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Cosmology of a congenitally non-visual person

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ABSTRACT

The purpose of this article is to present part of the outcomes of research done in the doctoral thesis and its objective is to understand the perceptions of people who were born blind about the astronomical and atmospheric phenomena happened in the universe. An interview with a non-visual person was part of the methodology. Then, this article sorted seven questions and answers to its analysis through the archaeo-genealogy by Michel Foucault. The answers are the initial comments and added more six about the sky and some of its elements: the clouds, the thunders, the rainbow, the horizon lines and the last question, about the universe. It has been identified the absence of perceptions which were supplemented by intuitive and imaginative discourse in order to make this complex scientific context some sense through whole life, the participant realized that his interest was not permitted whenever questions related to astronomical phenomena and atmospheric were asked. The study concludes the participant that built conceptions about this theme, in a random or systematic way, reached for alternative conceptions based on intuition and imagination to answer questions that required a greater abstraction.
PALAVRAS-CHAVE: Archaeo-Genealogical; Non-visual people; Science teaching.

A cosmologia de uma pessoa cega nativa

RESUMO

Este artigo apresenta parte dos resultados de pesquisa realizada em tese de doutoramento. Seu objetivo é compreender a cosmologia de uma pessoa que nasceu cega sobre os fenômenos astronômicos e atmosféricos. O estudo fez uso da arqueogenealogia como método de investigação científica, e se constitui, portanto, como um estudo qualitativo, com instrumento de constituição dos dados, em formato de entrevista semiestruturada com pessoa invisual. Foram analisadas, à luz da teorização arqueogenealógica de Michel Foucault, as respostas de uma das participantes da pesquisa. As perguntas-respostas abordam os temas: o céu, as nuvens, os trovões, o arco-íris, as linhas do horizonte e o Universo. A análise identificou ausência de percepções, que foram suplementadas por discursividades intuitivas e imaginativas para que esse complexo contexto científico faça algum sentido, sendo que no decorrer de toda a sua vida, a participante percebeu que o seu interesse era interditado sempre que formulava perguntas relacionadas aos fenômenos astronômicos e atmosféricos. O estudo concluiu que a participante construiu conceitos sobre esse tema de forma aleatória ou assistemática, recorreu às concepções alternativas baseadas na intuição e na imaginação para responder a perguntas que requisitavam maior abstração.
PALAVRAS-CHAVE: Arqueogenealogia; pessoas invisuais; ensino de ciências.

INTRODUCTION

> What can be put inside a box, in containment, under domain, preserved and archived? Sunlight, rain, dew? No. Scrap iron, minerals, a decaying animal? Yes. But it is not possible to do so with clouds. Like our souls, they cannot be imprisoned. (Gambini, 2010, p. 151).

It is possible to comprehensively perceive the challenges humanity faces nowadays. Among them, the most prominent one is the pseudosciences, which base themselves on vague, exaggerated, and doubtful statements created to confirm beliefs. These statements, unlikely in the scientific method, arise from certainties, reject doubt, and look for arguments to confirm their theses.

It is known that denialism dismisses rational arguments through selectivity and argumentative misrepresentations. Its logical fallacies trigger false expectations, spread panic, activate defense mechanisms in order to make people more vulnerable to the conspiracy theories' appeals (Caponi, 2020; Pasquim et al., 2020).

Likewise, non-scientific-based news constitute discursive modalities producing emotional impacts through cycles of self-referential enunciation, which feed on people's atavistic fears and the vacuum of certainties and meaning. Consequently, they intentionally produce a cacophony of misinformation, or polyphony of messages, as a panacea for provisional certainties that self-validate and self-impose themselves as a shelter for univocal certainties (Vasconcellos-Silva et al., 2015). In fact, denialism disputes scientific facts to assert arguments supported by imagination.

At the same time, the contemporary society values science as an institution of "truths" spread through images arranged in graphs and tables, which evoke feelings of truthiness when information is understood as scientifically proven (Cazetta et al., 2019).

Through the aesthetics of images, scientific discourses establish 'realities' that generate and disseminate statements, extending their reach beyond scientific circles. These are visual resources dramatically portrayed in photographs of dark clouds, with lightning striking over large cities, illustrating the dramatic consequences of the climate crisis. In contrast, images of people riding bicycles or exercising under a nearly cloudless sky suggest a balanced ecological relationship between humans and nature.

These discourses are visual resources that evoke instinctive feelings in people. When portraying dangerous situations, image-discourses become a powerful tool of control by clouding judgment and triggering people's defense mechanisms. As a result, they often function as "*Dominant Body-Discursive* resources [...] as if the images were given the *status* of densifying reality [...] about global warming' (Cazetta et al., 2019, p. 24, emphasis added). This operates similarly to how they reinforce negative perceptions of bodies deemed dispossessed or outside society's accepted norms.

