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Discussing the Nature of Scientific Divulgation Based on the Concept of Ideology[+*]

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Abstract

Within the production process of scientific communication material, several messages are transmitted implicitly, such as "what it is to do science" and that this activity takes place in a "neutral" fashion. However, when we analyze this process more deeply, we realize that scientific communication is much more than a "simplification" of scientific knowledge: it configures a new discourse, produced in a certain historical and cultural period by agents inserted into this context. That said, the aim of this article will be to understand the nature of science communication and connect it to the concept of ideology, using a historical materialist approach. From this perspective, we perceive the potential of such material, whether to support a hegemonic ideology, or to develop utopias from new perspectives and new ways of living.

Keywords: *Science Communication; Ideology.*

I. Introduction

Currently, we can observe an expansion in content creators on the internet who aim to disseminate scientific content, a trend that has intensified since the onset of the COVID-19 pandemic. Due to the initial uncertainties surrounding the new disease and the proliferation of fake news, scientists and the press found themselves compelled to report daily on the progress

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of science. This has demonstrated to the public that the path forward is not always linear, and that supposed advancements can be refuted in the future, compelling scientists to explore new perspectives and investigate alternative solutions to the problems under study.

With the popularization of science and, more importantly, with increased access to the internet, the growing circulation of information leads different populations to form conceptions about what science is or at the very least, in what contexts something can be labeled as scientific (Gavroglu, 2012b). The active pursuit of users on subjects that concern them stimulates different popularizers to discuss popular topics of the moment. The immediacy of the internet results in different perspectives on science being constantly conveyed, in addition to the proliferation of fake news.

> *COVID-19 has triggered a fountain of rumours — an indistinguishable mix of unverified information, helpful information, misinformation and intentionally manipulated disinformation. Between 1 January and mid-March 2020, our social-media monitoring at The Vaccine Confidence Project had captured more than 240 million digital and social-media messages globally referring to the new virus, with an average of 3.08 million messages per day. On Twitter, there have been 113 million unique authors sharing everything from messages from news reports and commentary on COVID-19, to views on quarantining measures, speculation on the source of the virus and details of home-brewed cures* (Larson, 2020)

When we delve deeper into the ideas that pervade the population's imagination about science, we perceive severe distortions when compared to the current understanding of what scientific work entails – or, as referred to by McComas (1998), we encounter different "myths of science". Among these myths, one can mention the idea that there is a general and universal scientific method, or that experiments are the primary path to scientific knowledge; that, over time, science will provide answers to all existing questions, or even that scientists are particularly objective when compared to the rest of the population.

In a recent systematic review (state of the art) paper on research into Science Communication in science education journals, Lorenzetti and colleagues (2021) point out two main gaps in research. Firstly, they emphasize the importance of what they have termed as metaphysical elements of Science Communication, that is, the need for a deeper exploration of *why* and *for whom* this communication is conducted. As we will highlight later, these questions are related to a third assertion, which is *the society for which the communication activity is conducted*, something that allows for new perspectives on the educational benefits and limits of Science Communication. The paper of Lorenzetti and colleagues also highlighted the need for research on Science Communication to seek engagement with discussions on the Nature of Science and to conduct analyses that enable communication actions to be more epistemologically qualified. In general terms, this paper aims to contribute to addressing these gaps by seeking to analyze the nature of Science Communication in the context of its social uses.

Understanding the concepts of science present in discourses about sciences also involves understanding the nature of scientific communication. As pointed out by Watanabe et al. (2020), the social space in which Science Communication takes place is situated at the intersection of the fields of Science Communication and the various scientific fields that are the subject of dissemination. Thus, one of the challenges for research in Science Communication is to comprehend the hybrid character of discourse that is formulated. There is the need to analyze how the interests and struggles of each field are reflected in concrete actions of knowledge dissemination. Some involved in the popularization of science see their role as the "transformation" of how science relates to society, altering technical terms in a way so that someone outside the scientific community can understand a specific idea. Considering the school environment and its goals, we also see that "it is the role of school to educate citizens for a critical reading of the world and, particularly, a critical reading of media coverage on science" (Cardoso; Gurgel, 2019, p.77). To achieve this, it is necessary to understand the material conditions in which scientific communication is produced and, from there, analyze it critically.

For instance, we need to understand that the quest for "simplification" of language tends to, among other things, conceal the difficulties and complexities of scientific endeavor. By considering only the presentation of the primary, mostly affirmative findings regarding a particular hypothesis, the result is the image of an alleged scientific "neutrality". Even though this in not the sole factor, this image is one of the most enduring illusions when it comes to the so-called natural sciences (Mészáros, 2004).

These illusions are more than a mere expression of a collective naivety among those outside the scientific sphere. They are employed within a perspective where the authority of science must be upheld and expanded so that, on its behalf, certain measures and actions can be recommended (Mészáros, 2004). In other words, without the idealization of the "neutrality" of science endeavor, the authority of scientific discourse would collapse. This leads us to the question: why does scientific discourse need to be "neutral" to maintain its capacity of recommending actions within our society?

To address this, we first need to consider *whether* and *how* science would have the power to influence social matters. One of the most superficial and visible layers of such influence occurs in the scientific development of products, which undeniably have the potential to directly impact social life. However, this is just the initial level of how science can alter our daily lives. Besides its products, there are various ways in which science can influence society, and we must contemplate how its development and discourse intervene in the way the population engages with it.

The questions that can be raised regarding the interplay between the production and dissemination of scientific knowledge are numerous and challenging to answer, especially when we conduct an analysis based on the historical materialist method, a perspective adopted

throughout this paper. In *The German Ideology* the book we will delve into in the third section, Marx and Engels (1998, p. 569) point out that

> *The question whether objective truth can be attributed to human thinking is not a question of theory but is a* practical *question. Man must prove the truth, i.e., the reality and power, the this-worldliness of his thinking in practice. The dispute over the reality or non-reality of thinking which is isolated from practice is a purely* scholastic *question.*

Here, we are reminded that the validity of a particular theory is established within the realm of human actions and practice. Therefore, it is not enough to merely produce theoretical knowledge; we need to share and put it into practice, moving from the subjectivity of the immaterial into the materiality of reality.

