

Digital Image as a Semiotic Agent

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ABSTRACT

In the context of the computational and algorithmic revolution, the digital image more than ever elevates the status of representations to the sphere of processes and operations. In a more general context, images can be seen as cultural agents, progressively developing new habits by promoting mediations between multiple subjects, whether human or nonhuman. From this perspective, we may question what characterizes the dynamics of those images. Can we consider digital images to be semiotic agents? Admitting this premise implies highlighting images not only as results or instruments but as integrated participants in processes. In light of this, we explore the digital image as a semiotic agent, from a Peircean semiotic perspective, from which the digital image can be seen as a sign, a dialogical being inserted in a network of relations.

KEYWORDS

Digital Image; Semiotic Agent; Communication; Visual Culture.

1 | INTRODUCTION

In the social and cultural contexts images are usually associated with a conventional model of communication that considers two agents: the sender and the receiver. Although it is an acceptable perspective, this form of communication neglects at least two instances: images as signs in themselves and the complex contexts they are involved in.

Advances of technologies and digital media give rise to the emergence of complex instruments for image creation, and systems that are increasingly more implicated in the processes of image production. In this context of computational and algorithmic revolution, computational systems become able not only to produce images but also to interpret distinct processes related to them. Thus, digital images more than ever elevate their status from representations to the sphere of processes and operations (e.g. Nake, 2004, 2008, 2016; Nake & Grabowski, 2017; Gonzalez and Woods, 2002; Farocki, 2004; Fuller et al., 2008; Manovich, 2013, 2017, Paglen, 2014).

In this regard, we emphasize digital images as active subjects of processes. Such a role is manifested especially in the emergent and growing fields of Artificial Intelligence (AI) and Computer Vision, in which image-related processes are gaining prominence.

This tendency of digital images to trigger processes can be seen as an index of their abstraction and symbolic potential. On that account, this paper questions digital images as semiotic agents, discussing conceptual foundations to understand the expansion of the image in cultural and technological processes.

It first examines the emergence of digital image as a symbolic technology. Then, it explores it in the context of the convergence of media, drawing differences between processes of images as symbols that involve mechanical and computational machines. From a Peircean semiotic perspective, we discuss the potential

character of images as semiotic agents, in the sense of producing processes and signs.

2 | IMAGE AS A SYMBOLIC TECHNOLOGY

Firstly, and foremost, we should mention that the notion of agency presented in this paper goes beyond a biological assumption. The notion of the subject of action assumed by images here reverberates in a nonhuman-centered view of the agent. In addition to this, to think about digital images as semiotic agents requires understanding what type of image we are talking about.

One of the first media theorists to discuss symbols as mediators between culture and nature was Vilém Flusser. A closer look into his ideas of *staircase of abstraction* (1983) and of *a new imagination* (1990) developed in the context of his theory on technical images give us valuable information to understand the evolution of the image as a symbol, code, and instrument.

According to Flusser, traditional images can be understood as “something ‘out there’ in space and time that they have to make comprehensible to us as abstractions” (1983, 8). Traditional images represent something usually external to the image itself. This quality is essential for understanding messages carried by images. Those messages encode events into situations, processes, and scenes. Flusser adds that those images are supposed to be maps to guide human beings in the world.

Such a situation was changed with the invention of text. Text appears as a new code that provokes a “tearing” of traditional images. With the invention of writing, humans took one step beyond images. Since texts do not signify the world but the images they tear up; concepts do not mean natural phenomena, but ideas about them. Furthermore, to decode texts is hence to discover images signified by them; images evidenced by the increasingly abstract concepts contained in the texts. However, as mediators, texts can also obscure images they intend to represent, and by struggling against images, texts may suffer the loss of their imaginative competence.

Technical images are post-writing and post-historic. Differently from traditional images, they are produced by apparatuses, which are themselves products of technique. Ontologically, “technical images are abstractions of the third order: they abstract from texts which abstract from traditional images which themselves abstract from the concrete world” (Flusser, 1983, p. 14).

