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Editorial

Discourse Perspectives of Science Divulgation/Popularization/ *Perspectivas discursivas da divulgação/popularização da ciência*

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Ancient science was practiced as a solitary, secret activity;
classical science became a public, academic activity;
Finally, contemporary science is practiced as a profession.
Each system renews the division between science
and opinion and legitimizes it in its own way.
Bernadette Bensaude-Vincent

The word paves the way for science.
Alexander Potebnya

Throughout history, science has established various relationships with the public sphere, which has determined not only society's general understanding of the world, but also the defining practices and goals of scientific activity, and the dynamic and interdependent dialogue between science and society. In contemporary times, the relationship between the knowledge produced by current science and the general public is also understood and created from different ideological, cultural, and discursive perspectives, especially in the dissemination/popularization of science. Language, either verbal or non-verbal, is a dimension that permeates all science dissemination activities and places itself at a privileged position from which science popularization is studied, described, and analyzed.

For the Russian linguist Alexander Potebnya (2010 [1892)], in the relationship between thought and language, the word allows the deconstruction of thought, its

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awareness, and its tendency to be integrated into a system, which are functions that facilitate the development of conceptual and scientific knowledge.

The discursive phenomenon of science popularization has been conceptualized in a number of ways from different theoretical perspectives. This volume includes papers that were submitted, assessed, and selected based on five definitions of science popularization: as a translation or reformulation of scientific discourse – this is the predominant approach within language studies; as a discursive genre; as a recontextualizing activity; as a construction dependent on the processes involved in media staging; and as a particular modality of dialogic relationship.

Coming from different theoretical perspectives, a first set of studies conceives science popularization as a practical reformulation or a translation of scientific discourse into a second discourse. The pioneering work of Authier-Revuz (1998 [1982]), from a discourse perspective, is a reference for the study of science popularization. In this case, science popularization is conceived as a reworking practice or a "translation operation" of scientific discourse into an equivalent second discourse, whose result is a text made up of three main aspects. The first one is a comprehensive framework of the discourse being reported, in which a double enunciation structure works and reveals itself: on the one hand, the interlocutors and the enunciation framework of the scientific discourse, and, on the other, the interlocutors and the enunciation framework of the scientific popularization. The second aspect is the recurring transfers from one discourse to another through the juxtaposition of scientific terms and their "translation" into everyday terms. This juxtaposition valorizes the scientific discourse, which is presented as accurate, rational, and erudite, while the everyday discourse is constructed as uncertain and approximate. The final aspect is the overt presence of metalinguistic signs that indicate distance in relation to a word – especially the use of italics and quotation marks – shown either in scientific or everyday terms. Both, however, are represented as foreign to the discourse of the writer. The result of these operations is an explicit and intentionally heterogeneous discourse that joins the disconnected dialogue between the scientific community and the public sphere. Here, Authier-Revuz makes use of the terms "heteroglossia" and "dialogism" from the Bakhtin Circle to conclude that science popularization is characterized by the display of the mediation-communication of dialogue between two languages – or bilingualism – corresponding to two discourses: the scientific and the

everyday discourses. According to the author, however, this dialogue does not address science through historical and social processes of knowledge production. Instead, it reinforces the universal and absolute image of scientific work. It can be seen that the description of these aspects does not favor the inclusion of science popularization in a particular sphere or field, but it situates the texts originally analyzed within the French media sphere.

The first article of this volume, Modalização autonímica na divulgação científica [Autonymic Modalization in Science Popularization] by Suelen Martins, Juliana Santos Botelho and Jeronimo Coura Sobrinho, is certainly based on this perspective. The authors study the use of autonymic modalization as a vector of discursive heterogeneity in science popularization texts. In addition, they set out to evaluate to what extent this feature appears in the texts from *Folha de S. Paulo* website and from international news agencies. After the discursive analysis of texts published in the sessions *Equilíbio & Saúde* [Balance & Health] and *Ciência* [Science], the authors found that autonymic modalization is employed in equal proportion in the texts of *Folha de S. Paulo Online* and of news agencies, which suggests to them a leveling of scientific information capable of erasing local and global differences in news production modes.