Messeder Neto and Moradillo (2020, p. 1332) further reinforce our argument: "The process of grasping reality through thought is always an approximate (though not unreal) process in which images are put to the test by the practical aspect in the historical development of humanity".

During this process, language plays a crucial role as it is precisely the link that connects these two spheres. Language is both social and individual. Just as it is a product of the practices of men and women, we use it to internally structure our understanding of the world. From there, we can return to the collective sphere when we share these intimate understandings.

Within the analysis from the perspective of language, it underpins and structures the generated discourses. "[L]anguage, in addition to serving as a support for thought and a tool for communication, is an effect of a historical process, in which discourse is the specific place where the relationship between language and ideology can be observed, with ideology being the very condition for language to occur" (Almeida, Silva, 2020, p. 1665-6).

In a material and historical analysis, the term "ideology" needs to be studied with care. Just like language, the terms it employs do not have fixed meanings *a priori* but depend on the historical context in which they are used (Orlandi, 1994). Even within Marxism itself, "ideology" is a word that carries multiple meanings and whose sense can change depending on the context.

Here, we will not employ the term from the postmodern perspective of individual belief, nor of a consciously manipulative process. Regardless of the Marxist perspective, ideology is presented as a collective dynamic, being both structural and unconscious, as we intend to demonstrate in section three.

This postmodern view of relativizing the meaning of the term "ideology" is not limited to this point alone. Although we don't aim to discuss this epistemological current, we cannot deny the existence of consequences for scientific divulgation and science education. According to this perspective,

> *It emerges the idea that scientific knowledge should be taught in school and even holds a value of truth; however, as it is a fundamentally relativist perspective, it consistently argues that the school should not aim to change the student's "belief" about what is being studied, as it would be seen as indoctrination* (Messeder Neto; Moradillo, 2020, p. 1339).

Taking into consideration these concerns and the socio-historical context in which we find ourselves, where information – both true and false – spreads rapidly, energetically, and often uncritically on the internet, we arrive at the main objective of this paper: *to understand how science is used in different discursive formations to support certain ideologies aimed at social organization from a historical materialist perspective*. In doing so, we aim to explore how this material relates to the legitimation of new powers or the preservation of the *status quo* in power relations within the capitalist system. To grasp the influential power of science, we have chosen to analyze how science can become an ideological discourse, thus understanding the role of science divulgation in this context and the ways in which it connects scientific content with the public.

In the next section, we will discuss the common view of science divulgation, which sees it as a "bridge" that neutrally connects the scientific and popular spheres and how this view was constructed. We argue that during the process of discursive formation of science divulgation, certain ideological assumptions can be unconsciously embedded. However, what do we mean by ideology? This is the question we intend to clarify in section three, where we present Marx's and Engels' understanding of the topic and how Gramsci connects science and the popularization of science as maintaining a hegemonic ideology. With this understanding, in section four, we can revisit the perspective on science divulgation and understand that, despite being used to reinforce the hegemonic ideology, it can also play a disruptive role by presenting new utopias and new ways of living. Finally, in section five, we discuss one reason why this might not happen, as science divulgation, as part of the press, is also subject to the capital fetish within the cultural industry.

With this approach, we hope to shed light on some of the facets of science divulgation from a Marxist perspective on the concept of ideology, highlighting the historical and social processes behind its development. This can raise awareness of the need for critical examination of the potential interests concealed within this content often considered "neutral".

II. The formation of a new discourse to bridge a gap

Initially, we need to analyze how science divulgation materials are created and their *nature*, including their *production conditions* and *social functions*. An essential point to raise here is the concept of a "gap" between scientific knowledge and the general public. From this

perspective, science divulgation would ostensibly serve to build a "bridge" between specialized scientific production and the "lay" audience.

The idea that there is a gap between these two forms of knowledge is not recent. Bensaude-Vincent (2001, p. 101) points out that "the notion of a gulf between two worlds causing radical misunderstanding between those who seek knowledge and those who conduct their daily business is as ancient as western science – it is primitive and archaic".

This division became more apparent during the 19th century when the European aristocracy's interest focused on the amateur practice of science. With experiments in small laboratories equipped with chemical and electrical instruments, there was not yet a clear demarcation between professional scientists and amateurs (Bensaude-Vincent, 2001). During this time, the widespread publication of journals and periodicals began due to technological advancements in printing presses, enabling the cheaper production of printed materials.

> *As newly entrepreneurial publishers sought to expand their markets to include new groups of middle- and even working-class readers, the language of the 'popular' developed to signal the targeted audiences for certain products. Here were works accessible to all, in terms of their price, their mode of address and their educational requirements* (Topham, 2009, p. 8).

A more significant distinction between so-called "popular science" and "academic science" began to emerge with the emergence of the category of "science consumers": individuals interested in scientific subjects but not actively involved in producing this knowledge. This category helped sustain and stabilize the "social division between scientists and the lay public brought about by the professionalization of scientific work through the course of the nineteenth century" (Bensaude-Vincent, 2001, p. 105).

From this perspective, considering two different spheres of knowledge with distinct worldviews, science divulgation comes into play with the role of popularizing science, which means making the scientific knowledge produced by professionals consumable for the general population. Behind this "dominant" view (Hilgartner, 1990) of popularizing science, there are implicit assumptions, as pointed out by Myers (2003, p. 266, emphasis added):

- *that scientists and scientific institutions are the authorities on what constitutes science;*
- *that the public sphere is, on scientific topics, a blank slate of ignorance on which scientists write knowledge;*
- *that this knowledge travels only one way, from science to society;*
- *that the content of science is information contained in a series of written statements;*
- that in the course of translation from one discourse to the other, this

> information not only changes textual form, but is simplified, distorted, hyped up, and dumbed down.