Faced with these "truths", the scientific literacy of non-visual people[1] can be a challenge for educators. This challenge becomes even more significant when considering the inclusion initiatives that have emerged and taken shape (or are still in the process of doing so, as some may disagree) in recent decades. These initiatives have been transformed into public policies that advocate for

universally accepted truths, with the aim of fostering widespread adherence. They underscore the importance of an educational approach that fosters behaviors within schools to promote and value human diversity. However, within this inclusive paradigm, a paradox can be identified as it denies individual differences in favor of a purported notion of diversity. This is because this concept of inclusion upholds the rules of normality dictated by a neoliberal and globalized societal agenda, but which requires large-scale implementation to achieve this goal.

In the classroom, when Astronomy concepts are introduced, engaging representations often arise from meticulously constructed models. In fact, these models have been highly valuable for science education. Yet, modeling practices present dilemmas that must be addressed, as they stem from the notion of empirically representing astronomical and atmospheric phenomena. This approach to teaching can facilitate the development of alternative conceptions in science teaching, influenced by common sense, that is, an “anti-science”.

To fully understand the experience of a non-visual individual, one must appreciate that it is not possible to physically interact with objects in the same way one might touch a tree, for example, and compare it to a model. Outer space, in particular, cannot be directly touched. By using a styrofoam ball to represent the Earth, a visually impaired person can conceptualize the Earth as having tactile characteristics similar to those of the styrofoam.

Therefore, while teaching is inherently challenging, instructing non-visual individuals about astronomical phenomena demands a thorough and thoughtful approach from educators. Certainly, educators need to question and investigate: how to integrate non-visual people’s learning styles into teaching activities? What approaches to teaching and methodologies can support the development of systematized knowledge within the school environment? These are questions that should guide science educators teaching non-visual individuals.

COSMOLOGY

Blind cosmology is here examined through the lens of perspectivism, as articulated by Friedrich Nietzsche, which posits that one’s perception of the world is not divided into a real world and an apparent one (Maués, 2012). Therefore, contemplating cosmology involves considering multiple possibilities grounded in both socially shared doubts and certainties. This approach is analogous to the Amazonian cultural perspectives, which do not distinguish between humanity and nature, or the Makuna culture’s view of the inseparability between reality and the subject. In this interconnectedness, dreams and reality, thoughts and beliefs, actions and words are intertwined, shaping both past and future in a continuous, bilinear time. This concept reflects a characteristic of the Juruna culture, which may describe *events that occurred ‘tomorrow*’. (Lima, 1999; Maués, 2012).

In this context, cosmology constructs myths and superstitions—such as the werewolf (a man who transforms into a beast) or the boto (an animal that becomes a human)—as systems of interchangeability between beings and objects. In this case, mutations are triggered by the full moon; a striking feature

of Kaingang culture is the harmonization of these opposing elements (Maués, 2012; Silva, 2002).

In indigenous societies, both humans and animals play integral roles in the formation of the cosmos, reflecting a continuous process of reciprocity between society and nature. This contrasts sharply with Western perspectives, which traditionally emphasize a dichotomy between technological practices and supernatural beliefs. (Maués, 2012; Silva, 2002).

Cosmology can be deemed as an idiosyncratic perception formulated by individuals embedded within specific geographic and historical contexts, but who formulate meanings about the Universe through their cultural framework and mediated by language.

For this study, "blind cosmology" refers to a *unique* form of subjectivation developed by individuals who are congenitally blind. This form involves engaging with and interpreting socially constructed meanings about the cosmos—specifically celestial bodies and cosmic events—in a culture that predominantly values sight as the primary sense.

NON-VISUAL PEOPLE

As this study focuses on non-visual people, it is necessary to clarify some aspects of this condition.

According to data from a 2010 survey carried out by the Brazilian Institute of Geography and Statistics (IBGE), approximately 20% of the Brazilian population can be considered visually impaired (Garcia & Braz, 2020). Visual impairment encompasses changes, degenerations, atrophies, or permanent lesions leading to either blindness or low vision. These impairments can occur either congenitally, from birth, or adventitiously, due to organic causes or accidents occurring after birth. Blindness is defined by severe or total loss of vision, whereas low vision refers to a significant reduction in visual acuity. (Garcia & Braz, 2020).

Public policies yearn to standardize human peculiarities in order to establish an uncontroversial concept of visual impairment. However, this effort is inherently challenging due to the statistical variability among individuals, which leads to conflicting interpretations. This issue arises when attempting to categorize subjective experiences.

> Currently, it is estimated that 285 million people worldwide are visually impaired, including 39 million who are blind and 246 million who have low vision. Of this total, approximately 90% of them reside in developing countries. In Brazil, according to the Brazilian Institute of Geography and Statistics, there are approximately 6 million people with low vision and 500 thousand blind people. According to IBGE data, people who carry visual impairment that can be treated with optical instruments accounts to around 29.2 million individuals. However, they cannot be legally classified as visually impaired people under the Brazilian Federal Government's executive order no. 5,296 of 2004 (Buzzá et al., 2018, p. 18).