In the context of a larger project focused on knowledge transmission processes in a variety of genres, Sophie Moirand (2000) seeks to understand the presence of didactic procedures, i.e., the intention of making the other more competent, in media texts that use scientific concepts and data. Moirand considers science popularization similarly to Authier-Revuz: "and if the activity of reformulating comes with constitutive evidence of any second discourse, it is the display of this heterogeneity that is itself typical of the encounter between science and the media" (2000, p.11; our translation).[1] The findings of her analysis of journalistic texts question their intention of making the reader more competent and of disseminating an image of the media in line with advances in science. For Moirand (2000), the fact that the newspapers are composed by text-commodities and that they are subject to the time and space constraints of the media, leaves little room for explanation or even scientific reasoning. Thus, science is barely revealed, and communication is characterized more for its production of information than for its

[1] Text in Portuguese: "e se a atividade de reformulação é com evidência constitutiva de qualquer discurso segundo, é a exibição dessa heterogeneidade que se mostra característica desse encontro das ciências com a mídia."

transmission of knowledge.[2] However, unlike Authier-Revuz, Moirand delimits the scope of her findings once she locates her analysis of science popularization within a particular sphere, that of the media, and in one of its vehicles, the newspaper.

In this issue, Sophie Moirand, Sandrine Reboul, and Michele Pordeus Ribeiro, in the article La vulgarisation scientifique au croisement de nouvelles sphères d'activité langagière [Science Popularization at the Crossing New Language Activity Spheres], follow this discursive perspective. They engage with the field of science popularization through the different spheres of language activity within which they intersect. The authors' starting point is the classic and linear model of science communication. From there, they present the displacement of the conventional media, which enabled the dialogue between different language communities (politicians, consumer associations, farmers, researchers, etc.), especially in scientific events. Finally, they indicate new forms of participation and enunciation brought with new technologies offered by the Internet.

It is important to remember that in a similar vein to Authier-Revuz, but from the theoretical perspective of the Anglo-Saxon[3] discourse analysis, Cataldi (2007) considers scientific popularization as "a continuous process of reformulation" that aims to democratize scientific knowledge to the general public. However, based on Cassany (2001), Cataldi proposes that the disseminating task consists of "recontextualizing scientific knowledge for each audience." This implies selecting, rearranging, and reformulating the scientific information to readers. Drawing on Ciapuscio, Cassany, López and Martí (2000), Cataldi specifies three discursive procedures which characterize print media's popularization practice and are not included in Authier-Revuz's proposal: expansion, reduction, and variation. The *expansion* procedure comprises the inclusion of information that is not present in the scientific text in order to "provide the conceptual meanings needed to meet the effective cognitive and communicative participation of the reader" (CATALDI, 2007, p.161; our translation).[4] The discursive procedure of *reduction*

[2] Bensaude-Vincent (2003) argues that only in the second half of the nineteenth century does science popularization writing become producer of facts, when to disseminate the results of science regardless of the process that allowed their establishment. In this process, science communication removes and isolates scientific results by inserting them in another context.

[3] Van Dijk is one of its main exponents and proposes looking at the text as a unity of analysis: "it must be focused from its real context of production, according to its purposes and the goals of each communicative situation" ["deve ser enfocado a partir do seu contexto real de aparição, de acordo com os propósitos e as finalidades de cada situação comunicativa"] (VAN DIJK *apud* CATALDI, 2007a, p.157).

[4] Text in Portuguese: "proporcionar os significados conceituais necessários para lograr a efetiva participação cognitiva e comunicativa do leitor."

is the removal and condensing of scientific information considered irrelevant and unnecessary to the disseminated version. The discursive procedure of *variation* is composed by various changes from the source text to the published text, such as lexical selection, denominative variation, the enunciation modality, etc.

Another concept of science divulgation/popularization defines it as a discursive genre. In confronting the work of Authier-Revuz, Zamboni (2001, pp.93-94; our translation) postulates that science popularization is "a particular genre of discourse that moves science from its primary destination field and disseminates it to the lay strata of society."[5] The author positions scientific communication in the field of information transmission, in which the journalistic and the didactic discourses meet. For Zamboni, these two discourses do not coincide, but share the fact that they work the language of the final product in order to make it accessible to the recipient.