Considering theories of discourse analysis, we realize that a discourse is produced and spoken based on the production conditions at play (Pêcheux, 1988): who is a particular discourse intended to address? Who is the subject behind the discourse? In what social contexts are the enunciator and the receiver of that particular discourse situated? Questions like these indicate that science divulgation is not merely an adaptation of scientific discourse; it forms a new discourse with proponents and receivers different from the original, and, most importantly, with specific objectives.

> *It does not matter whether we talk of expository science, knowledge in transit, circulation of knowledge or science popularization, it does not even matter whether we talk about the culture of science, scientific culture, science* in *culture, or science* as *culture, as long as we remember that when we discuss issues in the popularization of science we are referring to a set of social relations linking different communities with allies, audiences, publics and consumers* (Gavroglu, 2012a, p. 86).

When we analyze scientific discourse, whether in the form of an article, thesis, lecture, or oral presentation at an event, both the proponent and the recipient of the discourse are individuals who are part of the scientific community. They are generally familiar with the underlying assumptions that support this discourse. In other words, both are agents belonging to the same field, using the terminology developed by Bourdieu.

> *This means that we only truly understand what an agent engaged in a particular field (an economist, a writer, an artist, etc.) says or does if we are in a position to refer to the position they occupy in that field, if we know "where they are coming from," as was somewhat vaguely put around 1968* (Bourdieu, 2003, p. 23-24).

However, when we analyze the proponents of science divulgation materials, there is no consensus on who they are due to the variety of backgrounds that communicators come from. "Whether scientists, journalists, professors, or any other agents, communicators move in different spheres of ideological creation, and, after the production of science communication, they become public representatives of scientific culture" (Lima; Giordan, 2021, p. 389).

In other words, in the process of producing science divulgation, there is no single profile for the proponent of the discourse. It can be a science journalist, a reporter whose specialty is not necessarily scientific topics, the scientist themselves, a scientist from a related field, and so on. There are various possible enunciators for science divulgation discourse. "From this articulation arises the need to build partnerships between different social actors for

the development of science divulgation products that are both complex and accessible to the public" (Watanabe, 2015, P. 72).

Associated with this plurality of proponents, we also see a plurality of recipients of this new discourse. Each individual who comes into contact with science divulgation materials also has a unique human background. These discrepancies between proponent and recipient are at the core of science communication, as it specifically aims to address "[n]ot another pair of enunciators, […] but a recipient represented as laypersons in scientific matters or, at least, laypersons in that particular matter subject to dissemination" (Zamboni, 1997, p. 87).

Thus, science communication is not just a "simplification" of something beyond the reach of the "lay public," but it constitutes its own discourse, with one of its main ingredients being scientific discourse. While essential, it is not the sole influencer during the development of science communication discourse, as "*every discursive process is part of a class ideological relationship*" (Pêcheux, 1988, p. 92). The Pecheutian method of discourse analysis presupposes that we analyze the historical and cultural context in which discourses are produced, heard, read, and interpreted. In this process, ideology plays the role of concealing the production of discourse, as if it existed on its own spontaneously and naturally (Almeida; Silva, 2020).

After this brief preamble, let's return to the question of the "gap" mentioned earlier: we have seen that, although the notion of two distinct forms of knowledge is ancient, its widening occurred in the 19th century with the emergence of a science consumer market and the professionalization of the field. However, considering what has also been said about the production of science communication discourse, to what extent does it actually construct this bridge between specialized production and the lay public?

First and foremost, it is essential to clarify that we do not intend to undermine the role of science divulgation or its producers. We are only questioning how this occurs and what messages about science are conveyed to the public, as well as why these messages are transmitted, even – and especially – unconsciously.

That said, other aspects beyond, so-called, "neutral" knowledge are conveyed to the public in the process of shaping science divulgation discourse based on scientific production.

> *Such a process is also an attempt to imbue and instill audiences with a particular ideology, very often an ideology of neutral science which can provide answers to all kinds of problems or, worse still, that the character of the solution to many problems including social problems is exclusively scientific* (Gavroglu, 2012b, p. 226).

Thus, within the discourse of science communication, we find not only scientific discourse as a source, but also certain ideologies embedded in it, shaping its form. To understand how this relationship between science communication and society works, we need to comprehend what we are here calling ideology, as this is a broad term used by various thinkers in different and sometimes contradictory contexts and connotations.

III. A brief review of the term "ideology"

The word "ideology" has a wide range of meanings. This complexity regarding the term's meaning is expressed at the beginning of the first chapter of the book *Ideologias e Ciências Sociais* [Ideologies and Social Sciences] by Michael Löwy (2010, p. 10).

> *It is difficult to find in the social sciences a concept as complex, full of meanings, as the concept of ideology. It involves a fantastic accumulation of contradictions, paradoxes, arbitrariness, ambiguities, misunderstandings, which makes it extremely difficult to find one's way in this labyrinth.*

In popular terms, we can understand ideology as a set of ideas, an individual belief, something worth fighting for or against. This particular conception of ideology, using Mannheim's terms (1954, p. 49), "denotes that we are sceptical [*sic*] of the ideas and representations advanced by our opponent".

However, when we move away from this particular conception and take a broader and more inclusive approach, we refer to ideology not as something individualized but as an ideology linked to a specific time and a determined socio-historical group, in other words, a class. Unlike the notion that focuses on the individual, we are not referring here to isolated differences in thought content but to fundamental thought systems and different ways of experiencing and interpreting situations (Mannheim, 1954).

In this broad conception of the term, there is a significant distinction between the terms "ideology" and "ideals". According to Chauí (2001, p. 7), an "ideology is a historical, social, and political set of ideals that conceals reality, [...] a means of ensuring and perpetuating economic exploitation, social inequality, and political domination". In other words, ideology is not equivalent to ideals, but rather to a specific set of ideals that also has a clear objective of domination.

