



Research Article

Science Communication as *Praxis*: Analysis of ‘The Periodic Table’ by Primo Levi

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Citation: Massi, L., da Silva Lima G. (2025) Science Communication as *Praxis*: Analysis of ‘The Periodic Table’ by Primo Levi. *Substantia* 9(2): 111-120. doi: 10.36253/Substantia-3441

Received: Mar 31, 2025

Revised: Jun 17, 2025

Just Accepted Online: Jun 19, 2025

Published: Sep 15, 2025

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Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

Abstract. This article is an analysis of the book “The Periodic Table”, which derives from Primo Levi’s *praxis*. This is an attempt to highlight the reason for the communicative practice and subject-object relationship involved in his book’s production. The analysis was based on both *praxis* categories and the subject/object opposition unit emerging from historical and dialectical materialism. Accordingly, we mobilize and advocate for a science communication concept based on the sense of *praxis* that is not limited to the discursive aspects of this production type. Based on the sources’ selection carried out in the collection of “Centro Internazionale di Studi Primo Levi”, this book can be the very result of Levi’s transformative *praxis*, which was driven by a liberating human development substantiated by science. Science outspread as transformative *praxis* in Primo Levi’s work and in the subject/object relationship observed it. Human development was the reason for his practice, and it was driven by a liberating perspective, by outspreading a science that could help expanding the concept of world and society. This reason is linked to his biography and activities, which play a potential humanizing role in relationships man set with nature and society. The present article sought to broaden the understanding of SC as *praxis* based on a case study and to stand against a narrow view of SC and the superficial reasons often linked to it.

Keywords: Science and literature; science communication; *praxis*; Primo Levi; The periodic table.

CONTEXT

The Science Communication (SC) literature advocates for overcoming the classic Public Understanding of Science (PUS) or the Public Perception of Science model. These models identify gaps in scientific knowledge and their likely overcoming by making scientific facts available to the general public.^{1,2,3,4} This traditional discursive context perspective seems to be associated with SC as scientific discourse translation.⁵ According to Dahlstrom and Ho,

SC researchers have migrated to the Public Engagement in Science and Technology (PEST) model, which takes scientific controversy as focusing and widespread mechanism. This model makes it easier to discuss the risks and benefits of public policies substantiated by social values and technological information.¹ Furthermore, many important models featuring SC have been created and are still cited.⁴

The new SC perspective is in compliance with the understanding of science as culture. The metaphor to explain the scientific culture is the act of climbing a mountain; in other words, one must become increasingly involved in science and in making it worth the effort.⁴ Therefore, SC should be a popular culture aspect, just as storytelling, narratives, rituals and collective meaning-making processes,³ so stories about science should not be written differently from how other stories are created. From this perspective, Van Dijk analyzed Snow's classic text to advocate for the overcoming of the paradigm that separates science from culture in order to head towards a "(Multi)cultural Practice of Science Communication".²

Lima and Giordan understood scientific culture as a set of scientific values, knowledge, beliefs and technological practices forming the human heritage by overcoming the discursive dimension.⁵ Therefore, understanding science as part of culture can be better observed in light of Lima and Giordan's ideas.^{2,3,5}

Despite these new directions and potentials, Halpern and Rogers highlighted the persistent and problematic association between science and its outspreading, and between science and art.⁶ Some authors anchored in the perspective of science as culture and narrative advocate for using Science Fiction (SF) as SC topic, because, more than scientific ideas validity, the internal logic of fiction is what really matters.⁷ However, Lima and Giordan addressed the relevance of differentiating the scientific reference from the expanded scientific culture SC is part of, and it can include narratives.⁵ According to several authors, narratives seem to engage in, and convince more than, isolated scientific facts, besides leading to scientific careers, without distorting science and scientists' perception.^{3,7,8,9,10}

There are differences in both the compositional structure and main elements structuring scientific and everyday language symbolic forms.⁵ While scientific language is ruled by codetermination relations between scientific concepts in the search for a stable and monological meaning, everyday language is based on likely meanings expressions can have; thus, it is substantiated by polysemy. An appropriate form and content organization is needed in order to accomplish scientific communication and technological culture outspread. Not every

fictional narrative has the potential to help outspreading science, unless it is produced for this specific purpose and to mobilize appropriate materials, strategies and tools to do so. Furthermore, the discursive analysis is not enough to capture these potentials.