Zamboni makes four critiques of Authier-Revuz's proposal. Firstly, Zamboni disputes the high incidence of reported speech to be a specific characteristic of science communication, as Authier-Revuz would argue. Drawing on concepts from the Bakhtin Circle, Zamboni states that the enunciation of the discourse of the other is present in different genres and, therefore, is not a distinctive feature of science dissemination per se. Secondly, the scientists' reported speech does not belong to the discursive formation of science, since the information provided by newspapers originates largely from interviews in which the discourse of the scientist is already popularized due to the non-specialist audience for whom they write. Thirdly, Zamboni contends that "bilingualism," which characterizes two discourses in contact, as Authier-Revuz proposes, is present not only in science communication but in all specialist discourse, once it is transformed into an information transmission discourse. Zamboni supports this contention by showing traces of bilingualism in the fields of fashion, gastronomy, industry, and architecture. Finally, Authier-Revuz's analysis privileges the enunciation of the "other" in the discourse of the "I." In turn, Zamboni prefers to look at heterogeneity, such as the "effective realization of the subject," which works on the relative uncertainty of the linguistic system.

Zamboni's arguments open up a new perspective to the understanding and interpretation of the phenomenon of scientific popularization in the journalistic sphere,

[5] Text in Portuguese: "um gênero particular de discurso, que desloca a ciência de seu campo de destinação precípuo e a difunde para os estratos leigos da sociedade."

especially when she emphasizes the status of the scientists' statements to the media, already popularized, and the identification of terminological bilingualism as specific not only to scientific discourse, but to all specialist discourse.

Drawing on Critical Genre Analysis (MOTTA-ROTH; HEBERLE, 2015), a theoretical framework originally proposed by the Brazilian applied linguist José Luiz Meurer (2002), Motta-Roth focuses on a specific discursive genre, the journalistic news, as part of the activities or practices of science popularization (MOTTA-ROTH; SCHERER, 2012). In this issue, the author analyzes the role of the linguistic materiality of this discursive genre in the construction of the science popularization social activities. Her work focuses on indices of ideational content (on what is said), rhetoric organization (compositional connections with specific functions), and the identity and interpersonal dimension of language (style). From this perspective, the genre is a typical rhetorical action in response to recurring contextual variables. Similarly, the popular science news article is configured as a dynamic response to recurring conditions of scientific journalism; a use of semiotic resources to publicize scientific advances to society; and a discursive event of identity construction of the target audience. The aim of the authors is to describe the linguistic elements, explain the discursive function, and perform a semantic-discursive interpretation of these exponents. From this theoretical and methodological perspective, the popularization of science is a social activity, process, or practice of recontextualization of science's discourse into texts addressed to non-specialist readers. These texts are produced in different genres to promote the communication of scientific knowledge, which is an important element of the culture of any human being today. The analysis of the linguistic-discursive strategies of science popularization Internet news articles in English and Portuguese identifies three discourses, each formed by a system of genres, which are recontextualized in the process of popularizing science in the media: the scientific discourse, which shares the knowledge generated by science through genres such as books, theses, articles, etc., with society; the media discourse, which transmits this knowledge through news reports, article, etc.; and the education discourse, which explains the knowledge of science, bringing it closer to everyday life in different educational genres of science popularization, such as the textbook, for instance. The analysis of intertextuality between these three discourses shows that the recontexualizaion of science in science popularization news is

characterized by the predominance of "dialogic contraction" or the "monologism effect," which results in the dominance and exploitation of the scientific discourse to the detriment of the media and the educational discourses.

The article Popularização da ciência: a interdiscursividade entre ciência, pedagogia e jornalismo [Science Popularization: Interdiscursivity between Science, Education and Journalism], by Désirée Motta-Roth and Anelise Scotti Scherer, shows that scientific discourse produced by and for experts appears is the media's public sphere through the popularization of science, passing through shifts in time, in social space and in discourse. For the authors, this hybridization between science and journalism generates a discourse of science journalism that seeks to reveal the unknown or make the hermetical understandable, as a pedagogical act. They consider this process as a discourse recontextualization from the scientific into the journalistic sphere, mediated by a pedagogical discourse. Motta-Roth and Scherer argue that science popularization news and scientific articles are part of the same genre system that makes the discourse of science public.