These processes of abstraction in respect of technical images can be seen from the Peircean notion of *the action of the sign* or *semiosis*. Semiotics is defined as “the doctrine of the essential nature and fundamental varieties of possible semiosis” (CP 5.488) which involves “a cooperation of three subjects, such as a sign, its object, and its interpretant” (CP 5.484). Peirce defines *sign* (to which Flusser called *symbol*) as a medium (MS 339, 1906), but not as one which mediates between an addresser and an addressee. Instead, “the sign mediates between its object, which it represents, and its interpretant, which is its interpretative effect”. According to Peirce, a sign “endeavors to represent, in part at least, an Object, which is therefore in a sense the cause, or determinant, of the sign” (CP 6.347) and resulting in a further sign, the interpretant, which provides an interpretation of the first sign in relation to its object. Thus, semiosis is related to the action of the sign, that is, the continuous flow in which a sign is interpreted or translated into another, which, in its turn, is interpreted into another, ad infinitum.

Despite their abstract nature, technical images are oftentimes considered by human observers not only as images but also as mediations of reality (Flusser, 1983). Thus, they may not suggest a need of decoding, since their meaning seems to be visible through the observation of their surface. However, they derive from abstract generalizations that come from texts that originate images which, in their turn, conceive the concrete world. It is in this sense that, contrary to what one thinks, decoding technical images demands the knowledge of codes originated from highly complex and sophisticated symbols. They are “not only symbolic but represent even more abstract complexes of symbols than traditional images. They are metacodes of texts which, as is yet to be shown, signify texts, not the world out there” (1983, p. 15).

In *A New Imagination*, Flusser (1990) discusses the gesture of creating images. Although he does not provide a distinction between technical images and those made by computers, we can find some insightful ideas towards synthetic images and clues to understand the process of abstraction that follows with digital images.

According to Flusser, this new gesture of image creation follows an alphanumeric code which movement is quite different from alphabetical writing. “The linear gesture of writing tears the pixels from the image surface, but it then threads these selected points (bits) torn from the image into lines” (1990, p. 112). The numeric notation is not a sliding gesture, but a gesture of choice. “The numeric code broke out of the alphabetical code, freed itself from the pressure of linearity,

and switched over from numeric to digital” (1990, p. 113). To Flusser, this refers to an analytic, disaggregating intention, by which the thought reaches a high level of unsurpassable abstraction. Therefore, it will be possible to analyze the processes in the first place, then the events, and, finally, the world of objects. It is in this level of abstraction, expressed by symbolic technologies, that we cope with dialogical images.

Arjen Mulder argues that “the way to find meaning in dialogical images is to forget about linguistic meanings: dialogical images in Flusser are about agency” (2016, p. 2), and agency concerns the idea of “viewer/user that click beyond the image, change it when needed, or even synthesize them from scratch, in purely numerical form” (2016, p. 2). Mulder, however, seems to discuss the role of the image as a symbol only in instrumental terms. It should be observed that in this new imaginative experience, the production of images is not restricted to an idea of a human producer and their interaction with computational systems but may also include the relations between the signs themselves.

With this concept of new imagination, we may highlight the creative potential of symbol processing. Since the technological development of media leads to a not necessarily deterministic production of signs, it appears to potentialize the play, the search, the surprise in the context of cultural creation.

3 | IMAGE AS A PROCESS OF THE SIGN ON SYMBOL PROCESSING MACHINES

The Although digital and computational revolutions have sparked deep changes in our environment and ways of work, and hence in the cognitive ecology (Couchot, 2011), this did not necessarily imply an extinction of its processes (Bellour, 1997) nor precedent media (Bolter and Grusin, 2000).

It is essential to emphasize that the processes of abstraction are expressed in the continuous course of media hybridization. Santaella (2013) observes that as computers began producing images, texts, and saving files, media convergence becomes a rule. Marked by the origin of engraving, we moved from a pre-photographic paradigm (e.g. painting) to a photographic one. This transition started the principle of reproducibility. Then, we had the transition from the photographic paradigm to a post-photographic, whose passage marked the interruption of the dependence of image on concrete objects (Santaella and Nöth, 1997). The fourth paradigm of the image, as argued by Santaella (2013), involves the advent of

computational systems and connectivity, and is no longer about passages, but rather genealogies of images, a type of genealogy in which they are already immersed in the mixtures.

The frontiers between visual representations and the technological media became blurred. Thus, images might be seen both as instruments and representations. Let us examine some differences between symbol processing in trivial tools (or mechanical instruments) and computational machines.

