

PHILOSOPHICAL ASPECTS PRESENT IN QUESTIONS REGARDING MATHEMATICS TECHNOLOGY AND EDUCATION

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ABSTRACT. This article discusses how intentionality shows itself in cyberspace reality, where the phenomenon perceived stands out in the modern, contemporary life-world. We analyse the manifestation of human intentionality with the cybernetic life-world, based on a film (*Dèjá vu*, 2006), and underline the idea that this life-world we address sustains teaching and learning actions, among which to educate mathematically, to educate at distance and perceive the other as an equal, when being with the other who presents him/herself in the computer, through currently accessible gadgets. Moreover, we understand that this discussion opens new educational possibilities, to which we have to devote our attention.

Keywords: *mathematics education; technology; cyberspace; phenomenology; intentionality.*

Philosophical Perspectives and the Question Guiding this Investigation

The question that fosters this investigation is: how does intentionality present itself in the cyberspace reality where the action of communicating with other human beings, in particular the action of communicating mathematically, with the support of the computer and the auxiliary scientific and technological gadgets? Why do we pose this question? Because we are puzzled by the fact that people spend hours facing a computer screen dialoguing with software, unveiling ways to operate them or having fun playing games, or communicating with other people, known to them or not — or even trying to learn something in e-learning scenarios. Remaining seated in front of a screen, eyes fixed on what it shows, attentive, following directions and information of all sorts, as well as engaging in dialogues that unfold in this kind of environment, may be a strenuous endeavour.

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It is in these efforts that our psychophysiological and intellectual stamina wears out. The own body, in its physical, psychic and spiritual totality, feels the effects of this undertaking. In such scenario, a question arises within us: then what keeps us connected, that is, attentive? We believe that it is intentionality. We must now leave it perfectly clear that, according to the conception we are working with, intentionality is no synonym of intentional act. We are talking about intentionality as conceived under Husserlian phenomenology. Below we underline some of the phenomenological ideas with which we work, though not in full detail, due to space limitations for this article:

- Intentionality. Chiefly in the thoughts of its founder, Edmund Husserl — is a characteristic of consciousness, and defines extending one's self to what lies within the field of view, bringing back what is seen to one's consciousness, which works out what is perceived based on the completion of the acts of precisely what is perceived (intuiting, fantasizing, abstracting, counting, organizing, etc.). It sustains our movement towards what is seen and the pathway back, holding what is perceived in our perception — hence the statement that consciousness embraces the totality of the world.

- Perception. The act of perceiving takes place only as long as the subject attentively turns him/herself to something — no matter whether an idea, an object manifested in its own physicality, a theory, an image, and so forth — and then wraps this something up in that invisible thread, that string which brings it back in as it is perceived, ahead of the acts of consciousness. It is an act that takes place at the present moment.

- Perception does not come to an end at this moment, since it always takes place in a continuous flow of retentions (preserving what occurred) and protrusions (envisaging what will come, as an expectation, for instance).

- Perception and what is perceived gain existence in the horizon-world (since they extend themselves before one's eye in the light of temporal dimensions of possible events), from spatial-temporal perspectives and, also, according to profiles through which what is perceived presents itself to perception.

- The conception of intentionality, consciousness and perception as embodied, in sense that they occur and constitute themselves in the own body (Merleau-Ponty, 1990) and is interwoven in a fabric that ends up as the standing ground of the life-world we live in. This notion is expressed by the word *Lebenswelt*, occurring in the original texts by Husserl (1970a), in German. The term refers to the world where we find ourselves all the time, the standing ground on which we grow as citizens side by side with our co-subjects and all historical-cultural products generated, as well as with nature, thus understood by the perceptive consciousness.

- Husserl (1970b) made a reduction of the *Lebenswelt* so as to understand what its invariants are. Yet, this life-world he mentions is the life-world as lived until the mid-1930s, the years when the author's last works were published. The study carried out by Husserl did not address, therefore, the reality in which information science and the resources that developed since the advent of the computer are present. Today, the reality of the life-world is not the same as the reality of the life-world as described by Husserl, though we cannot deny the conception that we live in the life-world, and that it is our perceptive ground.

The question that motivates us sets itself up in the leap we take in order to comprehend the worldly reality as a reality that also encompasses the reality of the cyberspace (Bicudo & Rosa, 2010). In this reality, in which we are with the other and together with the computer, and its information science apparatus on hand, which is in consequence a scientific and technological apparatus as well, we ask: how does intentionality present itself, that is, shows itself, in the reality of cyberspace, where the standing ground on which the perceived phenomenon becomes prominent is not that described by Husserl, the world he lived in at the end of the 1930's, when questioning the standing ground of science of the modern and contemporary western world? We also ask: how does intentionality show itself, sustaining teaching and learning actions, with the respective actions pertinent to this process, such as teaching mathematically, assessing the distance learning process, perceiving the other as an equal, accepting oneself as a professional of education who teaches and promotes collaborative knowledge, who acts responsibly when being with the other who presents him/herself with the computer, through the gadgets of the world of information science?

