Number of Hedges and Boosters per 1000 Words

	Raw Number of Features	Number of words	Frequency per 1000 Words
Journal	2,169	155,668	13.93
Magazine	1,695	99,230	17.08
Newspaper	1,511	101,727	14.85

As we come to deal with the frequency of occurrence of boosters and hedges independently (Table 3), the first noticeable tendency is the considerably higher frequency of hedges than boosters in all three corpora. This can be an indication of the fact that the authors of scientific texts (regardless of whether the audience is expert or non-expert) prefer to open up the possibilities of alternative positions; in fact, providing a wider prospect for readers' positions in the text and lowering the degree of certainty of claims in scientific texts seems to be the common characteristic of all scientific texts. That is why the frequency of occurrence of hedges in the three corpora are very close. Narrowing down the possibilities of alternative voices through boosters comprises a comparatively lower share in the selected corpora, and this s an indication of the fact that developing a strong and certain authorial position (through boosters) which cannot be conflicted or challenged by the reader community is generally disfavored.

It should also be mentioned that our findings generally run against the findings of Fahnestock (1986), which showed that the tentativeness found in the original

scientific article was absent in more popular versions which displayed a more amplified picture of certainty and claims through the use of boosters. Among the popular genres included in the investigation, newspaper articles represented an almost equal tendency with journals articles in terms of the frequency of occurrence of hedges and magazine articles even represented a heavier presence of these features. In terms of the frequency of the occurrence of boosters, we had a similar pattern. Newspaper articles and journal articles were close to one another while magazine articles tended to display a higher degree of certainty through the use of boosters.

Table 3. Frequency of Occurrence of Boosters and Hedges in the Three Corpora

	Journal		**Magazine**		**Newspaper**	
Features	**Raw Frequency**	**Frequency per 1000 Words**	**Raw Frequency**	**Frequency per 1000 Words**	**Raw Frequency**	**Frequency per 1000 Words**
Hedges	1,582	10.16	1,143	11.52	1,105	10.86
Boosters	587	3.77	552	5.56	406	3.99
Total	2.169	13.93	1,695	17.08	1,662	14.85

We also went through the process of eliciting ten top hedges and boosters in the three investigated corpora to see if the authors of articles belonging to the different genres necessarily had different preferences (see Tables 4, 5 and 6). The findings indicate a similar pattern in the use of boosters where in all three corpora where the verb *found* and different variations of the verb *show* stand as the top preferences. However, we see slight differences in the top preferences of hedges in the three corpora: while in journal articles *may*, *would*, *likely,* and *could* occupy the higher positions, in magazine articles *could*, *would*, *around,* and *may* are the first four priorities, and in newspaper articles the first four priorities are *could*, *would*, *about,* and *around*. This finding can be linked to the stylistic features of the three genres; the relatively higher position of features like *about* and *around* in the popular science genres is an indication of a relatively stronger informality in such genres (we have already indicated this in press).

Table 4. The Ranked Frequency of Most Common Hedges and Boosters per 1000 Words in Scientific Journals

Hedges	**Percentage**	**Boosters**	**Percentage**
1. May	(12.19%)	1. Found	(22.48%)
2. Would	(8.97%)	2. Shown	(19.08%)
3. Likely	(8.09%)	3. Show	(17.03%)
4. Could	(7.39%)	4. Showed	(9.02%)
5. Estimated	(4.80%)	5. Shows	(8.85%)
6. Maybe	(4.61%)	6. Must	(4.77%)
7. Possible	(4.04%)	7. Find	(4.59%)
8. Suggest	(3.98%)	8. Clear	(2.89%)
9. Estimate	(3.79%)	9. True	(2.72%)
10. Should	(3.72%)	10. Indeed	(1.70%)

Table 5. The Ranked Frequency of Most common Hedges and Boosters per 1000 Words in Scientific Magazines

Hedges	Percentage	Boosters	Percentage
1. Could	(19.77%)	1. Found	(21.73%)
2. Would	(8.31%)	2. Shows	(19.20%)
3. Around	(7.96%)	3. Show	(6.52%)
4. May	(7.87%)	4. Actually	(5.07%)
5. Likely	(7.17%)	5. Thought	(3.98%)
6. About	(6.12%)	6. Think	(3.80%)
7. Might	(5.24%)	7. Find	(3.62%)
8. Should	(4.11%)	8. Sure	(3.44%)
9. Maybe	(3.93%)	9. Finds	(3.26%)
10. Almost	(2.36%)	10. Showed	(3.07%)