Guided by principles and concepts from the Tartu-Moscow School's semiotics of culture, Machado (2011, p.39) rejects the idea of science popularization as vulgarization, literacy or formation of the scientific culture in order to understand it as the process of translation of scientific information:

> vulgarization implies working with different levels of semiotic systems that involve all those who perform experiments and translate them into cultural texts. According to the modeling of cultural languages and culture texts, the work of the communicator, whether a scientist or a journalist, is always one of metalanguage resulting from different processes of translation (2011, p.153; our translation).[6]

Despite the different theoretical framework, Machado's formulation approaches Authier-Revuz, Moirand and Cataldi's propositions in the sense that science popularization is a practice of reworking or a translation operation. However, Machado distances herself from these authors once she includes visual and graphic language or

[6] Text in Portuguese: "a vulgarização implica o trabalho com níveis de diferentes sistemas semióticos a envolver todos aqueles que realizam as experiências e as traduzem em texto de cultura. Segundo a modelização das linguagens culturais e dos textos de cultura o trabalho do comunicador, seja ele o cientista ou o jornalista, é sempre de metalinguagem resultante dos diferentes processos tradutórios."

continuous signs as part of the work of the communicator. This idea leads Machado to claim that it is "only a manifestation of the work of communication: from the reformulation of the scientific article into a journalistic text: news article, news report, essay" (p.161).[7] In her article A argumentação gráfica na prosa [Graphic Argumentation in Prose], Irene Machado explores the concept of graphic argumentation as an essayistic exercise of prose, which has developed with the expansion of writing in printed texts. Through the study of this concept in articles from Pesquisa FAPESP [Sao Paulo Research Foundation] journal, Machado shows that they have become an indispensable modeling of science communication texts. Machado believes that by extending the scope of the word in the context of visual graphic processes such as drawings, photography, and infographics, the arguments become much more the realization of diagrammatic reasoning than of rhetorical formulations.

A fourth position on the popularization of science, developed by Charaudeau (2008) and taken up by Giering, uses the semiolinguistic model of communication contract. It contends that science popularization discourse depends on the conditions of the communication situation in which it operates. Once in the media, it would not be a translation, but a construction dependent on media staging processes.

The focus of the next article, O discurso promocional em artigos de divulgação científica midiática para jovens leitores [The Promotional Discourse in Media Science Popularization Articles for Young Readers], is science popularization aimed at children in *Ciência Hoje* [Science Today] magazine. Maria Eduarda Giering examines the communication and discursive features of articles that aim to incite a reaction, and notes the presence of narrative and argumentative patterns employed as strategies to convince the reader to act upon what is communicated. Giering notes that, through the popularization of science in the media, the writer seeks to provoke the reader's actions that promote social or individual well-being. Thus, science knowledge is valued and a relationship between science and social life is established. For Giering, the presence of promotional discourse is related to the Contextual Model of public scientific communication.

[7] Text in Portuguese: "apenas, de realizar o trabalho de comunicação a partir da reformulação do artigo científico em texto jornalístico: notícia, reportagem, ensaio."

In the same vein, the article Infográfico: modos de ver e ler ciência na mídia [Infographic: Ways of Seeing and Reading Science in the Media] by Juliana Alles Camargo de Souza shows that verbal and plastic (eidetic, chromatic, topological) resources potentialize science information in this discursive genre. By studying the multissemiotic configuration of the infographic, which uses descriptive-explanatory and argumentative procedures, Camargo notes that the infographic in science popularization performs a demonstrative and argumentative action, divulges facts and scientific phenomena, and integrates actions of formal and informal scientific literacy.