In his theory regarding technical images, Flusser (1983) developed the notion of apparatus: a tool that produces techno-pictures (he uses the photographic camera as a prototype of discussion to this idea). Through this notion, we can understand that even a common photographic camera, which operates in a mechanical way, produces pictures through a process of transformation of signs. This operation describes, for example, the conversion of light rays reflected in an object into another sign, which may be the negative or the developed image. In view of this, the camera follows a model, a program, which determines the process of cultural sign production. As mentioned by Nöth (2009), by discussing the apparatus in the sense of media, Flusser draws attention to the invention of instruments that produce symbols, that is, instruments of sign production.

Although technical devices operate in a deterministic way – with means that their production is completely determined by their input –, the fact that they are involved in the production of a sign cannot be ignored. On account of that, Nöth (2009) points out that there is no doubt they can be considered semiotic instruments or machines. To him, what differentiates semiotic instruments from semiotic machines is their degrees of complexity and their semiotic potential. Text processing machines, for instance, “differ from their nondigital precursors, such as the manually operated duplicating machine or even the simple typewriter, only in their degree of efficiency” (2009, p. 28).

It is also relevant to notice that the signs that a “camera ‘produces’ by its proper agency (disregarding the photographer who is indeed a sign producer) are natural signs, which cannot be said to be produced because natural signs have no sign producer” (Nöth, 2009, p. 28). So, a better way to say in regard to the mechanical camera is that it does not necessarily ‘produces sign’ but ‘processes sign’. As deterministic machines, they present “a heteronomous semiotic agency since their goals are determined by the purposes of operators and programmers, which are external agents from the point of view of the machine”

(2009, p. 27). Otherwise, the agency of this kind of semiotic machines is reduced to the processing of other signs by efficient causality.

Efficient causality corresponds to the cause-effect phenomena in a process determined by irreversible physical laws, that is, “the Brute Actuality of things and facts” (Peirce, CP 6.455). The force of efficient causality belongs to the category of dyadic relations. Given this, we can assume that instruments in general, which collaborate in processes of action or work, are efficient or deterministic causes (Nöth, 2009). Final causality, on the other hand, is related to the category of triadic interaction, that is, the long-term causality of general laws, purposes, ideas, semiosis. In fact, the sign “act by final semiotic causation insofar as their semiotic potential can reach its effect by different means” (Nöth, 2009, p. 19). This action, however, cannot be possible without the efficient causes to convey their messages. In accordance with these premises, “the agent in the process of semiosis in which the sign creates an interpretant, is the sign, not the addresser, and the agency of the sign is one of final causality” (2009, p. 19).

There is a significant difference when dealing with sign processing in computational systems. Since computers are able to process both numbers and symbols (Newell, 1980; Nake 1998; Nöth, 2001, 2004) they can be seen as apparatuses processing signs and as machines performing work. In general, this means they are co-agents of sign processing and work not only as instrumental replicators of signs but also “signs replicating themselves as signs” (Nöth, 2009, p. 27).

In addition to this, the process of image creation and interpretation in computational environments admits a variety of procedural combinations. In the field of image processing, for example, those variations can be understood as distinct types of computerized processes on images, such as low-, mid- and higher-levels (Gonzalez and Woods, 2002). The low-level involves primitive operations such as image pre-processing, in which both inputs and outputs are images. Mid-level processing concerns to “tasks such as segmentation (partitioning an image into regions or objects), description of those objects to reduce them to a form suitable for computer processing, and classification (recognition) of individual objects” (2002, p. 2). This process is characterized by the fact that its inputs generally are images, but its outputs are aspects and information extracted from those images, as in image analysis. The higher-level processing involves forms of interpretation of an ensemble of recognized objects, and at the continuum in AI, cognizing on systems.

On account of that, let us examine the image not only as a product or a cultural sign but also as a possible co-actor of sign processing; a role that outlines its operation as semiotic agent.

4 | SOME ASPECTS OF THE DIGITAL IMAGE AS A SEMIOTIC AGENT

In the field of computational studies, Frieder Nake seems to be the first to introduce the notion of algorithmic image as a sign. Based on Peirce’s *Theory of Signs*, Nake (1997) sought to develop a theoretical basis to the computer science that he called “technical semiotic”.

According to him, the artifacts developed in computational contexts are characterized by a surface and subface duality. The surface is the analog sensorial layer through which signs can be communicated to humans, and the subface is the immaterial and algorithmic substrate of the medium, where computation, code, and processes are developed (Nake, 2004, 2008, 2016). With those notions, Nake repositions the image from a linear and isolated sign to a complex one with procedural bias.

