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Popularization of Scientific Discourses and Penetration of Informal Elements

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Abstract

By the force of our social constructivist gyrations, we have developed glimpses of a social, cultural, and historical dimension in which the discourse of science operates. These glimpses indicate to us how much the discourse of science is part of complex webs of human's social interaction. Recognizing this social, cultural, and historical nature, the present paper looks 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 present article shows 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. Providing a deeper sociolinguistic explanation on the observed variations, the paper is concluded with some implications of the findings for ESP pedagogy.

Keywords: Informal Elements, Popularization, Science, Scientific Discourse, Social Interaction

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Introduction

In the 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 as an interactive endeavor is now well-established (see, for instance, Duszak, 1994; Hunston, 1994; Hoey, 1988, 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 such 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; and
- an interactional act.

In fact, in the 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 to us how much the discourse of science is part of complex webs of human's social interaction. Research form the social construction of knowledge has clearly shown to 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):

- 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; and
- 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 implies that scientific communication does not operate in a vacuum and its qualities are constantly shaped and reshaped by the qualities of other discourses. Recent research on the discursive qualities of scientific discourse has revealed some of the ways non-scientific discourses have penetrated into scientific/academic discourse. 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 Author (in press), a detailed framework of such discourses including penetration of instructional/pedagogical discourse (see, for instance, Hanrahan, 2010) has been outlined, and it has 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), penetration of commodification discourse (see, for instance, Fairclough, 1992a, 1992b, 2002; Kuhi, 2014; Yakhontova, 2002), etc.

Heterogeneity and popularization of science

One specific area of the influence of non-scientific discourses has been elaborated upon in Kuhi (2017) 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 plays 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. These will be dealt with in the following.

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 (2009) 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, and 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, and 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, and 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 researcher compares 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. In 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 our

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.

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 from 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 Julia 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, and 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.

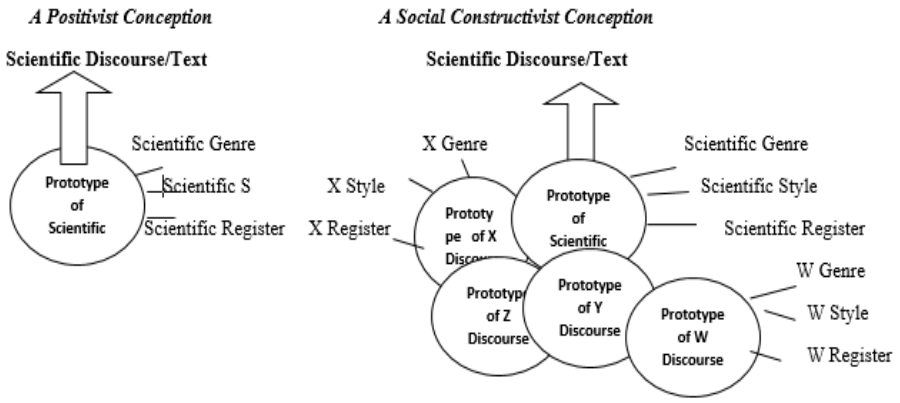

Fig. 1. An Intertextual Representation of the Hybrid Nature of the Discourse of Science

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 (as cited in Hyland, 2006, p.56) 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. Thorough 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. Barthes (1970) 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 informality

Informality has generally been contrasted to what is seen to constitute formality. In other words, the very concept of informality presupposes the existence of formality and a recognized, distinguished set of conventions and practices. A short glance at the existing literature indicates that informality has normally been treated as deviation from a set of norms and conventions. This approach is clear in definitions like the ones suggested by Cobuild dictionary: formal speech is one which is "very correct and serious rather than relaxed and friendly". The theory of pragmatics, similarly, defines formality as something associated with 'negative politeness' and the use of distancing behavior to respect the others' face and their wish not to be imposed on (Brown & Levinson, 1978). A large number of definitions also link informality to the features found in spoken language (see for instance *Longman Dictionary of Applied Linguistics*) and sees its use in writing as a deviation from the standards of written communication.