With this, we work here from this broad approach to ideology, relying on the material and historical method to understand the term. Here, it's worth noting a terminological distinction regarding the references we will work with: we will rely on *Marxist* ideals, not *Marxian*[2]. This terminological care already indicates that our sources go beyond the works produced by Marx and Engels since they "never produced a fully-fledged theory of ideology; but their writings on other matters contain suggestive ideas in this direction, and their early work *The German Ideology* (1845-46) engages the topic directly" (Eagleton, 1994, p. 23).

Although Eagleton (1994) suggests that the theory of ideology constructed by Marx and Engels can be found only in hints from their other writings, we can use these hints to

[2] "We will refer to 'Marxologist' as those who specialize in the knowledge and scientific interpretation of Marx's thought. [...] 'Marxian' is the individual – a proposition can also be considered 'Marxian' – who refers or can refer to Marx's thought without belonging to the provisionally orthodox interpretation of Marxism given by the official representatives of the state that claim to be Marxist. 'Marxists' are those who officially declare themselves as such, namely, the representatives or spokespeople of communist parties, the Soviet Union, China, or any other popular republic or Soviet state" (Aron, 2008, p. 25).

establish a solid foundation upon which subsequent Marxist thinkers studying the subject have relied. Therefore, we will begin by presenting these clues and then delve deeper into the theory developed by Antonio Gramsci.

III.1 In Orthodox Marxism

It is worth noting that Marx, throughout his life, worked on various subjects and in various mediums – in addition to books, particularly texts published in newspapers and pamphlets[3] – making his body of work highly heterogeneous. Therefore, we will primarily rely on his main scientific books where the texts are more elaborated over the years and guide his lines of thought. In *The German Ideology*, the only case in which some fragments of his manuscripts were published while Marx was still alive, when criticizing German philosophers, Marx and Engels state that "[i]t has not occurred to any one of these philosophers to inquire into the connection of German philosophy with German reality, the connection of their criticism with their own material surroundings" (1998, p. 36).

In *The German Ideology*, in one of its drafts originally conceived as part of an article titled "Critique of Modern German Philosophy According to Its Representatives Feuerbach, B. Bauer and Stirner" the authors present to us the foundations of history and the processes through which human beings must go to develop self-consciousness as social beings. It is important for us to briefly delve into these processes since "Marxist critique is simultaneously a critique of reality and a critique of the consciousness of reality as perceived by people" (Aron, 2008, p. 79).

The stages outlined by Marx and Engels (1998) for us to speak of history and, thus, conduct a material analysis of it, are as follows: 1) satisfaction of primary needs (water, food, clothing, etc.) of humans; 2) the complexity of needs, leading to the importance of joining with peers; 3) the creation of the family, exemplifying the satisfaction and transformation of human needs; 4) human action to alter nature, in conjunction with other humans, in a more initial and general form of the dialectics of production relations: the relationship of humans with nature and their ability to transform it is simultaneously the relationship of humans with each other; 5) consciousness, which arises only from the social relations among humans and between humans and nature.

This fourth stage is crucial for the understanding of various themes addressed by Marxism, considering all the different lines of thought that have emerged from the original ideas of Marx and Engels. It is in this stage that the division of labor takes place, which is essential for analyzing concepts like private property, capital, surplus value, fetish, ideology, among many others present in historical materialism. With the division of labor, we recognize

[3] You can find the texts written (in German) by Marx and Engels in the years 1848 and 1849 for the Neue Rheinische Zeitung at the following links: http://www.mlwerke.de/me/me_nrz48.htm and http://www.mlwerke.de/me/me_nrz49.htm. Accessed on: June 22, 23.

something fundamental: the division of labor goes beyond a mere division of tasks. We realize that there are various forms of property – within the family, within the production process – and that men and women only fully develop their senses through social interaction (Chauí, 2001; Marx; Engels, 1998).

In this way, we can commence our analysis of ideology by starting from the premise of how history is constructed. "Individuals have always proceeded from themselves, but of course from themselves within their given historical conditions and relations, not from the "pure" individual in the sense of the ideologists" (Marx; Engels, 1998, p. 87). When critiquing the German philosophers,

> *they [Marx and Engels] perpetuate in transformed mode the 'ideology' of the Enlightenment, reducing ideas to sensational life - though that life is now firmly defined as practical, social and productive. At another level. from a wholly opposed political perspective, they share in Napoleon's brisk pragmatic contempt for 'ideology'*[4]*, in the sense of a fantastical idealism* (Eagleton, 1991, p. 77-78).

In the conception of Marx and Engels, ideology was a negative concept, equivalent to false consciousness and illusion. "For Marx, clearly, ideology is a pejorative concept, a critical concept that implies illusion, or it refers to the distorted consciousness of reality that occurs through the dominant ideology: the ideas of the ruling classes are the dominant ideologies in society" (Löwy, 2010, p. 11-12).

Chauí (2001, p. 116-118) identifies three stages in the formation of ideology based on Marxist principles. In the first stage, ideology originally "takes on the task of producing a universality as a real basis to legitimize the struggle of a new class", as it is originally formed by a set of ideas developed by thinkers from a rising new group. In the second stage, it becomes "what Gramsci referred to as common sense", as the ideas and values of the emerging new class become popular among non-dominant members of society and socially consolidate. Finally, ideology transforms from an ideal of the non-dominant classes into ideology itself when "the new domination turns the interests of the emerging class into the

[4] It's advisable to backtrack a bit to the conception of ideology before the Marxist perspective. The first appearance of the term "ideology" occurred in the book *Eléments d'Idéologie* (Elements of Ideology) by Destutt de Tracy in 1801, in a post-French Revolution context. De Tracy aimed to create a science for the emergence of ideas, and the term, more specifically, was used for "the analysis of sensations and ideas" (ABBAGNANO, 2007, p. 531). Along with Cabanis, De Gérando, and Volney, the group became known as French ideologists and were "antitheological, antimetaphysical, and antimonarchist. They were materialists, meaning they only accepted natural, physical (and material) causes for human ideas and actions" (CHAUÍ, 2001, p. 28). The fact that they were antimonarchists is important for the evolution of the term's meaning: after supporting Napoleon in the coup of 18 Brumaire, they realized that a new monarchical regime had been established, "so they turned to opposition, launching a campaign against the government and its legislation" (PARRA, 2008, p. 36). This led to a campaign against the French ideologists by Bonaparte, who removed them from their government positions, closed their academy, and initiated a defamatory campaign against them (PARRA, 2008), resulting in a shift in the meaning of the terms "ideology" and "ideologist" to a pejorative sense after a declaration by Napoleon in the Council of State in 1812.

particular interests of the dominant class, thus denying the possibility of realizing them as the interests of the entire society".