The discrepancies between the data presented by Garcia and Braz (2020) and Buzzá et al. (2018) arise from the differing *interpretations of data extracted* from the 2010 IBGE Census. In this survey, respondents were asked to categorize their difficulty in seeing into one of three options: a) "some difficulty," b) "great

difficulty," or c) "can't do it at all." The inclusion of the "some difficulty" category by Garcia and Braz led to a significant discrepancy in the results compared to those of Buzzá et al., who did not consider this category in their analysis (Brazilian Institute of Geography and Statistics [IBGE], 2011).

It can be argued that the inclusion of the category "some difficulty" (item a) introduces greater rigor by accounting for subjective aspects that are not captured by the standard metrics used in measuring visual conditions or by public health campaigns aimed at preventing blindness.

In light of this controversy, this research project uses the data available on the IBGE *website* in its entirety, without modifications. This approach is preferred because Executive Order No. 5,296 of 2004 characterizes visual conditions through a biomedical model, whereas the 2010 Census employs criteria more aligned with the Social Model of Disability, as endorsed by Law No. 13,146 of the 6th of July of 2015 (Statute of Persons with Disabilities):

> A person with a disability is the one who has a long-term physical, mental, intellectual, or sensory disability, which, in interaction with one or more barriers, may hinder her full and effective participation in society on equal terms with other people (Law n. 13.146, 2015).

It is evident that education systems have historically not been designed to accommodate students with disabilities. These students have often been relegated to charitable or custodial settings, based on the belief that their disabilities would be a form of inherent sin. It can be inferred, however, that a visiocentric (Lima; Magalhães, 2018) or visuocentric (Moraes et al., 2016) discourse prevails among groups that use deficiencies in sensory, motor, and cognitive diversity as criteria for distinguishing between "normal" and "abnormal" individuals.

Considering blindness as a form of existence within a diverse spectrum of sensory experiences that extends beyond vision is a significant contribution of feminist studies. This perspective, grounded in the development of new paradigms, has led to a novel strand of post-colonial research. It facilitates a distinction between sex (biological) and gender (sociological), as well as between impairment (nature) and disability (social) (Diniz, 2003; Lima & Magalhães, 2018).

This approach conceptualizes disability as a disadvantage experienced by individuals with impairments within a society that imposes barriers. It proposes a redefined meaning for the term "deficient," which is applied to bodies in need of correction through a normalizing process. This process aims to standardize modes and means of perception, action, and interaction, aligning them with a vision-centric linguistic framework (Lima & Magalhães, 2018; Moraes et al., 2016).

In this context, blind individuals are situated within educational environments where their needs must be acknowledged, and their valuable knowledge should be both recognized and appreciated within the school setting. For this reason, this study focuses on blind individuals' perceptions of the universe and the phenomena within it, since many research projects focus on teaching methods and techniques tailored for blind individuals, despite the existing literature on their learning processes and knowledge being relatively limited.

This underscores the significance of this research project, as the perceptions of individuals with non-visual experiences are often overlooked, as if they were incapable of formulating concepts about the universe. Thus, the central question guiding this project is: *What are the perceptions of individuals who were born blind regarding astronomical and atmospheric phenomena occurring in the universe?*

In this paper, part of the *corpus* from the author's PhD research project, defended in 2019, is utilized. That research project aimed to understand how congenitally non-visual individuals perceive astronomical and atmospheric phenomena.

METHODOLOGY

This study is grounded in archaeo-genealogy, a framework that combines two key axes of Michel Foucault's theories. Archaeo-genealogy examines issues at their origins, providing a critical analysis of the historical and genealogical foundations of problems. This method takes, as a point of intersection, two concepts of great relevance in the philosopher's thought: "archaeology" and "genealogy" (Chaves, 2016).

It is well-known, however, that research employing the Foucauldian method does not adhere to *predetermined* models or established frameworks, particularly because it "resists predefined intellectual paradigms and claims of neutrality and critical *distance from conventional fields of inquiry*" (Magalhães Cunha, 2014, p. 187, highlighted by the author).

From a genealogical perspective, all established causal relationships are questioned. This approach encourages researchers to engage in a more open and exploratory research activity, fostering the development of new epistemological paradigms and engaging with controversial and evolving knowledge. "History, therefore, is constantly changing; it is a metamorphosis rather than a continuity. Consequently, it is discontinuous and shaped unpredictably by events" (Lemos & Cardoso Júnior, 2009, p. 354).

The discussion begins with the polysemically reinterpreted method within a non-Enlightenment framework, conceptualized as the establishment of a novel grammar leading to an unpredictable trajectory that revises historical narratives. This approach necessitates careful attention to historiographic pitfalls. Thus, it seems that the theory only reveals itself a *posteriori*, serving as a framework that was not initially intended to guide the investigation." (Veiga-Neto, 2009, p. 91).