However, in the light of what we discussed in the previous sections, this concept of deviation (from norms, conventions, etc.) should be replaced by a more discursive characterization of the term, a characterization which recognizes the sociocultural origins and processes of this textual practice. Halliday's (1985) approach provides such a framework; in Halliday's systemic functional approach, the question of formality relates to tenor, or the grammatical choices that enable speakers/writers to enact their complex and diverse interpersonal relations by selecting language options which project an appropriate persona and a suitable connection with readers.

In their influential work on informality in academic writing, Hyland and Jiang (2017) follow a Hallidayan approach when they relate informality in academic writing to the expression of a more personal tenor which implies a more intimate relationship to readers, a willingness to negotiate claims and a positive attitude towards subjectivity. In this approach, informality is not seen as a reluctance to attend to norms and conventions; it is not seen as an inappropriate colloquial use of language. It is instead seen as a discursive adjustment to the sociocultural demands of academic/scientific communication. This is how we have approached informality in the current research.

Of course, approaching the issue from a pedagogical perspective, what we have called the discursive adjustment of academic/scientific discourses to the sociocultural demands of scientific/academic communication should be approached

with some caution. Chang and Swales (1999) and Hyland and Jiang (2017), as two influential works on informal aspects of academic writing, have dealt with the pedagogical challenges of the issue in detail. On several occasions throughout their project, Chang and Swales asked L2 graduate student informants whether the informal features identified in academic texts made academic writing easier or more difficult. A clear majority of the respondents were concerned about this greater flexibility that greater informality could offer. Some respondents believed that penetration of greater informality makes academic English more complicated. Some also said that learning the conventions of formal academic English was already a challenging task and that it should not be made more complicated by mixing formal and informal elements together.

These challenges have not escaped the attention of Hyland and Jiang (2017) who are similarly concerned with the potential difficulties this rhetorical change can create for students and novice writers, particularly in ESL context. They argue that further informality in academic writing can create additional complexities in the relationships the writer is seeking to build with readers and further increases the compositional burden of novice writers.

Hence, it seems that whatever we have characterized as the inevitable realization of discursive changes in the process of academic/scientific communication is not that much easily welcomed practice. This is due to the fact that we are accustomed to dealing with clear-cut conventions and norms in pedagogy and the chaotic picture offered by the hybridization of the discourse of science would naturally create unease and concern among those teaching and learning the conventions of communication in academic/scientific English.

The present study

The urgency of informing the lay audience of the most newsworthy findings of science has dramatically increased in recent years. What interests analysts about this is that academic papers written for specialists and popularized accounts of this research differ in their purposes and audiences, and so in their use of language. Research articles are central to scientific knowledge constructed through the negotiation of claims with reviewers, editors, and readers, while texts produced for the general public attempt to link issues in the specialist domains to those of everyday life. One way the use of language might vary across these different texts produced for different audiences is in terms of the use of informal elements.

In the light of this assumption and also based on the insights we have received from the theoretical perspective outlined above, we developed a corpus based on a continuum of scientific texts ranging from less popular to more popular. This corpus consisted of three sub-corpora: articles published in scientific journals, articles published in magazines and articles published in newspapers. The hypothesis guiding the design of the mentioned corpus was that the more popular a scientific text is, the more informal elements are likely to penetrate into it. Hence, the three sub-corpora were compared in terms of the frequency of occurrence of informal elements.

Methods

Corpus

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 the Appendix.

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

Model of analysis

Developing a dependable and valid model of analysis including what counts as a textual index of informality is an extremely challenging task (Hyland & Jiang, 2017 provide an insightful account of such challenges). The model developed by Chang and Swales (1999) is one of the rare systematic ones found in the previous literature. The researchers point out that they have developed the list of ten most frequently mentioned informal features on the basis of a survey covering writing manuals and guidebooks published from the 1960s to the 1990s. They also mention that in this survey they put aside rules which were more trivial and focused on more general rules which represent certain broad grammatical patterns or regulate specific groups of lexical items. Of course, they mention that they have found disagreement over the usage of several of these items among the authors of manuals and guidebooks, which, in our view, should not be treated as something surprising. Table 2 provides the list developed by Chang and Swales.