With the formation of ideology within historical conditions, one might wonder: how can we observe social phenomena when we are also part of this context, and when ideologies seem to be mirrors that distort reality? The question of the internal observer is broad and intersects with Marxian thought. From the Marxist perspective, "*the observer is in a position to make his observation by starting from the non-correspondence between the system's internal elements. It is precisely this factor that enables him to observe as if from the outside, notwithstanding the fact that he is located within the observed phenomenon*" (Iacono, 2016, p. 114). This correspondence between elements arises because Marx grounds consciousness in social reality, creating a strong correspondence between the forms of material production and the consciousness people have of them.

However, as this perception is based on an inversion, the correlation between consciousness about the forms of production and the actual material conditions is unstable, with contradictions that constantly disrupt the connections that allow the system to persist.

> *Marx tends to consider historical development as a progressive separation of men from nature, as their alienation from naturalness. This is why, if on the one hand the analysis of social forms is focused on the processes of separation which develop within them, on the other, all this seems to be in some way supported by a more general process of separation from nature, which seems to incorporate the forms themselves* (Iacono, 2016, p. 180).

Even with these descriptions, Marx and Engels' "theory" of ideology remains vague and diffuse. We have only a few outlines of what it is, how it forms, and what its function is within society, but it still requires further refinement. The points they addressed continued to underpin the work of subsequent Marxist philosophers.

III.2 Gramsci, hegemony, and ideology

An important thinker in the development of Marxism was the Italian Antonio Gramsci, the founder of the Communist Party of Italy. He was imprisoned during Mussolini's fascist regime, and his writings during his time in prison remain highly influential to this day.

> *Gramsci developed a highly original interpretation of Marx's philosophy. He believed that the perspective of the German thinker was one of "absolute historicism". Essentially, Marx's thought challenges us – always! – to think historically. This challenge confronts us with both magnificent possibilities and colossal difficulties* (Konder, 2002, p.102).

The issue of ideology, for Gramsci, is closely tied to the concepts of *hegemony* and *civil society*. We will briefly touch on these concepts since we don't need an in-depth

exploration to understand their connections with ideology, which is our main focus.

The *hegemony* is "a complete fusion of economic, political, intellectual and moral objectives which will be brought about by one fundamental group and groups allied to it *through the intermediary of ideology*" (Mouffe, 1979, p. 181). Thus, hegemony occurs when a predominant position, whether in the economic or intellectual sphere, is achieved through consent rather than the use of the coercive machinery of the state. "Hegemony is attained through the myriad ways in which the institutions of civil society operate to shape, directly or indirectly, the cognitive and affective structures whereby men perceive and evaluate problematic social reality" (Femia, 1981, p. 24).

On the other hand, *civil society* is one of the two spheres that make up the broader State: while the political society holds the mechanisms of repression and violence, civil society is characterized by organizations whose objectives are the "elaboration and/or dissemination of ideologies, including the educational system, churches, political parties, trade unions, professional organizations, material culture organizations (magazines, newspapers, publishers, mass media), etc." (Coutinho, 1989, p. 76-77). With his criticisms of economism and the reductionism of Marxist theory up to that point, Gramsci understood that the ideological realm wasn't just about ideas but rather a set of hegemonic apparatuses within civil society (Rehmann, 2013).

Gramsci understood the issue of ideology in a materialistic way, since "men's acquisition of consciousness through ideology will not come individually but always through the intermediary of the ideological terrain in which two 'hegemonic principles' confront each other" (Mouffe, 1979, p. 186). Thus, from the Gramscian perspective, ideology is fundamental for the acquisition of self-awareness. It is within the ideological terrain that consciousness is constructed through the social relationships among individuals in a society.

"One must therefore distinguish between historically organic ideologies – that is, ideologies that are necessary to a given structure – and arbitrary, rationalistic, 'willed' ideologies" (Gramsci, 2007, p. 171). Arbitrary ideologies do not generate any form of movement within the ideological terrain, while organic ideologies create the grounds for the movement of people, organizing the masses who acquire self-awareness and mobilize in struggle. Drawing a parallel with the definitions given by Mannheim (1954), arbitrary ideology would be akin to the particular definition of ideology, whereas historically organic ideologies are similar to Mannheim's expanded definition.

It is also through historically organic ideologies that science and its advancements take place, since every science is "necessarily linked to man, his needs, his life, his activity" (Gramsci, 1996, p. 190), meaning that science is also an activity situated within history, and the marks of its development determine how its constructions will be. Thus, according to Gramsci, science is also part of the superstructures that shape civil society to maintain hegemony.

The concepts of superstructure and base are of great importance for the development of Marxism. In the "transition from Marx to Marxism and in the development of the most widespread Marxism, the proposition of the determining base and the determined superstructure has commonly been regarded as the key to a Marxist cultural analysis" (Williams, 2011, p. 43).

The concept of the base can be traced back to Marx's book *A Contribution to the Critique of Political Economy* (2014), a work that predates *Das Kapital.* Although the passage is somewhat lengthy, it is worth reproducing here to provide an understanding of what Marx referred to as the base, before we explore the nuances that this concept takes on in Gramscian thought.

> *In the social production which men carry on they enter into definite relations that are indispensable and independent of their will; these relations of production correspond to a definite stage of development of their material powers of production. The sum total of these relations of production constitutes the economic structure of society – the real foundation, on which rise legal and political superstructures and to which correspond definite forms of social consciousness*. ***The mode of production in material life determines the general character of the social, political and spiritual processes of life. It is not the consciousness of men that determines their existence, but, on the contrary, their social existence determines their consciousness*** (Marx, 2014, p. 11-12, emphasis added).