Based on the idea that, when we are using a computer, it presents itself to us in the activities we carry out, differently from a common utensil at hand to be used, as described and analysed by Heidegger in *Being and Time* (1962). It is with the subject conducting the operations, understanding the Heideggerian notion "being-in-the-world-with", written with hyphens to leave no doubt that it is a phrase, always expressing that we are constantly connected to the world, our standing ground-horizon where, through our actions, space is updated and time is perceived — and, more than this, that it is in this standing ground-horizon that we are with the other, whoever it is. In other words, with people, co-subjects, ideals, theories, utensils, animals, etc. This is the meaning of *with*. It means that we are together.

Intentionality, as understood and worked out by Husserl (1970a; 2002), in his dialectics of *see/seen*, or, phenomenologically speaking, *noesis/noema*³ underlies the act carried out by the human being at the computer towards what the other says, that is, exposes. Herein, “what the other says” is a phrase used to clarify the modes through which the other and the respective environment manifest themselves in the screen, both through exposure of its image and through speeches intersected by dialogues, elaborate texts that reveal sophisticated thoughts, modes of calculation, simple or complex software, games, and artistic and scientific programs, etc. The connection with the other, this other being with the computer, demands the intentionality of the one/ones who keeps/keep in contact. The embodiment of the subject conceived now as the own body is, therefore, an inalienable mode through which this subject places itself as a ‘*Da-sein*⁴’. This mode of placing oneself as being in the world, being totally present in the world, is also the same as that of placing oneself before a computer screen as being in the openness of the horizon. It is the own body (Merleau-Ponty, 1994) who gives life and nurtures the cybernetic world that makes itself available for use, as a resource, and, more than that, which gives itself as *the other* — with whom we meet in the world. In search for the modes in which intentionality presents itself in situations where one is empathically with the other in cyberspace, we set out and resorted to films that exploit, in our understanding, these situations. There are movies which stand out mainly due to the fact that they make use of complex resources available as a product of scientific-technological investigations (Bicudo & Rosa, 2010). Essays of this kind have proved their relevance to enlarge the comprehension of intentionality itself, now made explicit in an aesthetic dimension, and with the potential to be visualized.

The Life-World Today and the Mode of Being in It

The reality of the life-world, in which we are, is constituted by a reality woven by physicality in nature as felt and perceived at once in the hyletic layers⁵ of the own body, by the network of scientific, artistic, religious, historical and cultural outputs

³ *Noesis/noema* is mentioned by Husserl in his various works. *Noesis* refers to the intentional act; *noema* is used with respect to what is wrapped by this act. For instance, there is a tree. Seeing the tree is an act of consciousness, and therefore intentional. There is a *noesis*. What is seen, the tree, is the *noema*.

⁴ *Da-sein* is conceived by Heidegger (1962; p.80) as being-there and being-in, where ‘there’ is openness and ‘being-in-the world’ is the *Da-sein*’s essential state.

⁵ Hyletic refers to the sensations, that is, the sensorial feeling that, phenomenologically, is taken as a starting point for the construction of the complexity of the subject understood as a totality embodied physically/psychically/spiritually (Husserl, 2002).

that materialize through different ways, among which the mode of cyberspace. In this sense, there one finds a whole scientific-technological apparatus that sustains actions and decisions, apart from modes of feeling and becoming present, of perceiving and bringing what is perceived to consciousness (Bicudo & Rosa, 2010). Nonetheless, significant is the fact that there is always the intentional eye, looking in search of something, which feeds this search and triggers actions. In order to understand this, we discuss scenes of the movie *Dèjà vu* (2006), mainly those in which the intentional eye shows itself as directed to the life-world of the main character, probing for relevant evidence to what is searched for and triggering decision-making and actions.

In Bicudo & Rosa (2010), the scenes of this film were described and numbered with a view to conducting a philosophical-scientific-technological analysis. In this paper we underline scene 17, when FBI agents equipped with state-of-the-art apparatus and top-line scientific and technological information are unable find evidence to solve a terrorist attack against a ferryboat that killed over 500 people, shown on screen. This reality is shown as flowing in a constant past time stream, chronologically stipulated as 4 days, 6 hours, 3 minutes and 45 seconds before. Thus projected, this reality shows itself as a set of senseless scenes. In order to cast a questioning eye focusing on meaningful scenes for that purpose, the FBI agents need the help of a person familiar with local investigations and therefore familiar with that reality and who is willing to watch (see) attentively. In this sense, the agents call on Doug, a detective allotted in that specific community's precinct, to help them. Scene 17:

The FBI agent in charge invites Doug to joint his team, since he is short of time to close the investigation. They need a person that watches the crime scene once only and perceives things that they, unfamiliar with the place, do not perceive. Technology: the team does not tell Doug what the machine they work with is about. Doug resists a little, but the team starts a game and drags him in: the call is a personal issue: the death of Larry⁶.