Table 2. A List of Informal Elements (Based on Chang and Swales 1999)

First person pronouns	I, my, me, mine We, ours, our, us (refer to the author(s))
Broad reference	Which, this, that, those, it
Split infinitive	to+ adverb+ verb
Forbidden first word	However, and, but, so, or, it
Final preposition	
Run-on	no conjunction + so on, so forth, e.g., etc.
Sentence fragments	Miss an essential element (subject, verb, object)
Contractions	Such as I'm → I am
Direct questions	
Exclamations	!

Results and Discussion

Table 3 and Table 4 represent the frequency-based findings of the analysis of the three corpora in terms of the informal elements. Based on the theoretical justification we outlined in the introduction to this paper, it is not surprising that all three scientific genres under investigation, regardless of differences their audience and variations in their communicative purposes, are vulnerable to the penetration of informal elements. Informal elements constitute 20.50 per 1000 words of the journal articles, 30.84 per 1000 words of magazine articles and 16.33 per 1000 words of the newspaper articles. This clearly suggests that informality has already become an integral quality of all scientific discourses; even the very fact that a scientific text addresses an expert community does not secure that text from the frequent occurrence of informal elements.

Table 3. Total Number of Specific Grammatical Features per 1000 Words

	Raw Number of Features	Number of words	Frequency per 1000 Words
Journal	3,192	155,668	20.50
Magazine	3,061	99,230	30.84
Newspaper	1,662	101,727	16.33

Table 4. Frequency of Occurrence of Informal Elements in the Three Corpora

	Journal		Magazine		Newspaper	
Grammatical Features	Raw Frequency	Frequency per 1000 Words	Raw Frequency	Frequency per 1000 Words	Raw Frequency	Frequency per 1000 Words
I and We	1,199	7.70	161	1.62	0	0
Broad Reference	1,786	11.47	1,839	18.53	1,283	12.61
Split Infinitive	1	0.006	0	0	0	0
Forbidden First Word	205	1.31	544	5.48	291	2.86
Final Preposition	0	0	2	0.02	0	0
Run-on	1	0.006	2	0.02	0	0
Sentence Fragments	0	0	0	0	0	0
Contractions	0	0	462	4.66	75	0.73
Direct Question	0	0	47	0.47	13	0.13
Exclamations	0	0	4	0.04	0	0
Total	3,192	20.50	3,061	30.84	1,662	16.33

Of course, this general trend does not necessarily mean that the selected features were used consistently across the three corpora. A close analysis of the individual features revealed very interesting patterns of frequency: broad references were the most frequent informal feature in the corpora and appeared in all three corpora; of course, among the three corpora, magazine articles authors used this feature more frequently than did the authors of other two corpora; forbidden first words also appeared in all three corpora; self-mentions did not occur in newspaper articles while they occurred in magazine articles and were very frequent in journal articles (7.70 per 1000 words); 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; only 4 magazine article authors used exclamations in their texts; only one journal article author used a split infinitive; run-on sentences were not found in newspaper articles while 1 journal article author and 2 magazine article authors used it; final prepositions occurred twice in the corpus only in newspaper articles; no instance of sentence fragment was observed in the three corpora. Of course, it should be mentioned that these findings are somehow in line with the overall generic qualities of the three genre. Features

like direct questions, contractions exclamations naturally belong to those scientific genres which 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.

However, it should be acknowledged that when we consider the overall frequencies something runs against our original hypothesis – that the more popular a genre becomes, the more frequent informal elements are likely to occur. Much of this is due to the frequent use of self-mention in journal articles; without that property, the general trend was more likely to confirm our original hypothesis. The more frequent use of this property in journal articles has to do with the more competitive and more commodified nature of journal articles in modern academy (see Fairclough, 1992a, 1992b; Kuhi, 2014). Here, self-mention is favored by journal article authors to create a symbolic capital which is seen as a pre-requisite for the development of economic capital (see Bourdieu, 1998; Harwood, 2005a, 2005b; Putnam, 2009; Whitley, 2000) – 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.

Still another explanation that can be provided for less frequent use of informal features in journal articles (except self-mention) is one suggested by Hyland and Jiang (2017): research articles are carefully refined and polished in the strict process of being reviewed and edited they undergo before being finalized for publication. Magazine articles and journal articles may not be subject to a similar system of stylistic monitoring and that might be one reason why informal features are relatively more frequent in them.