Table 6. The Ranked Frequency of Most Common Hedges and Boosters per 1000 Words in Scientific Newspapers

Hedges	Percentage	Boosters	Percentage
1. Could	(22.17%)	1. Found	(42.36%)
2. Would	(12.57%)	2. Shows	(10.09%)
3. About	(11.40%)	3. Show	(6.65%)
4. Around	(9.14%)	4. Showed	(6.40%)
5. Likely	(6.24%)	5. Shown	(5.66%)
6. May	(4.79%)	6. Thought	(4.67%)
7. Almost	(4.25%)	7. Find/Must	(3.44%)
8. Estimated	(2.80%)	8. Clear	(3.20%)
9. Should	(2.17%)	9. Believe	(2.95%)
10. Suggests	(2.08%)	10. Actually	(1.47%)

Conclusion

The major finding of the present research was that all scientific texts, regardless of the generic category they belonged to and the reader community they addressed, tended to open up the possibilities of alternative voices rather than narrowing them down. The relatively higher frequency of occurrence of hedges in comparison with boosters indicates that regardless of whether the audience is expert or non-expert, their voices are seen as respected in the scientific texts. Similarly, boosters as means of narrowing down the alternative positions and developing a strong and certain authorial voices are equally disfavored in both expert and popularized scientific texts. Despite this similar pattern of the use of hedges and boosters in the investigated corpora, the means to achieve the mentioned objectives slightly differed and the informal style of language use dominating popular genres influenced the textual realizations of such functions. The findings of the present research can be taken seriously due to the large number of samples included in the corpora. However, more dependable conclusions on the (similar and/or different) use of interpersonal features in various scientific texts require including in the analytic framework more metadiscourse features from different categories (e.g. interactive features, stance features, engagement features).

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Appendices

Appendix 1

The following are some of the journal articles used:

Cardoso, S., & Cartwright, J. (2016). Increased methane emissions from deep osmotic and buoyant convection beneath submarine seeps as climate warms. *Nature Communications*. Online publication. doi:10.1038/ncomms13266.

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The following are some of the newspaper articles used:

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Appendix 2

Metadiscourse items investigated (Hyland, 2005, p. 218)

Hedges	Fairly	On the whole	Suspects
About	Feel	Ought	Tend to
Almost	Feels	Perhaps	Tended to
Apparent	Felt	Plausible	Tends to
Apparently	Frequently	Plausibly	To my knowledge
Appear	From my perspective	Possible	Typical
Appeared	From our perspective	Possibly	Typically
Appears	From this perspective	Postulate	Uncertain
Approximately	Generally	Postulated	Uncertainly
Argue	Guess	Postulates	Unclear
Argued	Indicate	Presumable	Unclearly
Argues	Indicated	Presumably	Unlikely
Around	Indicates	Probable	Usually
Assume	In general	Probably	Would
Assumed	In most cases	Quite	Wouldn't
Broadly	In most instances	Rather x	
Certain amount	In my opinion	Relatively	
Certain extent	In my view	Roughly	
Certain level	In this view	Seems	
Claim	In our opinion	Should	
Claimed	In our view	Sometimes	
Claims	Largely	Somewhat	
Could	Likely	Suggest	
Couldn't	Mainly	Suggested	
Doubt	May	Suggests	
Doubtful	Maybe	Suppose	
Essentially	Might	Supposed	
Estimate	Mostly	Supposes	
Estimated	Often	Suspect	
Boosters	Incontrovertibly	Undeniable	
Actually	Indeed	Undeniably	
Always	Indisputable	Undisputedly	
Believe	Indisputably	Undoubtedly	
Believed	Know	Without doubt	

Believes	Known
Beyond doubt	Must
Certain	Never
Certainly	No doubt
Clear	Obvious
Clearly	Obviously
Conclusively	Of course
Decidedly	Prove
Definite	Proved
Definitely	Proves
Demonstrate	Realize
Demonstrated	Realized
Demonstrates	Realizes
Doubtless	Really
Establish	Show
Established	Showed
Evident	Shown
Evidently	Shows
Find	Sure
Finds	Surely
Found	Think
In fact	Thinks
Incontestable	Thought
Incontestably	Truly
Incontrovertible	True

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