The concepts of surface and subface emphasize not only the involvement of the semiotic machines in processes of creation of images but also the potential nature of the image itself as a code. Moreover, it requires attention to the continuous dynamic between the concepts, a condition that reduces dualistic ideas regarding images. Thus, Nake argues that to understand the effects of sign processing of algorithmic images – and among them are artistic possibilities – it is fundamental to approach the algorithm image as a semiotic entity.

Both dynamic and continuous characteristics of sign processing are also related to the Peircean notion of semiosis. One way to comprehend semiosis in the context of the semiotic agent may come from understanding Peirce’s concepts of efficient causality and final causality that we presented previously.

The potential of the image to create even more innovative processes and signs, which respond not only to an agency determined by the sign stipulated by the programmer or the operator, highlights the semiotic creativity inherent in the sign processing itself. The condition of continuity and variety of the image expressed especially by its nature as an algorithmic substratum of the medium, evidence possible characteristics of final causes in image-related processes. However, since the materiality related to the efficient causality of the sign, the materialities and aesthetics involved and derived by those processes are examples of efficient causes.

Thus, among the instances of efficient causes are included the media through which the image appears to us on its visible format (e.g. the computer screen and the printer); the tools that are used, for example, to edit, interact or print images; and the hardware that makes possible these scenarios.

The development of image-related technologies, devices, and programs has been positively impacting the increasing potential of the image as a semiotic agent. Thereby, the digital image cannot be disconnected from this context of new forms of semiosis production. However, this does not imply that they have a semiotic agency autonomy themselves since their action (in the sense of intentionality) are related to a multiple-agent context.

5 | CONCLUSION

Taking a Peircean semiotic perspective, we discussed distinct approaches and potentialities seeking to explore the digital image as a semiotic agent. We started examining some thoughts about the evolution of the image as a symbol, code, and instrument, by discussing Flusser's ideas of technical images as means of mediations of reality. Then, we explored its processes of abstractions in the context of media hybridization, where apparatuses were apprehended in the sense of media, that is, as instruments of sign processing. In this context, images may act both as instruments and representations. Finally, we briefly examined the digital image in the field of computational studies, in which its semiotic potential goes beyond the response to an agency determined by the programmer.

The idea of digital image as a semiotic agent means understanding them not only as objects that contain information, or as products of human actions, but also as active signs that may potentially be agents in new processes of signs. If we understand image as a sign, and therefore as a medium, we will see that such potential is something intrinsic to images in general but was intensified with the computational revolution.

From the sign processing perspective, one may note that the levels of the action of the image are revealed through its own role alongside the agents involved in the production of images, whether humans or nonhumans. Its semiotic agency potential also differs according to the apparatus (technological systems and devices) and distinct levels of determination. In the context of technical images, for example, semiotic agency is usually determined by external agents (operators and programmers). In the algorithm context, on the other hand, digital images have the potential to become more autonomous

agents. Those abilities involve complex and complementary cycles in which the image codifies and is decoded. That is, it interprets (outputs and feedbacks) and is also interpreted (generates new inputs and outputs), especially when integrated with machine learning systems.

There is yet much to be discussed regarding the digital image as a semiotic agent. Here we sought to present some initial thoughts that may spark discussions with respect to the digital image as semiotic agents. This general role is becoming more evident after the developments from cybernetics, automata theory, and general systems theory to the new technologies of intelligence (Donald, 1991; Santaella, 2007). On account of that, Artificial Intelligence and Computer Vision, where image processing is a central subject for the development of intelligent systems, appear as relevant fields to be explored in further work.

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BIOGRAPHICAL INFORMATION

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Miguel Carvalhais is a designer, musician, and assistant professor at the Faculty of Fine Arts of the University of Porto. He studies creative practices with computational systems, having written the book "Artificial Aesthetics" on the topic. His research and practice explore how computational and procedural systems are read by humans, and how procedural discovery and interpretation are paramount for the creation of meaning and the aesthetic experience. His artistic practice spans computer music, sound art, live performance, audiovisuals, and sound installations. He runs the Crónica label for experimental music and sound art, the xCoAx

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Article received on 10/06/2019 and accepted on 17/04/2020.

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