Gramsci, unlike Marx, does not speak of just one superstructure but rather in the plural, of various superstructures. He does not limit himself, as Marx did, to the legal and political sphere, but understands superstructures as "all of the forms in which classes know and comprehend the conditions of their struggle within a determinate social formation" (Thomas, 2009, p. 99). The Gramscian concept of superstructure is much broader than that initially pointed out by Marx. For Gramsci, even "[t]he philosophy of praxis[5] itself is a superstructure, it is the terrain on which determinate social groups become conscious of their own social being, their own strength, their own tasks, their own becoming" (Gramsci *apud* Forgacs, 1988, p. 196).

Even though it is a superstructure, Gramsci distinguishes the philosophy of praxis from other forms of superstructure. In the same notebook where he states that the philosophy of praxis is a superstructure, *Notebook 10*, he makes this differentiation because other philosophies are ideological in their attempt to reconcile contradictory interests. "The philosophy of praxis, on the other hand, does not tend towards the peaceful resolution of the

[5] While some may claim that the philosophy of praxis is equivalent to Marxism, the terminology has a broader meaning in the works of Gramsci. "This terminological shift was a method that the Italian philosopher discovered to combat vulgar and mechanistic Marxism, as well as to make his notes meticulously, since he lived in the fascist period and faced numerous restrictions while in prison" (Lole, 2015, p. 1).

contradictions existing within history. It is itself the theory of those contradictions" (Gramsci *apud* Forgacs, 1988, p. 196-197).

The dissemination of ideology within the sphere of civil society through organizations, including cultural materials, "science popularization in its most general sense appears to be one of the fundamental means through which the dominant ideology is being (re)produced and assimilated" (Gavroglu, 2012a, p. 88). Gramsci tells us that due to the specialization of science and the way it is disseminated, scientific fanaticism and various superstitions are spread.

> *This infatuation, the ideological dangers of which are obvious (superstitious faith in the power of man, paradoxically, leads to the impotence of the very bases of this power), must be opposed in diverse ways, and the most important of these has to be a better understanding of the basic principles of science. Science should be disseminated by scientists and serious scholars and no longer by omniscient journalists and know-it-all autodidacts* (Gramsci, 1996, p. 242).

Thus, we can see that science itself is an organization within civil society with an aim of disseminating a hegemonic ideology, contributing to social stability. It's important to be cautious here: this fact doesn't arise from "conspiracy theories" or Machiavellian plans with people consciously scheming to influence scientific development in order to maintain certain privileges.

On the other hand, we must not forget that science and its dissemination are embedded in a social-historical context, with constant struggles for hegemony and a prevailing ideology that requires legitimation, with scientific development and its dissemination on the agendas of various social groups. Thus, "both science and its popularizations cannot be considered to be isolated from such contentions for hegemony" (Gavroglu, 2012a, p. 93). Therefore, *within scientific divulgation, we can find characteristics of the context in which it was developed embedded in its discourse*.

IV. Science divulgation, hegemonic ideology, and utopia

As we have just seen, scientific divulgation, in and of itself, already carries embedded ideological aspects as it is part of a defined social context, partly shaped by ideological processes. However, when we revisit the issue, we were discussing earlier about the formation of a new discourse when trying to transfer scientific knowledge to the lay public, we now realize that, in addition to the notion that there is a cultural gap, the idea that egalitarianism could be achieved through dissemination is, in itself, an ideological assertion.

> *Regarding the lack of scientific knowledge of particular social groups as being an expression of a cultural gap or a cultural lag with respect to that of the elites, presupposes a particular social and political agenda: that both groups, both the*

> *elites and the rest,* should *share the same fundamental scientific culture, in fact, they should share the culture of the elites* (Gavroglu, 2012a, p. 90).

It is in this sphere that we find the first ideological aspect in scientific divulgation: its very existence is ideological because it presupposes that scientific culture is the only one that should be disseminated and that dissemination can, in a neutral manner, achieve this goal. Regarding the neutrality of scientific dissemination, we have already seen that it is not just a "simplification" of something but constitutes its own discourse, which is also part of a social-historical context.

The second ideological aspect that can be found in scientific divulgation is within the content it conveys, not only through the formation of a new discourse but also through the very development of science. As mentioned earlier, science is also embedded in a social-historical context, so its development is also influenced by it.

Scientific culture, *being a culture*, is not neutral in itself. According to Mészáros (2004), we can understand a new relationship between science and the culture of capital from the revolutions promoted by the Enlightenment philosophical movement, as well as the emergence of public scientific communication for the European aristocracy (Bensaude-Vincent, 2001). With its attempt to reclaim reason, the Enlightenment found support in science, while science, at the same time, was developing and sustaining the Industrial Revolution.

This new relationship between science and the production resulting from the Industrial Revolution proved to be extremely powerful. With the advances stemming from technological developments of the time in production, social issues could, for the first time, be presented as merely transient since the development of scientific knowledge and increased production would "inevitably" lead to the overcoming of social inequalities.

> *The neutrality of science and the belief that its ideological and political aspects are materialized only when science is applied has been the fundamental tenet of technocracy. Such an attitude helped underline the view that the solutions of social problems were of an exclusively technical character, promoted by technocrats who are supposed to be thinking objectively and have the necessary knowledge* (Gavroglu, 2012a, p. 91).

This attempt to unlink social issues from social agents resulted in a metamorphosis of social issues into seemingly "neutral" technological-scientific issues (Mészáros, 2004). Thus, the historically constructed ideal by science – the notion of progress, for example – transformed into a scientistic ideology, involving the transposition of what was desired in a particular field to all others, with a view to creating social control, which, as previously mentioned, is one of the processes of producing an ideology (Chauí, 2001).

However, an ideology cannot sustain itself for long periods on its own. It needs to be constantly reformulated through negotiations with antagonistic ideologies and disseminate its

core values, beliefs, and explanations for the entire population to share, thereby making it a hegemonic ideology (Gavroglu, 2012b). In this sense, we can consider the process of scientific divulgation as a way to spread this hegemonic ideology.