In this scene, there are at least two aspects that address the intentionality of the local detective: he is moved by the death of his partner in the attack, at the same time that he is driven to find and interpret evidence leading to a solution to the crime and the identification of the criminal. When Doug looks at the reality sliding on the screen, he sees that this reality is becoming the same reality he finds himself in, the totality of his own body. He feels emotions, reasons mathematically

⁶ Larry is Doug's partner

and/or logically, and moves. The act of perceiving places the detective in touch with what is projected on the screen. The detective, Doug, wants to know what he is dealing with, with respect to the technology available at the spot. He asks about the motion of scenes and the perception of temporality that comes about with this motion. The FBI task force answers:

It is not image that is moving. It is your vantage point that shifts. They explain: time passing is a constant, though we change the vantage point according to the data received, as fast as we wish. Do you understand? Doug: Yes, yes. No. (Bicudo & Rosa, 2010).

In this scene, we see stressed, once again, the importance of vantage point for the one who sees. What vantage point is this? What reference does it take? In phenomenological philosophy, this is the point that indicates all and every perspective given by the own body. The own body is the starting point from which the eye casts itself onto what is seen. In this sense, depending on the shift in focus, the perspectives change as well and, along with them, the profiles of what reaches us in the form of what is seen are also altered. It is thus that the move see/be seen takes place mediated by foci determined through the intentionality of the eye that, in turn, are brought along “the invisible thread” connecting intentionality to consciousness, which cognitively “process” these data.

Standing in the investigation room of the FBI task force, Doug lives two moments in tandem: the moment at which he is physically in the room, with the FBI agents, and the moment he is on the screen, kept real by the scientific-technological support. Therefore, time as lived by him and time as hyletically sensed are there in these pieces of equipment. The presence of people on the projected scenes manifests itself as recorded messages, images and voices. There is no overlapping of *nows*, that is, of present moments, but there is a stream of *nows* which is liable to be apprehended in its own continuity. Materiality made available as equipment expands modes of expression, memory, perception of what has occurred at the same time that offers potential ways of operationalization for lines of reasoning that are in the subjectivity of the subject and their respective expressions, which may be given in operationalization. These devices increase the complexity and speed up the investigation initiatives carried out by Doug and the task force, inasmuch as these are actions intentionally intertwined with thoughts and respective expressions of the subjects investigated.

From an educational standpoint, what is experienced in the film is the experience with cyberspace, in which the being plugged is intentionally driven to learn about mathematical questions that take place in this differentiated time-space. Bicudo & Rosa (2010) discussed this in terms of distance learning.

In Search for a Provisional Synthesis of this Article

In this article, aspects of the complexity in which we live are underlined. These complexities are considered from the perspective of everyday life, since we are always, somehow, with media, keeping connected to whatever, for us, makes itself present. Going beyond the considerations formulated, we emphasize, in this briefed version of the article, background questions conceived in ontological and anthropological terms.

In ontological terms, reality is understood by us as covering the reality produced by resources of information science with the actions of people who intentionally operate this reality. From the standpoint of the human person, its own body is the ground zero, where he/she focuses aspects of the life-world and where he/she feels what reaches him/her, coming from this world. Based on what is exposed in this article, the hyletic layers that form the modes this person feels advance, constituting — in an intertwining with *other* characteristics of the totality of the subjective, like the dimensions of the biologic, psychic and spiritual — modes of feeling and perceiving, of reasoning and making a judgment. These modes, which reveal the subject's bio-psychic and spiritual frameworks, sustain answers, both to the queries sprung from the life-world, which is placed directly in the dimension of the other's physicality that is there, and to the queries born from the reality present on the computer screen, and given by other medias. In our opinion, in the scope of mathematical education, apart from the actions as those required by mathematical reasoning with the media (in logical terms, many times), apart from mathematical actions expressed by the own body, and apart from the situations intentionally driven to the learning of mathematical issues that take place in this differentiated time-space, a wide array of possibilities is open as regards research on education considering the theoretical framework sustained by philosophers, in particular, relative to phenomenological intentionality.

In this sense, we argue: then how do we constitute ourselves? How does mathematical education lived in the cyberspace take place? Apart from these, there are other relevant questions, according to our interpretation, which point to need to conduct investigations and define ethical and political stances, which we formulate thus: Where are we heading to? What changes are taking place in our neurological-psychic-spiritual system?

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