The PhD research project was conducted during the first term of 2018. It involved two congenitally non-visual individuals. The interviews took place in different moments at the Braille Library, located within a Convention Center in the central region of Belém do Pará, Brazil. With the participants' consent, they signed an Informed Consent Form. The interviews were then recorded and subsequently transcribed, forming the *basis* for the analysis.

Out of a total of 12 original questions and answers, this article presents the initial comment and six additional responses from one of the participants, selected due to space constraints. These responses pertain to various aspects of

the sky and its elements, including clouds, thunder, rainbows, horizon lines, and, in the final question, the Universe.

Initially, a preliminary conversation was conducted to establish rapport between the researcher and the participant. This interaction facilitated the acquisition of the participant's profile.

Heloisa[3], a 22-year-old massage therapist, has graduated from high school and from a technical course. She has been blind since birth, a condition she attributes to retinal detachment. She also reported having attended a school for blind people for several years. She learned Braille at the age of 6, began using a cane when she was 9, and started going out independently when she was 16.

ARCHAEO-GENEALOGICAL ANALYSIS

A post-critical analysis was chosen for this study, as the focus thereof is not on uncovering objective truths about the objects in question, but on proposing their visibility. This approach involves establishing ways of seeing and doing, combined with a form of expression specific to blind individuals. It is based on the premise that languages, in addition to representing realities, also contribute to the creation of new ones.

While acknowledging that the interviewee should not be viewed as a mere repository of objectively extractable information, it is also recognized that the interview constitutes a constructively and interactively produced discourse (Bastos & Santos, 2013). To mitigate any potential "surprise effect" given the specificity of the subjects, Heloísa was provided with some questions in advance. This approach aimed to ensure she was prepared for the topics to be discussed during the interview. Despite this preparation, she expressed some apprehension as the discussion commenced and initially made the following comment.

About the set of questions,

> *[...] how am I going to answer that?!*

As a result, questions formulated within the scope of Astronomy may elicit a degree of concern, as the subject is often perceived as being primarily within the domain of scientists. Nonetheless, daily updates on discoveries from manned and unmanned space missions, satellites, and space probes are widely disseminated by the media. This information is often made accessible to an audience that may lack a systematized understanding of the content needed to fully interpret its complexity.

The introduction to the interview reveals indications of device elements, both "said and unsaid", including "discourses, institutions, architectural organizations, regulatory decisions, laws, administrative measures, scientific statements, and philosophical, moral, and philanthropic propositions." (Foucault, 1979, p. 244), which, according to Foucault, establish truths. In this context, the prevailing notion appears to be that only those with specialized knowledge are capable of discussing the Universe.

THE SKY

> *Oh, my God, that is hard! As children, we are often taught that the sky—commonly referred as heaven—is akin to a house, where one goes after death and remains there. But Heaven, nowadays, it is very different... In this case, Heaven for me... there is no difference between heaven and earth, because God... he is present everywhere. So it is as if Heaven were close, but not as far as we see it.*

Heloísa's concept of sky has been subjectified within the Judeo-Christian cosmological perspective. According to Michel Foucault, "subjectification" refers to the process through which individuals are constituted as subjects. In her discourse, the frequent use of mystical or religious expressions can be seen as an intuitive strategy to organize her thoughts and provide coherence to the linguistic universe that encompasses numerous allusions to the heavens.

This excerpt highlights that Heloísa articulates a shift from the conception of a distant sky, which she internalized as a child, to a religiously informed perception of an omnipresent sky. Despite this shift, the sky remains perceived as equidistant. Religious knowledge significantly influences worldviews, yet for Heloisa, it manifests with particular intensity, seemingly due to the tacit and recurrent refusals by society to grant her access to such scientific knowledge.

> Under the surface of what is manifested, the semi-silent conversation of an alternative discourse is not pursued: it is necessary to demonstrate why this particular discourse could not be replaced by another one, how it excludes all others, and how it occupies a unique position among related discourses that no other can fill. (Foucault, 1987, p. 31).

Otherwise, these statements outline the contextual possibilities in Heloísa's discursiveness. As a woman, historically marginalized as part of an inferiorized majority, and as a non-visual person under similar conditions, religious discourse presented itself as the only possibility of enunciability for her.

THE CLOUDS

> *Look, no one has ever described me **yet**, but usually they say it's a "black thing", which is kind of like walking in a circles.*

From this excerpt, a paradox can be apprehended in Heloísa's discourse: while she unconsciously reveals a lack of intentionality and investment in her formal teaching, she also highlights the absence of commitment to providing information about atmospheric phenomena. In the adverb "yet", she unintentionally states her hope of one day accessing the information hitherto privileged for non-visual people. "This means that you cannot talk about anything at any time; it is not easy to say something new; it is not enough to open your eyes, pay attention, or become aware, so that new objects soon light up and, on the surface of the ground, release their first clarity" (Foucault, 1987, p. 51).