> *[T]he hegemonic ideology does not involve a static and unchanging set of values. It needs continuous revamping since a particular ideology needs to be reinforced in order to be lasting. Popularization, or rather the ideology of popularization, is one such means. And, thus, the popularization of ideology affects in turn the ideology of popularization* (Gavroglu, 2012a, p. 99).

Another important aspect in the relationship between scientific divulgation and ideology that needs to be mentioned here is the connection of these points with utopia. The relationship between ideology and utopia has been explored by various authors over the years, among whom Karl Mannheim (1954) and Paul Ricœur (1986) stand out.

According to Mannheim, utopia occurs when the state of mind is incompatible with the actual state in which one finds themselves. Although this definition seems much like the definition of false consciousness attributed to ideology in orthodox Marxism, Mannheim (1957, p. 173) points out that:

> *In the course of history, man has occupied himself more frequently with objects transcending his scope of existence than with those immanent in his existence and, despite this, actual and concrete forms of social life have been built upon the basis of such "ideological" states of mind which were incongruent with reality. Such a incongruent orientation became utopian only when in addition it tended to burst the bonds of the existing order.*

Therefore, utopia exists in society in contrast to ideology: while ideology is presented as an attempt to disguise reality by the controlling classes, "utopias would turn towards the future, being advocated by ascending classes and attacking the reality they disagree with" (Magalhães, 2017, p. 45).

Ricœur (1986, p. 17) points out that both ideology and utopia share the same turning point, which is authority. "If every ideology tends finally to legitimate a system of authority, does not every utopia, the moment of the other, attempt to come to grips with the problem of power itself?"

In this context, where ideologies on one side legitimize hegemonic authorities and utopias on the other side attempt to subvert this structure, scientific divulgation plays an important role: formulating and legitimizing utopias. Examples of scientific utopias can include a world with clean and limitless energy or agricultural production with minimal food loss.

> *Historically at least, science popularization has been articulating the characteristics of utopias which, in turn, are used to further legitimize ideological trends, and as these trends become entrenched in society, the utopias become even more dominant*

> *and they need to further the help of science popularization etc. Hence, science popularization, utopias, hegemonic ideologies seem to be intractably associated with each other* (Gavroglu, 2012b, p. 227).

Recapping and interconnecting what has been presented so far: scientific divulgation is not merely simplification but rather a discourse of its own, dependent on the enunciator, the recipient, and the conditions in which it is generated. This dependency on the context occurs because both science and its dissemination take place within a society and, thanks to that, are influenced by hegemonic apparatuses within civil society. According to Gramsci, science is also one of the superstructures that determine civil society for the maintenance of hegemony and a hegemonic ideology. However, the hegemonic ideology is not something fixed and unchanging but requires constant reinforcement to sustain itself, and scientific communication enters the context to provide this reinforcement. Thus, scientific divulgation has characteristics of the hegemonic ideology present in it, as well as formulating new utopias that also legitimize ideological tendencies, generating conflicts, debates, and movement within the ideological terrain.

V. Fetish, ideology, and cultural industry

As mentioned earlier, Marx's works are highly heterogeneous, especially when considering the different mediums in which they were published or left unpublished. Many of his key texts, including those used in this work, are actually unfinished drafts that have been edited in various ways over the centuries. *The German Ideology*, which we discussed earlier, is an example of this:

> *Emerging from obscurity in 1921, the texts that make up The German Ideology are still awaiting a definitive edition. The arduous task of editing this unfinished work, riddled with numerous gaps and inaccuracies, with some pages missing and others chewed by rats, has sparked a controversy from the outset regarding its true form* (Enderle, 2007, p. 17).

However, one of his major completed works, edited during his lifetime, was undoubtedly the first volume of *Das Kapital*. Marx's idea when composing *Das Kapital* was to conduct a critique of political economy. The three volumes of *Das Kapital* form a whole, beginning with the capitalist production process, continuing in the second book with the process of circulation, and concluding in the third volume when Marx subverts various previously explored categories to comprehend the global process of capital production.

Among the various concepts Marx worked on throughout his life – such as ideology, value, surplus-value, alienation, bourgeoisie, proletariat, lumpenproletariat, class antagonism, and, of course, capital – an important concept for his economic theory is that of fetishism. In the very first chapter of the first volume of *Das Kapital*, Marx introduces a subsection titled

"The Fetishism of Commodities and Its Secret". Right at the beginning, Marx revisits five historical moments to introduce his analysis of the subject.

> *So far as it [the commodity]is a use-value, there is nothing mysterious about it, whether we consider it from the point of view that by its properties it satisfies human needs, or that it first takes on these properties as the product of human labour. It is absolutely clear that, by his activity, man changes the forms of the materials of nature in such a way as to make them useful to him* (Marx, 1992, p. 163).

In orthodox Marxist conception, fetishism is closely linked to human actions aimed at transforming nature and, subsequently, with how such transformations take on a "mysterious" character when carried out for the satisfaction of the needs of others. In other words, when the product of human labor ceases to be for oneself but for the production of commodities.

The sociologist Francisco de Oliveira (2017, foreword), in an important Brazilian edition of the first volume of *Das Kapital*, already warns us about the structure of the book: "Those who expect this book to begin with an examination of capital, prepare for an anticlimax: Marx examines, above all, the commodity and its formation, for capitalism continues to be [...] a mode of commodity production". The commodity, thus, occupies a central role. Marx primarily associates capital, at this initial stage, with the production of commodities and how human labor adds value during this process. This value, when it enters the realm of circulation, externally expresses its internal dichotomy as a use-value, i.e., its usefulness to a specific individual or community, and also as the expression of value in the form of exchange-value.

> *Without commodity exchange the usefulness of products in general is a fact self-evident and thus invisible to producers and users. Only with the emergence of commodity relations do the opposition of usefulness and exchangeability and the resulting contradictions and puzzles of commodity-organized life become an object of speculation and investigation* (Foley, 2001, p. 561).