Primo Levi's texts are an example of narratives produced to promote SC¹¹. According to Lima and Giordan, they are close to the most appropriate scientific culture form, since these fictional narratives or essays acknowledge science as historically determined human production made up of complex social relationships.⁵ Levi was an Italian Jewish chemist who became a writer after surviving Auschwitz concentration camp. He wrote books in several genres throughout his life, most notably autobiographical texts with memoirs of concentration camp experiences or as chemist working in laboratories. The present article is an analysis of the autobiographical book "The periodic table", whose chapters are named after a chemical element. The reported story associates the named element with specific fragments of his life. The other books introducing the same autobiographical aspect are 'If his is a man' and 'The truce', both focused on the Lager tragedy. In "The periodic table" only chapter 'Cerium' talks of his experience in a concentration camp.

Dahlstrom and Ho discussed the likely ethical implications of adopting narratives to outspread science by highlighting an external realism observed in fictional narratives.¹ They also pointed scientists' almost unethical behavior of not taking advantage of these potential narratives to outspread science. Reinsborough even stated that natural and social scientists should be involved in producing narratives, because they are more informative to the public than scientific research results.⁹ William Wilson, back in 1851, already advocated that fiction should be a vector for popular science.

The Scottish poet William Wilson issued a brief manifesto for a new genre of "science-fiction" in 1851, but it proved premature, although Wilson's chosen book, 'The Poor Artist' by Richard Henry Horne; or, Seven Eye-Sights and One Object (1850), is a good illustration on how scientific knowledge can inform and transform Nature's imagery.⁷

Acknowledging the difficulty in articulating art and science, as well as SF potential in SC as part of scientific culture, allowed observing the potential of Primo Levi's life and work to explore such associations.^{6,12} His book "The Periodic Table" was awarded as best science book of all times by the Royal Institution of Great Britain, which is one of the oldest and most prestigious sci-

entific institutions. It was founded in London, in 1799, and is dedicated to outspread and apply new scientific ideas and scientific education to the general public.^{13,14} According to Gordon, this award does not refer to scientific competence, nor does it point out a broader understanding of science by this institution (if one bears in mind its diversity of works), as proposed by Cerruti, but points towards its origins linked to popular science and SC.^{13,15} He highlighted literary writers among competitors, such as Bertold Brecht, and writer-scientists like Darwin, Watson and Dawkins. All these authors produced hybrid works that have balanced science, narration, history, ethics or science politics, and modernity.

Many authors state that this award refers to the quality of a given work in spreading out science and in integrating science to art. However, they did not identify the authors of these works as science communicators and avoided classifying those works in this genre.^{16,17,18} Assumingly, classifying a book as SC would diminish its literary and author's value, because, according to these authors, despite the work's informative character, it is secondary to literary intentions.^{16,17} Therefore, although this particular author is a chemical narrator, his fantastic vicissitudes connected to scientific research refer to the true art of short stories, rather than to its outspread.¹⁸ Although "The Periodic Table" has been awarded as the best science book of all times, it has been more often analyzed as autobiography than as SC work. Authors who deny this book as SC, such as Di Meo, classify it as a book about the scientific practice of a chemist, that highlights a narrow view of scientific-knowledge outspreading, which is limited to major scientific facts, canonical knowledge, he also sees it as disconnected from life.¹⁶ According to this author, Levi did not write SC because he addressed anachronistic or marginal content and practices, rather than discussed major scientific topics. Di Meo stated that the approach by Levi would only be of interest to a historian of science.¹⁶ He argued that, other than producing SC, Levi writes about the association among scientific practice, life and individuals' general conduct.

Gordon's analysis is an important exception, since he rebuilt SC presence in Levi's story.¹³ He stated the need for studies acknowledging this aspect in order to fully understand Levi's communicative power, as well as the charm, curiosity and pleasure emerging from his work¹³. Philip Ball, who was Nature's editor and is an important science communicator, reinforced that this is "the best book ever written about chemistry" and suggests naming a new chemical element "levium".¹⁹ Amidst this dispute, it is necessary understanding that

"The Periodic Table" is a work of scientific communication given the reasons substantiating its elaboration. This interpretation will be introduced in the herein described analyses.

The general aim of the present article was to analyze the book "The Periodic Table" as product of Primo Levi's *praxis*. Its specific goals lie on analyzing the reason for Primo Levi's communicative practice in the book and on the subject/object relationship involved in his work's production process.