In the same vein, it can be said that it is not only the aspect related to the time period that shapes it, but also that contextual factors influence what one says and what can be said. Thus, unsightedness, even when mistakenly converted into a disease by common sense, was historically characterized as a deficiency conforming the epitome of present time, marked by the stigma that presupposes the impossibility of seeing with the inability to know.

Therefore, the phenomena that Heloísa cannot see might indeed be known to her when the epistemological spectrum of present time—which alternately views unsightedness as a disease or a disability—triggers seismic shifts that challenge the assumptions of impossibility and incapacity associated with non-visual individuals. One should not wait for ruin to arise spontaneously or naturally; unlike seismic tremors, which cannot be avoided but can be predicted, the episteme of an era is modified by this relational bundle, which suggests alternative ways of thinking about what is considered thought and determined.

THE THUNDERS

> *They usually **say** it's lightning, right? Like a fire, they sometimes say that if it catches you, [you] die.*

It is highlighted in this excerpt the importance of language, in contrast to compensatory theories of the senses, which are based on the assumption that the absence of one sensory modality would naturally enhance the other senses. The verb "to say" is conjugated in the third person to encompass the narratives that attribute meanings to the atmospheric phenomenon that was inquired about.

> Language provides continuity to the perpetual rupture of time by linking it with space. It is through analyzing, articulating, and framing representation that language has the power to connect knowledge of things across time. With language, the confusing monotony of space is fragmented, while the diversity of sequences is unified (Foucault, 1999a, p. 160).

Thunder is known to be an atmospheric phenomenon with predominantly audible characteristics, producing a loud noise due to the sudden heating and expansion of air. Thus, the expectation raised by the question would be a sonic description, but this was contradicted by a statement based on the random descriptions of the speakers.

THE RAINBOWS

> *They never explained it to me, but, in fact, I've always been curious to know, but usually **people can't describe** some things to me and nowadays I don't ask so much [...]; they say they can't explain it to me, that this is a difficult thing to describe.*

From this excerpt, it can be inferred that Heloísa acknowledges her condition of not knowing. It is observed that there is no attempt to describe the atmospheric phenomenon; her alleged curiosity waned after her unsuccessful attempts to understand it. It is important to note that her statement reveals more than a presumed epistemological resignation, as it places her in a state of incapacity, preventing her from forming perceptions about the phenomena she observes, without the ability to see.

The description of these phenomena is crucial for Heloísa to fulfill the basic requirements for forming cosmological concepts. Her account reveals the challenges faced by people who see in accurately describing these phenomena. It is assumed that these difficulties stem from an imagined society organized primarily through visual images at the expense of narratives, leading to a impoverishment of language and a decline in imagination.

To think of oneself as a subject of knowledge and to consider oneself as a cognizant person capable of forming perceptions about the objects of astronomy exemplifies parrhesia. This is because it breaks with the boundaries that define the place of knowledge and, especially, ignorance for the non-visual person in a predominantly ocularcentric society, in the manner of Cartesian thought.

> Genealogy would thus be, in relation to the project of integrating knowledge into the power hierarchy inherent to science, a kind of endeavor to desubjectify historical knowledge and make it free—capable of opposing and resisting the coercion of a unified, formal, and scientific theoretical discourse (Foucault, 1999b, p. 16).

This analysis does not aim to delve into the minutiae of Heloísa's statements. Instead, it seeks to explore the possibilities within a field of knowledge that is sparse for non-visual individuals. However, her determination to overcome the numerous physical obstacles encountered in reaching one's presence as an autonomous and independent person was not sufficient to overcome the inability to formulate even random knowledge about these phenomena.

THE HORIZON LINES

> *I've heard about it, I haven't seen it, but the curiosity never went away, as I've already told you... because I asked a lot of things, I wanted to know what the sky is like, I wanted to know what the clouds were like, the sun, the other planets, but a lot of people told me, that they didn't know how to explain it, that they didn't have the right answer to give me, and then with that I stopped asking a lot of things. [...] they usually say like this: I don't even know how I'm going to explain this to you; because some things can't be explained. Then I say: come on, explain it!*

According to Foucault, knowledge is inherently linked to power relations. Thus arises the need to analyze forms of knowledge dominated or delegitimized by science—the body of local knowledge considered outside the realm of scholarly erudition, disqualified, and restricted by the logic of common sense. It is from this discursive dispersiveness that the focus shifts to the minutiae of "trivial" knowledge, and this "smallness" is examined as an archaeological condition for discourse analysis (Portocarrero, 1998).

It is important to critically examine the popular saying repeated for generations: "Knowledge liberates, and ignorance imprisons." The fact is that knowledge in a capitalist society is permeated by numerous coercions, which produce forms of knowledge aimed at creating docile and obedient bodies (Portocarrero, 1998).