One way the author presents to exemplify this dichotomy between utility and exchangeability is through the contradiction between the products of a family association and those of a society of commodity producers. In a family production, although there are still divisions in terms of tasks performed, the result "confront the family as so many products of its collective labour, but they do not confront each other as commodities" (Marx, 1992, p. 171).

In a society of commodity producers, the system in which we live, the exchange relationship appears to occur not between people who work to produce specific products but rather as a relationship between products, separating their producers from it[6].

> *Men do not therefore bring the products of their labour into relation with each other as values because they see these objects merely as the material integuments of homogeneous human labour. The reverse is true: by equating their different products to each other in exchange as values, they equate their different kinds of labour as human labour* (Marx, 1992, p. 166).

Thus, according to Marx, the social character of labor, something historically constituted, is metamorphosed into things, into commodities that are bought and sold. Commodity, then, becomes the bearer of this social character, transforming the perception of this characteristic of labor into something indirect. "The illusion of fetishism stems from conflation of the social characteristic and its material shapes: value seems inherent in commodities, natural to them as things" (Geras, 2001, p. 191).

Marx terms this dialectical twist that reverses the logic between essence and appearance as fetish, and in the case of commodities, precisely, the commodity fetish. Throughout the three volumes of *Das Kapital*, other dialectical twists are presented, such as the fetish of production and the fetish of capital. Although in appearance, fetish and ideology may seem to overlap, we can discern the distinction between these two categories in essence:

> *This fetishism transforms into an ordered system of ideas and representations of norms or rules, existing as something separate and independent from material conditions, and is therefore considered by Marx and Engels [...], ideology. Ideology emerges when there is a disconnection between the productive force of labor and intellectual thought and is understood as a form of control and repression of the working class, in a silent domain ensured by the alienation of history as a social fact* (Figueiredo; Brito; Botazzo, 2003, p. 757).

However, just as the concept of ideology has evolved over time due to the contributions of other thinkers, the concept of fetishism has also changed, thanks to the shifts in social structure brought about by the development and alterations of capitalism. For our work, it is interesting to delve into the writings of Critical Theory, specifically Adorno and Horkheimer, regarding the culture industry and the fetishism of cultural commodities.

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[6] Marx also presents to us how exchange would occur in an association of free individuals, "working with the means of production held in common and expending their many different forms of labour-power in full self-awareness as one single social labour force" (Marx, 1992, p. 171). The items produced also have exchangeability, but their distribution takes place in a distinct manner, as it is planned, maintaining the social relations among individuals and their work in a transparent way, unlike in a society where commodities are at the center of exchanges.

> *Such a designation [culture industry] intentionally invokes the controversial idea that culture has ceased to be a spontaneous outcome of the human condition, where traditionally, the deepest aspirations and projections of humanity are expressed in aesthetic terms. Instead, it has become yet another field of economic exploitation, managed from the top down, with the primary objectives of generating profits and ensuring the public's adherence to the capitalist system, as mentioned above* (Duarte, 2007, p. 9).

Without denying the importance of Marx for a critical analysis of economics and politics, the authors recognized that social relations have now changed to the point where "[f]ilms and radio no longer need to present themselves as art. The truth that they are nothing but business is used as an ideology to legitimize the trash they intentionally produce" (Adorno; Horkheimer, 2002, p. 95).

This dissemination occurs through various means of transmission, and in this process of dialectical twist, "powerful multimedia companies and private conglomerates appear, which increasingly empower the technologies of reproduction and dissemination of cultural goods" (Rüdiger, 2007, p. 138). Now, we can return to scientific divulgation, as a sector of the press. However, if the press has become a business aimed at legitimizing a particular ideology, could scientific divulgation be part of this process? Can scientific divulgation escape the spell of capitalist fetishism?

VI. Final thoughts

Throughout this article, our aim was to understand the nature of scientific divulgation from a materialist and historical perspective, connecting our subject of analysis to the concept of ideology. We have shown that scientific communication is not merely a "simplification", as it is sometimes portrayed, and from there, we began to analyze the conditions under which this communication is produced.

In our understanding, ideology is not something individualized, contrary to the post-modern view. Ideology is a collective force that permeates all human actions; it is material, as it generates conflicts and movements within an ideological terrain that is fundamental for the maintenance of hegemony. Ideology is historical because it is determined by the context and social relations among individuals within a specific society. When it becomes hegemonic, it spreads through civil society organizations to legitimize itself.

Since the actors involved in the process of forming the discourse of scientific divulgation are part of civil society, we cannot ignore the role played by ideology. Scientific communication thus has a dual ideological character: firstly, in terms of *its very existence*. For scientific divulgation to exist, a particular type of knowledge is required, which only a small portion of the population can access and, more importantly, understand. Therefore, this knowledge needs to be disseminated in a specific, more "simple" language, and scientific divulgation is supposed to perform this function neutrally. The second aspect relates to the

content being communicated because both the new discursive formation and the scientific development itself occur within a social and historical context and are influenced by it.

Scientific divulgation is necessary in the society we live in, but we do not view it with a missionary role. The role of communication is not to build a bridge where sophisticated knowledge is transformed so that the less educated can passively understand it. Uncritical scientific divulgation sustains a certain imaginary of neutrality, which allows science itself to dictate which material measures and actions should or should not be taken by society.

However, since scientific divulgation *is part* of the press, we cannot deny its presence within the culture industry and the influence of capital over it. Depending on the editorial stance of a particular media outlet, the same news can be presented from various perspectives, or it may even be ignored or actively denied.

However, we must not forget the potential of scientific divulgation. Just as it disseminates hegemonic ideology when produced uncritically, it can also mitigate this effect when it spreads new perspectives on society, new ways of living, and new utopias. Therefore, when we read and share a particular scientific news, we cannot have the preconceived notion that it is naturally neutral. We need to maintain a critical outlook on what it tells us and, most importantly, what potential interests may be behind those who produced it.

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