Praxis is the conscious activity of the subject based on the theory/practice inseparability. Therefore, *praxis* means an intentional action carried out by human beings, so a science communicator activity is driven by SC concepts and goals. The need for understanding SC as *praxis* arises from interpreting the totality of such an activity. This *praxis* cannot be summarized as discursive simplification, because it also implies recognizing a discourse source that does not always exist. The entire science and technology field form its references, not just its discourses. This field includes practices, agents, stories and, of course, discourses. Therefore, SC interpretation as simplification or discursive translation²⁰ accounts for only capturing one dimension of this complex human activity.

Understanding it as *praxis* is an attempt to overcome limits imposed by the division of labor, which is herein understood as theoretical and practical work. According to the Marxist theory, *praxis* is the dialectical unit bringing together theory and practice. This interpretation derives from observations, according to which, the theory alone is incapable of transforming reality if, at the same time, it is not intertwined with human activity.²¹ Practice without theory, in its turn, is an alienated practice, whose reasons and execution means are obscure throughout human activities. It is clear, however, that degrees of overshadowing can vary, and it determines different alienation levels.

Understanding SC as *praxis* implies recognizing that the association between subject and object is dialectic. Therefore, by understanding and changing the object, the subject also changes. According to the Marxist theory, subject and object are mutually historically produced. This association is also mediated by the human society, which determines the social being. This association in "The Periodic Table" shows Primo Levi as subject and scientific culture as object, and the book is their product. By bearing in mind that it is essential understanding the subject who produces the *praxis* in order to understand *praxis* itself, the second analytical section is an investigation about both Primo Levi and his relationship with the scientific and technological culture (the book theme).

METHODOLOGY

The analysis *corpus* emerged from a search in the collection of “Centro Internazionale di Studi Primo Levi”, mainly on OPAC Primo Levi database, which comprises several sources by, and about, Primo Levi. In addition to the digital search carried out by research internship students, the physical collection of “Centro Internazionale” was also accessed and the selected material was read in full. The search was based on the following meshes: “*Il sistema periodico*” on “ricerca libera” (free search) and “accesso tematico” (thematic access), which led to approximately 600 results. The material was physically selected and consulted. Only publications presenting a straight reference to “The Periodic Table” as SC material were selected for the study, which also included literary analyses, interviews with Primo Levi and book excerpts. Interviews with Primo Levi about the book were included because it is essential understanding the *praxis* and assessing the author’s own awareness of his practice.

The analysis was based on reading the book, on interviews available in the book by Poli and Calcagno, and on *The Complete Works of Primo Levi*.^{22,23} It was done to help better understanding how Primo Levi’s *praxis* was expressed in his book. The analysis followed historical and dialectical materialism categories, mainly the *praxis* category, as proposed by Marx and summarized by Vázquez.²¹ This category centrality is justified by contributions from Lima and Giordan, who defend SC as *praxis*.⁵ Based on Marx’s contributions to the study, the goal was to understand the activity to produce “The Periodic Table”, based on need/reason, since this is the very foundation of any working process. Furthermore, the subject/object relationship analysis was substantiated by the materialist dialectic, and contradiction (unit of opposites) was the main aspect assessed through it.

The aim of the present article was to articulate the theoretical foundation during the analysis itself due to writing-style reasons, because this integration helps better understanding the references and the analysis itself.

SCIENCE OUTSPREAD AS TRANSFORMATIVE PRACTICE IN THE WORK BY PRIMO LEVI

Primo Levi is very clear about the reasons leading to his work. This “duty of clarity” is associated with his experience in Auschwitz and with his role as testimony writer, and it was extrapolated to his work as science communicator. According to him, all individuals must feel responsible in order to become human again,

after Auschwitz.²⁴ Martin understands that “the central imperative of this individual responsibility is communication” as “linchpin of liberty”.²⁵

If one understands that the aim of Levi’s work is to help forming responsible human beings, it is interesting observing his intention to address the scientific and technological culture by emphasizing the need for a free society. Science relevance to form a dignifying society can also be noticed in the report about reasons leading him to write “The Periodic Table”, namely: showing that every human experience deserves attention, even in case of careers like factory technician, which is tiring and difficult, because it consists of facing and solving problems, just as many other human experiences.²² This clarity of purpose in writing about science points towards the awareness of a transformative *praxis* in Levi’s work.