It remains archaeologically questioned: *how*, in today's society, non-visual individuals came to be classified as visually impaired? How did they fall into the category of not knowing? *Why did* sighted attain the *status* of information providers? What decisions were made to subjugate this category of people to a naturalized *nonsense* ? "[...] that is, the bundles, mechanisms, the entire technique that ensures a decision is accepted and could not have been made any other way" (Portocarrero, 1998, p. 51).

Heloísa's expressed desire to understand the phenomena of the skies and the Universe contrasts with society's tacit refusal to grant her this knowledge. This situation also calls for an archaeological inquiry into the power techniques

used to establish hierarchies of competence, which reserve for non-visual individuals a normalized incapacity perceived as self-evident. In this context, it implies that non-visual individuals are naturally incapable of understanding certain phenomena or practicing certain professions—such as being a photographer or an astronomer.

> Knowing consists, therefore, in relating language to language. In restoring the vast, uniform plain of words and things. In making everything speak. That is, in bringing forth, above all marks, the secondary discourse of commentary. What is intrinsic to knowledge is neither seeing nor demonstrating, but interpreting (Foucault, 1999a, p. 55).

How have strategies for exercising power over non-visual individuals developed throughout discontinuous periods of time? The past indicates that it has not always been this way. This changed with the rise of the Enlightenment, when medical knowledge was granted the authority to define the realms of possibilities and impossibilities for non-visual individuals.

THE UNIVERSE

> *The universe is very vast; it is immense. Yet, at the same time it is small. There are times when one cannot **imagine** that things can be so far away—things one never **imagined** could happen often do occur, things one has never considered in life.*

It is observed that the concept of the Universe for Heloísa remains in the realm of abstraction. There is a noticeable absence of these contents, which, as previously mentioned, should have been covered in school. However, these are often neglected in the science subjects that make up the curriculum of the early years of elementary school.

On the other hand, when astronomical references are included in high school curricula, they are often mathematized. Although Astronomy is inherently interdisciplinary, it is primarily taught by Physics teachers who include astronomical information in some textbooks, followed by exercises requiring mathematical calculations.

Given the absence of astronomy content, Heloísa once again turned to her imagination to address a conceptual gap. However, it is considered that this is indeed a very difficult question to answer (about the Universe), primarily because the term “Universe” can encompass multiple meanings. In this sense, it is observed that

> things and words are intricately interwoven: nature only manifests through the filter of names, and it, without such names, would remain mute and invisible. It glimmers from afar, behind them, continuously present beyond this grid that, however, presents it to knowledge and only makes it visible when it is fully traversed by language (Foucault, 1999a, p. 222).

It is emphasized that language, as an exclusively human tool, is essential for teaching, especially Astronomy, given that it deals with concepts that are highly complex and abstract, such as the concept of the Universe. In this sense, language becomes essential for the constitution of meanings that enable the constitution of a coherent perception.

FINAL CONSIDERATIONS

It is considered that the discursiveness of the interviewee, who is an non-visual individual, regarding astronomical and atmospheric phenomena, is deeply influenced by religiosity and mysticism. It is presumed that these motivations find their place in the shortcomings of the educational system, which has flagrantly failed, at least with Heloísa, to convey scientific content. This failure has left her vulnerable to narratives that promise miraculous cures or the promise of a fulfilled life after death. This is why her intrinsic religiosity was significant in attempting to fill the scientific gaps.

Alternatively, one can discern her implicit dissatisfaction with the inconsistency of this information. Her unease with the inconsistencies in mythological narratives, which address another human need—providing solace through faith in the face of death—becomes apparent.

It can be said that science addresses another facet of the human condition: the unease in the face of the unknown. This constitutes another aspect in Heloísa's accounts, which can be linked to her frustration with the lack of scientifically reasonable information or the incongruence of explanations. This led her to repeatedly turn to imagination in her narratives.

Thus, it can be observed that her perceptions of astronomical and atmospheric phenomena are influenced by mystical, religious, and imaginative aspects. It is within this triad that Heloísa relies to make sense of the phenomena around her—phenomena she hears about and discusses but does not attribute scientific meanings to.

In turn, some fragments of explanations have allowed her to form approximate versions of certain phenomena, such as clouds. Conversely, her perception of atmospheric phenomena, such as rainbows and horizon lines, has been obstructed by the school's negligence and society's refusal to impart this knowledge.

It is concluded that her perceptual formulations of these astronomical and atmospheric phenomena are permeated by relations of knowledge and power. Sighted individuals, sometimes even unwittingly, subordinate non-visual people either through the explicit refusal to transmit this knowledge or through the careless manner in which it is communicated.

It is considered that the conceptual void to which Heloísa was relegated underpins her inclination towards cosmogonic thinking, as opposed to cosmological thinking. While the latter is based on rationality, the former is composed of mythic thought that, in some way, structures, organizes, and provides meaning, albeit simplistically, to the Universe surrounding her.