Finally, there is the position held by Sheila Grillo (2013), from the perspective of Bakhtin's metalinguistics. Grillo develops the argument that science popularization is a particular modality of the dialogic relationship – understood in Bakhtin's sense as an axiological-semantic relationship – between the scientific sphere and other spheres of human activity. These include the higher levels of everyday ideology, which materialize in various genres enunciations (report, news article, editorial, book, novel, statement, etc.). In this dialogue, the author takes up the role of a competent mediator between scientific knowledge and the consideration of the "perceptible ground of responsive understanding" of his or her interlocutor, which consists of what the writer assumes that he or she dominates and, most importantly, does not dominate. It is not, therefore, either a genre or a sphere, but dialogical relations between the scientific sphere and other spheres of human activity or culture. Hence, science communication distinguishes itself due to the externalization of science and technology from its sphere of production, thus creating a scientific culture in the recipient. In other words, its common defining feature lies in what will be called the externalization of science in instances of circulation and reception. In this process of externalization, scientific and technological knowledge enters dialogic relations with other spheres, especially with everyday ideology, but also the artistic, political, and religious spheres. These relationships are not restricted to a terminological aspect, such as the translation of scientific terms into everyday terms and the co-presence of both in the text, but they put different spheres of knowledge production into contact, which are comprised of their own evaluative centers, by their genres, by their images, by their chronotopes. Not only does this contact increase the knowledge state of the recipient, but it also subjects the scientific and technological knowledge to an active critical assessment.

Three articles address science dissemination from this perspective. The first one is Luiz Rosalvo Costa's Ideologia e divulgação científica: uma análise bakhtiniana do discurso da revista *Ciência Hoje* [Ideology and Science Popularization: A Bakhtinian Discourse Analysis of *Ciência Hoje* Magazine]. From his research corpus, which is the science communication discourse of *Ciência Hoje* [Science Today] magazine, Costa explores the relationship between discourse and ideology, based on the theoretical propositions of the Bakhtin Circle. Costa starts from the hypothesis that concrete utterance is the privileged locus of ideology constitution. In his analysis, Costa focuses on two editorials from *Ciência Hoje* [Science Today] (one of each from the 1980s and the 1990s), and seeks to show how ideological clashes in contemporary society are manifested in its architecture.

Sheila Vieira de Camargo Grillo and Maria Glushkova are the authors of A divulgação científica no Brasil e na Rússia: um ensaio de análise comparativa de discursos [Science Popularization in Brazil and Russia: A Comparative Discourse Analysis Essay]. They aims to provide a comparative analysis of science divulgation in the two countries. In order to establish this comparison, the authors turn to the theoretical and methodological foundations at the confluence between Bakhtin's theory and comparative analysis of discourses. By examining a corpus of utterances from the Russian and Brazilian editions of the Scientific American magazine, the authors note, on the one hand, large similarities in the news articles and news reports genres of science popularization in both ethno-linguistic communities, and on the other, differences regarding the relationship with the discourse of the other and the use of verbal tenses and modes.

In the same vein, the article A divulgação científica e o enunciado digital [Science Communication and Digital Enunciation], by Flávia Silvia Machado, seeks to interpret the specificities and constitutive factors of the digital utterance of science communication, from the theoretical perspective of Bakhtin and his Circle. Machado draws attention to the fact that in addition to verbal and verbal-visual aspects of science communication in various printed genres, her object of analysis is formed by/in the complexity of the digital medium. Machado aims to reflect on the hypertextual dialogical relations, finalization, and alternation of the utterance, as well as on the conditions of production and reception of digital enunciation of science communication.

In general, the approaches listed here converge towards a social perspective of science divulgation/popularization discourse, which emphasizes the importance of characterizing the social context for the study of non-specialized science communication. Nevertheless, faced with the same empirical object, they construct distinct theoretical objects, seeking to reveal different facets of science divulgation/popularization. In this *Bakhtiniana* issue, we intend to provide a sample of the science we value: instead of consensus, we seek debate, controversy, disagreement, and a plurality of viewpoints. The articles herein express this plurality as a way of scientific thinking about language. They are different perspectives on the discourse of science divulgation/popularization, providing knowledge and reflections that aim to contribute to the discussion about what is at stake, from the point of view of the discourse, and in the act of making science accessible to non-specialized audiences.

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