Marx explains that labor is a product of human needs and Leontiev broadens this understanding by stating that all activities require a motive.^{26,27} This is a universal feature of human activities: food production satisfies the need for eating, clothes manufacturing fulfills humans’ need for protecting themselves from the weather, art production satisfies the need for interacting with the world from multiple human perspectives.

Therefore, according to our interpretation, the Marxist category can be mobilized to infer that “The Periodic Table” had human development as its motive; this was the need guiding Primo Levi’s work, although he never declared himself as Marxist. Levi takes scientific and technological culture as object contributing to human development. He designed and triggered a series of actions and means to change scientific and technological culture in order to develop his interlocutors by writing the book. The clear reason substantiating Levi’s activity highlights that the teleological projection process (intellectual anticipation of the produced work), the actions taken and the adopted meanings are intrinsically connected to each other, and it points out his transformative *praxis* aimed at seeking to outspread science by heading towards human freedom and non-oppression. The following excerpt was taken from the Silver chapter and introduces this dimension of Primo Levi’s work in a unique way:

I told him that I was in search of events, mine and others’, that I wanted to put on display in a book, to see if I could convey to the uninitiated the strong and bitter flavor of our occupation, which is a particular case, a more strenuous version, of the occupation of living. I told him that it didn’t seem right to me that the world knew everything about how the doctor lives, the prostitute, the sailor, the assassin, the countess, the ancient Roman, the conspirator, and the Polynesian, and nothing about how we trans-

muters of matter live; but that in this book I would deliberately ignore grand chemistry, the triumphant chemistry of enormous facilities and dizzying profits, because that is collective and therefore anonymous work. I was more interested in stories of solitary, unarmed, pedestrian chemistry, on a human scale, which with few exceptions had been mine: but it was also the chemistry of the founders, who worked not in teams but alone, amid the indifference of their times, for the most part without gain, and who confronted matter without helpers, with their brains and their hands, with reason and imagination.²³

It shows the author's clear and explicit intention to socialize the chemist's trade. This craft is not immersed in the human world, and it requires dealing with stories, concepts, and scientific and technological practices. Levi seeks to broaden his interlocutors' education by seeking to socialize this knowledge, so that they can come to understand the chemist's work. Understanding how to communicate science as *praxis* implies acknowledging that the object (scientific and technological culture) is turned into a process. This transformation derives from the subject/object relationship (in this case, the interaction between Primo Levi, and scientific and technological culture), which must consider the process (work) and the product planned to be objectified (book).²⁷

It is clear that the SC production content is essential, although it is not limited to the scientific-concept approach, as often observed in many SC practices. In addition to SC concepts, as they are currently referred to, Levi stated (in an interview compiled by Poli and Calcagno) that he intended to discuss an important scientific profession, although summarizing his sense of responsibility for outspreading science, as he felt indebted to his profession, which many see as mysterious, arid and suspicious.²² He introduced a whole collection of chemical stories in his book, as well as the contrast between man and matter. In another interview, he stated:

In this book, I have tried to bring to light the nobility of my work, its educational and formative value. [...] the relation between man and matter in the book is ambivalent. Matter is maternal, even etymologically, but it is also inimical. The same goes for nature. And in any case, man too is matter and is thus in conflict with himself, as all religions have acknowledged. Matter is also an education, a genuine school for life. Fighting against it, you mature and grow. In the course of the struggle, you win and you lose. At times, matter seems astute, at others obtuse, and there is no contradiction because the two different aspects coexist.²⁸

In addition to the clear reasons for his activity, this sequence of references by Primo Levi highlights his vision of science scope and social function, which were

acknowledged by other authors who have analyzed his work.^{13,15} These writers also pin pointed the need for science to understand the universe, to understand ourselves, the individual and social development of mankind, and how the specificity of chemists' work relates to this whole universe of information.

Levi's understandable and integrated understanding of science, in combination to his clear reason for communicating science, is far from alienated scientific and technological culture practices. Sometimes, the reason for communicating scientific and technological culture in modern society is based on inaccurate, tautological or singular justifications, such as those given to scientific culture due to scientific production growth, to science complexity or even to make science popular, and to personal or corporate enrichment. None of these justifications essentially embodies a social need. They are particular reasons that, although assumingly relevant in certain cases, do not capture the essence of outspreading scientific and technological culture, which is herein understood as element contributing to individual and collective development, which takes place through science and technology appropriation aimed at human emancipation – this reason is close to Primo Levi's statements.