It is understood that inclusive propaganda cannot serve as a panacea for resolving crucial issues in education. Among these issues, scientific literacy stands out as crucial for combating scientism, which is an excessive belief in science as the sole solution to the problems of today's civilization, as well as its opposite, anti-scientificism, which relies on denialism and self-truth to reject scientific evidence.

However, it cannot be forgotten that power produces knowledge within the relations that legitimize it. Therefore, scientific knowledge cannot be viewed as aseptic, as it is embedded with various interests—both legitimate and illegitimate—competing for validation, recognition, and visibility, which are attributes associated with the *status* of scientific truth.

Thus, for the social inclusion of non-visual individuals to be realized, it requires much more than the mere sharing of physical space. An epistemologically inclusive environment is necessary to ensure that access to knowledge for non-visual individuals is granted without obstacles. This underscores the need for educational inclusion, which necessarily includes scientific literacy. The responses provided by the participant in this research highlighted the difficulties that sighted individuals face in formulating and verbalizing scientifically valid concepts about the phenomena of the Universe.

It is concluded that there is a need for a genuinely inclusive astronomy education that comprehends the interaction between cosmology and cosmogony. Together, these two elements encompass two important attributes: logic and speculation. This brings individuals back to the origins, when their ancestors observed the skies for multiple reasons, speculating about their mysteries to understand their location, seeking simple pleasure, or in search of survival.

NOTES

1. This paper derives from a doctoral thesis defended in 2019.

2. “Non-visual” was chosen instead of the usual term “visually impaired” to mark a perspective that contrasts with the medical-clinical model. It is also important to mention that there is a legal framework, Executive Order No. 5.296, of the 2nd of December of 2004, which parameterizes visual impairment, based on the medical-clinical substrate constituted by ophthalmology. Even while diverging from this model, it remains a reference due to its legal dimension. For more information, see: Decreto No. 5.296 (2004).

3. The participant is named Heloísa herein to protect her identity. The research was approved in the comprehensive opinion of the Research Ethics Committee, number 4.029.5581.

4. This paper was translated by Paulo Garcia de Almeida.

REFERENCES

Bastos, L.C. & Santos, W.S. dos. (2013). *A entrevista na pesquisa qualitativa*. Rio de Janeiro: Quartet, Faperj. https://bit.ly/3GZiF7R

Buzzá, H. H. Campos, C. P., Requena, M. B., Andrade, C. T., Leite, I. S., Fortunato, T. C., Stringasci, M. D., Geralde, M. C., Faria, C. M., Correa, T. Q., Romano, R. A., Rosa, R. G. T., Ono, B., Oliveira, B. P., Camargo, E. P. & Kurachi, Cristina. (2018). Preparação de material tátil-visual torna o ensino dos conceitos de óptica acessível para pessoas com deficiência visual – Exposição “Luz ao Alcance das Mãos” *A Física na Escola*, *16*(1), 36-42. https://repositorio.usp.br/item/002889015

Caponi, S. (2020). Covid-19 no Brasil: entre o negacionismo e a razão neoliberal. *Estudos Avançados*, *34*(99), 209-224, DOI: https://doi.org/10.1590/s0103-4014.2020.3499.013

Cazetta, V., Viviani, L. M. & Antunes, D. de M. M. Visual education and climate change: the invention of global warming. (2019). *Pro-Posições*, *30*, 1-26, DOI: https://doi.org/10.1590/1980-6248-2017-0172

Chaves, V.C.B. (2016). *Arqueogenealogia, soberania e disciplina*: *uma problematização das passagens no pensamento de Michel Foucault*. 2016. [Dissertação de Mestrado, Universidade Federal de Pernambuco]. https://repositorio.ufpe.br/handle/123456789/29602

Decreto n. 5.296, de 2 de dezembro de 2004. (2004). Regulamenta as Leis nos. 10.048, de 8 de novembro de 2000, que dá prioridade de atendimento às pessoas que especifica, e 10.098, de 19 de dezembro de 2000, que estabelece normas gerais e critérios básicos para a promoção da acessibilidade das pessoas portadoras de deficiência ou com mobilidade reduzida, e dá outras providências. Presidência da

República.
http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2004/decreto/d5296.htm

Diniz, D. (2003). Modelo social da deficiência: a crítica feminista. *SérieAnis*, *28*, 1-10, http://www.anis.org.br/serie/artigos/sa28(diniz)deficienciafeminismo.pdf.