To conclude, we need to highlight our position towards a significant issue which may arise as the potential implication of this study. The question is how the very discursive phenomenon of informality should be approached in scientific writing. How should we deal with the potential difficulties this rhetorical variation creates for students and novice writers, particularly those writing in a second or foreign language?

In the review of literature of this paper, we outlined a number of issues raised by Chang and Swales (1999) and Hyland and Jiang (2017) regarding the feeling of unease which further informality can create among particularly novice academic/scientific writers. We have noticed how novice writers might suffer from the uncertain and chaotic picture of the discourse of science created by greater informality (or other manifestations of the hybridization of the discourse of science).

The participants of Chang and Swales' project are completely right that we already have a great number of challenges in learning the conventions of academic communication in English. This hybridization seems to be destroying the established conventions without suggesting a clear-cut framework that teachers and learners are used to.

However, we think in line with Hyland and Jiang (2017) that these academic/scientific discourses are not merely storehouse of arcane, abstract, practices, monolithic and forever frozen in time; what this means is that academic/scientific discourses have to be responsive to changing contexts and the demands of new conditions (this is what we have been trying to say in this paper). These changes are taking place and both expert and novice members of academic/scientific discourse communities should be able to adopt their rhetorical practices to them.

While not necessarily ignoring the concerns of novice academic authors, we suggest that English for academic/scientific purposes should aim at developing an understanding (among, for instance, the practitioners, learners, and writers) of how communicative behavior should be adjusted to unpredictable sociocultural variables. We indicated above that the penetration of such variables to the discourse of science is an inevitable fact beyond the control of those communicating in scientific sphere. Hence, students attending scientific writing programs should be familiarized with the heterogeneous and hybrid nature of scientific discourses and be equipped with the communicative capacity to manage such heterogeneity. A hybridity-sensitive ESP pedagogy should actively engage the novice members of scientific discourse community in recognizing *intertextual/interdiscursive signals*. These are genre, style, and register-relate properties of scientific discourse/text which trigger the process of intertextual/interdiscursive search, setting in motion the act of semiotic processing. Having identified these intertextual/interdiscursive signals, novice members of scientific discourse communities would embark on the more crucial exercise of charting the various routes through which a given signal links up with its pretext (the prototype which has become hybrid with scientific prototype), or, as these routes are two-way systems, a given pre-text links up with its signal. These pretexts (or prototypes) are the sources from which intertextual/interdiscursive signals are drawn, to which they refer, or by which they are inspired. The departure point of this analytic journey can be three major properties of scientific discourse - genre, style, and register. Each level can incorporate a cyclic awareness-raising structure which begins with exposure tasks, continues with analysis tasks, and ends in production tasks (a very practical instance of this approach to awareness-raising can be found in Weissberg & Buker, 1990). The following tasks would be helpful in engaging the learners in recognition of what we have called intertextual/interdiscursive signals:

a. Genre-related tasks
   - engage the learners in analyzing the cognitive organization/schematic structure/move structure/same scientific genres, or rhetorical sections of the same genres produced in different cultures; these types of analyses can

focus upon the sequencing, frequency of occurrence, distribution, and formal properties used for performing a specific functional act;
- engage the learners in analyzing the cognitive organization/schematic structure/move structure of different scientific genres or rhetorical sections of those genres produced for different purposes and different audiences; these types of analyses can focus upon the sequencing, frequency of occurrence, distribution, and formal properties used for performing a specific functional act;
- engage the learners in analyzing the cognitive organization/schematic structure/move structure/same scientific genres, or rhetorical sections of the same genres produced in different disciplines; these types of analyses can focus upon the sequencing, frequency of occurrence, distribution, and formal properties used for performing a specific functional act;

b. Style-related tasks
- engage the learners in analyzing different degrees of formality in different scientific genres with different purposes and different audiences;
- engage the learners in analyzing different degrees of formality in similar genres produced in different cultures and different disciplines; and

c. Register-related tasks
- engage the learners in analyzing the syntactic and lexical properties of different scientific genres with different purposes and different audiences;
- engage the learners in analyzing the syntactic and lexical properties of similar scientific genres produced in different cultures and different disciplines.

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