It is important emphasizing that not all human practices should be interpreted in singular terms, but as reflections of existing social relationships. Therefore, both alienated and transformative/emancipatory practices aimed at achieving science outspread correspond to existing social forms and relationships.

From the Marxist perspective, capital is the main cause of alienated practices. The work process makes workers distant from their product, because their activity is determined by the salary setting the relationship among the producer, the capitalist and the product. On the other hand, transformative/emancipatory practices are based on fighting oppression. Marxism allows inferring that Levi's practice emerges from his experience with oppression and fight for freedom. This same condition, in association with the defense of science, consolidated his reasons for, and commitment to, science communication.

These bases have supported Primo Levi's writing of "The Periodic Table", and they were also expressed in his reasoning about the process to write the text available at "The Complete Works of Primo Levi".²³ Two brief excerpts from this book are provided below. The first one shows the process to overcome the interest in the chemistry profession due to technical procedures, given his passion for relating his social-practice work to his second text in order to deny the book as treatise on chemistry and as autobiography:

I was in love with my work from the first day, although in that phase it was nothing but the quantitative analysis of rock samples: attack with hydrofluoric acid, precipitate iron with ammonia, precipitate nickel (how little! a pinch of pink sediment) with dimethylglyoxime, precipitate magnesium with phosphate, always the same, every blessed day: in itself, it wasn't very stimulating. But both stimulating and new was another sensation: the sample to be analyzed was not an anonymous manufactured powder, a quiz that appeared out of nowhere; it was a piece of rock, guts of the earth, extracted from the earth by the force of an explosion. And, little by little, from the data of the daily analysis, a map emerged, a portrait of the subterranean veins. For the first time, after seventeen years of school, of aorists and Peloponnesian wars, the things I had learned began to be useful to me. Quantitative analysis, so stingy with emotions, as heavy as granite, became lively, true, and useful when inserted in a serious and concrete job. It could be used: it was set in a plan, a tile of a mosaic.²⁹

It is, or would have liked to be, a micro-history, the history of an occupation and its defeats, victories, and sufferings, such as everyone wishes to recount when he feels close to the end of the arc of his career, and art ceases to be long. [...] So it happens, then, that every element says something to someone (something different to each individual), like the valleys or beaches visited in youth. We must perhaps make an exception for carbon, because it says everything to everyone; that is, It is not specific, just as Adam is not specific as an ancestor, unless you can find today (why not?) the chemist-stylite who has devoted his life to graphite or diamonds.³⁰

The second excerpt shows the contradiction between the science approach and the scientist - science moves between errors and successes, i.e., it is a non-linear science production.

Furthermore, the first excerpt also points out a non-fanciful view of the scientific work. It even highlights how discouraging some tasks in science production can be. However, it also emphasizes the charm of understanding nature, since it establishes associations between particular and general elements - rock dust is no longer seen through its own features, but through its association with the social practice, itself. It pinpoints social practices ability to integrate and give meaning to the produced scientific knowledge, another fact that shows Primo Levi's transformative *praxis*.

The aim of this approach lies on critically (not fanciful) making sense of and on understanding how science drives the contribution to the liberating development Levi has clearly shown. This reason manifested itself in the analyzed case, not only in the writing process, but in the very product of it (the book), which was written amidst a transformative *praxis*.

Accordingly, it can be said that Primo Levi has both practical awareness and awareness of the *praxis* he carried out. This statement is made explicit in his book and in his interviews. Such an idea is based on the fact that we understand awareness as our capacity to understand the world through subjective reflections about the objective reality generated by subjects, based on their activities in the world. Practical awareness can be understood as articulation between understanding the process and the intentional chain of actions to teleologically achieve the ends planned at the beginning of the activity.^{21,27} Therefore, practical awareness is observed at the beginning of, and throughout, the production process in order to intervene in the course to objectify his book "The Periodic Table". Awareness of *praxis*, in its turn, refers to the fact that the entire action process is known by the subject who carries it out.²¹ Batista clarified that awareness of *praxis*, the reflective plane (reflective awareness), is only achieved by overcoming spontaneous viewpoints (common awareness). Only, then, it is possible to consciously gather thoughts and actions.³¹

ON THE SUBJECT/OBJECT RELATIONSHIP IN PRAXIS TO ELABORATE "THE PERIODIC TABLE"

Primo Levi's practical awareness and awareness of *praxis* can be observed in his interviews about "The Periodic Table" and in the analysis of his work. The conscious articulation of the book's form and content seeks to outspread the scientific and technological culture. Assumingly, this is the aim of the book, if one bears in mind its target, namely: forming humans through science.