Foucault, M. (1987). *A Arqueologia do Saber*. Translated by Luiz Felipe Baeta Neves. (7a ed., 3a reimp.). Rio de Janeiro: Forense Universitária.https://bit.ly/3p9WXbx

Foucault, M. 1972. *História da loucura na idade clássica.* Translated by José Teixeira Coelho Netto. São Paulo: Perspectiva, Éditions Gallimard, (Collection Studies Directed by J. Guinsburg). https://bit.ly/3pa77Ja

Foucault, M. (1979). *Microfísica do poder*. Organização, introdução e Revisão Técnica de Roberto Machad. Rio de Janeiro: Graal. https://bit.ly/3qbwoSh

Foucault, M. (1999a*). As palavras e as coisas*: uma arqueologia das ciências humanas. Translated by Salma Tannus Muchail. (8a ed). São Paulo: Martins Fontes, (Coleção Tópicos). https://bit.ly/3q8dWdw

Foucault, M. (1999b). *Em defesa da sociedade*: curso no Collége de France (1975-1976). Translated by Maria Ermantina Galvão. São Paulo: Martins Fontes.

Gambini, R. (2010). Com a cabeça nas nuvens. *Pro-Posições*, *21*(2), 149-159. https://bit.ly/3mhaXhH

Garcia, F. M. & Braz, A. T. A. M. (2020). Deficiência visual: caminhos legais e teóricos da escola inclusiva. *Ensaio: Avaliação e Políticas Públicas em Educação*, *28*(108), 622-641, DOI: https://doi.org/10.1590/s0104-40362020002802399.

Instituto Brasileiro de Geografia e Estatística. (2011). *Censo 2010*: características da população e dos domicílios. Resultados do Universo. Brasília, DF: IBGE,

Lei n. 13.146, de 6 de julho de 2015. (2015). Institui a Lei Brasileira de Inclusão da Pessoa com Deficiência (Estatuto da Pessoa com Deficiência). Presidência da República. https://www.planalto.gov.br/ccivil_03/_ato2015-2018/2015/lei/l13146.htm

Lemos, F. C. S. & Cardoso Júnior, H. R. (2009). A genealogia em Foucault: uma trajetória. *Psicologia & Sociedade*, *21*(3), 353-357, DOI: https://doi.org/10.1590/S0102-71822009000300008.

Lima, B. F. A &; Magalhães, I. (2018). Ordem Visiocêntrica do Discurso: uma proposta de reflexão teórica sobre os letramentos de pessoas com deficiência visual. *DELTA*: *Documentação de Estudos em Lingüística Teórica e Aplicada*, *34*(4), 1.045-1.070, DOI: https://doi.org/10.1590/0102-445025160055960627.

Lima, T. S. (1999). Para uma teoria etnográfica da distinção natureza e cultura na cosmologia juruna*. Revista Brasileira de Ciências Sociais*, *14*, 43-52. http://www.scielo.br/j/rbcsoc/a/gW8xqx7XPTFnN3wv3FBVy9w/?lang=pt

Magalhães Cunha, A. C. (2014). A Arqueogenealogia como ferramenta de pesquisa no campo da Atenção Psicossocial. *Revista Ciências Humanas*, *48*(2), 186-203, https://bit.ly/3IaTXC1

Maués, R. H. (2012). O Perspectivismo indígena é somente indígena? cosmologia, religião, medicina e populações rurais na Amazônia. *Revista de Ciências Sociais*, *17*(1), 33-61. https://ojs.uel.br/revistas/uel/index.php/mediacoes/article/view/2012.v17n1p33

Moraes, M. O. et al. (2016). PesquisarCOM: efeitos de uma oficina de experimentação corporal com pessoas cegas e com baixa visão. *Pesquisas e práticas psicossociais*, *11*(1), 147-160.

Pasquim, H., Oliveira, M. & Soares, C. B. (2020). Fake news sobre drogas: pós-verdade e desinformação. *Saúde e Sociedade*, *29*(2), e190342. DOI: https://org/10.1590/s0104-12902020190342.

Portocarrero, V. (1998). *Filosofia, história e sociologia das ciências I*: *abordagens contemporâneas*. Rio de Janeiro: Fiocruz. https://bit.ly/37jhCTV

Silva, M. L. B. da. (2019). *O discurso cego sobre o universo*: *narrativas invisuais sobre o espaço sideral*. [Tese de Doutorado, Universidade Estadual Paulista].

Silva, S. B. da. (2002). Dualismo e cosmologia Kaingang: o xamã e o domínio da floresta. *Horizontes Antropológicos*, *8*, 189-209. http://www.scielo.br/j/ha/a/YPFRvPpqwtFFpGT9pNqttMm/?lang=pt

Vasconcellos-Silva, P. R., Castiel, L. D. & Griep, R. H. (2015). A sociedade de risco midiatizada, o movimento antivacinação e o risco do autismo. *Ciência & Saúde Coletiva*, *20*(2), 607-616, DOI: https://doi.org/10.1590/1413-81232015202.10172014.

Veiga-Neto, (2009). A. Teoria e método em Michel Foucault (im)possibilidades. *Cadernos de Educação*, (34), 83-94, DOI: https://doi.org/10.15210/caduc.v0i34.1635

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