It is important highlighting that scientific and technological culture mastery was elementary condition to write "The Periodic Table". These two elements guided the objects of Primo Levi's productive activity.

It was necessary to dialectically understand the unit of opposites established between subject (Primo Levi) and object (scientific and technological culture) at the time to write the book, since the interpenetration of opposites was essential to objectify his work. The process of having the object penetrating the subject derived from the subject's appropriation of the object, and it resulted from the individual's activity in the world and from its ability to produce a subjective image of the object, based on the highest degree of verisimilitude possible, within historical limits. Subject penetration in the object, in its turn, resulted from the subject's activity in the object to transform it into something different from what it was before the subject's conscious action. Each of these situations will be addressed separately in order to clarify the analysis.

Primo Levi made it clear in an interview that he was fully aware of the object of his activity. He even compared it to the repertoire of other writers who did not master chemistry. He did so, because chemistry was his raw material, his core topic, mainly in “The Periodic Table”.²² Although clarity about the object of the activity was important, it did not imply the appropriation of it. Levi’s appropriation of the scientific and technological culture resulted from his life story. He was already encouraged for and showed interest in science since childhood. Cesare, Levi’s father, was an engineer and voracious reader who used to give his children books as gifts.²³ His book collection included many books on popular science, books translated from the Anglo-Saxon and European tradition of popular science, including some books printed by the Royal Institution. Later on, Levi was awarded with the herein mentioned prize by this same institution.¹³ He included two popular science books in his work: “La ricerca delle radici”, where he highlighted passages and authors that had most influenced his writing and led him to choose chemistry as career, in addition to reasons linked to the fascist context experienced at that time.²⁴ The cases shone light on the popular science work by Sir William Bragg, ‘The Architecture of Things’, since it inspired Levi to become a chemist.³²

There is a brief Levi autobiography in “The Periodic Table”, and it includes some fictional elements, besides the main aspects of his life.³³ Levi had Jewish origin; he was born and lived most of his life in Turin. He chose the scientific career, although he had a broad humanistic education, which was highlighted in the book ‘Le ricerca delle radici’. He understood that chemistry was less contaminated by the fascist ideology observed in his formative years. He graduated with the highest institutional honors and was one of the best students in his course, although his diploma disclosed his “Jewish origin”. He had difficulty in completing mandatory internship disciplines and getting jobs, because he graduated at a time when racial laws were tightened in Italy. He stated in some interviews that he would possibly have become a researcher if he had not been captured and imprisoned in Auschwitz in 1943, at the age of 24. He survived the camp thanks to a series of “fortunate circumstances”²³, including the fact that he understood German, was a chemist and worked in the laboratory. That is why he was less exposed to the cold and to heavy manual labor. It was very hard for him to return to Italy. He described his time in Auschwitz and his return to Italy in his books ‘Is This a Man?’ and ‘The Truce’, which were the first two works of his career as writer, although he was initially only acknowledged as testimo-

nial author. He worked as chemist in paint and varnish factories until his retirement at the age of 56, and this activity was defined as technical by him. He registered a patent (in this sector) and kept on writing alongside his work in the factory, besides intensifying his writings after his retirement. He published more than 10 books in different genres, such as poetry, science fiction, novels, short stories and essays. The book “The Periodic Table”, from 1975, gave him the status of writer. In addition to the broad chemistry expertise shown in his training and performance in the industry, it is important highlighting the “Periodic Table” analyses carried out by scientists focused on scientific concepts, which showed Primo Levi’s exceptional conceptual mastery, as observed in several book chapters by Magro and Sambi.³³

If, on the one hand, Primo Levi’s appropriation of the scientific and technological culture expressed the object’s penetration into the subject of the activity; on the other hand, the subject penetration (Levi) into the object (scientific and technological culture) was the very product of his own activity (book), which was in compliance with the need it was created for. Therefore, Levi’s penetration into the scientific and technological culture takes place as the book is consumed by many interlocutors, as well as contributes to human development, from a liberating perspective.

The aforementioned liberating perspective is disclosed in the book by the precise articulation between science and social practice, or between science and human life. Scientific and technological culture is not substantiated by sensory effects, by ‘showing the extraordinary and inaccessible world of science and technology’. Yet, Levi integrated science to life. An exceptional example of it is clear in the chapter “Carbon”, where Levi describes the story of a carbon atom (generated through a cosmic process, but intentionally ignored by the author), which begins from the composition of a limestone rock. The molecule this carbon atom bonds to is transformed after human action in the limestone production process. This atom is carried by the wind, dissolved in the sea, converted into organic matter, recombined to other atoms countless times, and so on, after existing through the chimney. It goes on, up to the time when, after a series of cycles, it was found in Levi’s body and contributed to placing the final period to “The Periodic Table”.

This integration between science and social practice, or between science and life, crosses the whole book, and it points out that they are one of the main ways through which the author understood science. This science is not limited to verbal or mathematical formulations, but is observed in human reality and takes part of his world-

view. Levi describes the objective of writing the book to a fellow undergraduate in an excerpt from the previous chapter (Silver) and asks him to share a story of this same nature with him, so it could be included in his book:

I told him that I was in search of events, mine and other's, that I wanted to put on display in a book, to see if I could convey to the uninitiated the strong and bitter flavor of our occupation, which is a particular case, a more strenuous version of the occupation of living. I told him that it did not seem right to me that the world knew everything about how the doctor, the prostitute, the sailor, the assassin, the countess, the ancient Roman, the conspirator, and the Polynesian live, and nothing about how we transmuters of matter live; but that in this book I would deliberately ignore grand chemistry, the triumphant chemistry of enormous facilities and dizzying profits, because that is collective and, therefore, anonymous work. I was more interested in stories of solitary, unarmed, pedestrian chemistry, on a human scale, which with few exceptions had been mine: but it was also the chemistry of the founders, who worked not in teams but alone, amid the indifference of their times, for the most part without gain, and who confronted matter without helpers, with their brains and their hands, with reason and imagination.³⁴

Levi referred to a chemistry type linked to the human race. He highlighted its role in society by mentioning the great chemistry and by making other references to social practices throughout the book, while overshadowing the professional dedicated to chemistry. Here, once again, it is clear that scientific concepts are not Primo Levi's exclusive object; the subjects of science must appear in communications about science. Certainly, the approach to chemists in "The Periodic Table" was Levi's way to penetrate the scientific and technological culture. This is even clear in his own words when he stated, in an interview, that one of the best compliments he had ever received came from some young people who wrote to him and said that if chemistry was what he described, they would like to become chemists.²²

FINAL CONSIDERATIONS

The aim of this article was to analyze the book "The Periodic Table" as a product of Primo Levi's *praxis*. It was done as attempt to highlight the reason for his communicative practice in the book and the subject/object relationship involved in his production process. Science outspread as transformative *praxis* in Primo Levi's work and in the subject/object relationship in the *praxis* to elaborate "The Periodic Table", disclosed his practical

awareness and awareness of *praxis*, as it can be seen in excerpts from his book.

According to Levi, human development was the reason for his practice, and it was driven by a liberating perspective, by outspreading a science that could help broadening the concept of world and society. This reason is linked to his biography, both because he had lived traumatic experiences in Auschwitz and because he had worked as chemist. He acknowledged these activities as potential humanizing role in the relationship man establishes with nature and society. This same formative and professional trajectory provided him with great conceptual and scientific expertise, which stands out in his work and is acknowledged by other authors.

Despite the elements explained in the current analysis and the fact that "The Periodic Table" has been awarded as the best science book of all times, it has not been analyzed as SC work. It is partly so, because of a narrow view heading towards scientific-knowledge outspreading. Therefore, one of our main remarks in the current article is that it feels like we could identify two opposite ways of conceiving SC or of providing simplistic explanations for scientific contents by using linguistic and multimedia resources or by introducing science as a way to conceive the world through its practice and culture. Levi's way represents the second and broadest SC perspective. The aim of the present study was to broaden SC understanding as *praxis* based on a case study and to stand against this narrow view of SC and the superficial reasons often linked to it. The herein adopted perspective is part of discussions carried out by other authors who believe in overcoming the PUS and PEST models and in heading towards a broader understanding of scientific culture, although it remains deeply anchored in science itself.^{1,2,3,4}

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FUNDINGS

The study was partly financed by São Paulo Research Foundation (FAPESP), Brazil. Process Number 2023/12333-6. Partly financed also by Minas Gerais Research Foundation (FAPEMIG), Brazil. Process Number APQ-02477-24.