The Triadic Model and the Process of Semiosis of Charles S. Peirce and On-line Education

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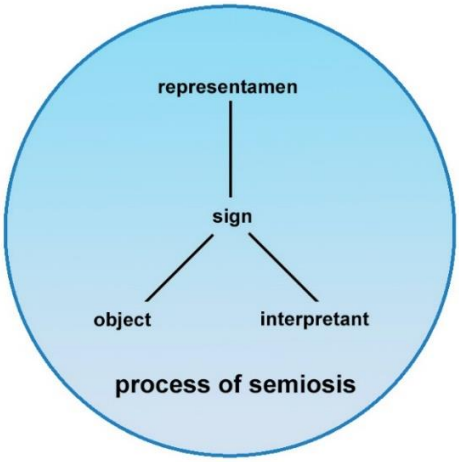
Introduction

Charles Sanders Peirce devoted his work to Philosophy, Logics, Mathematics and Semiotics, establishing himself as an important theorist of the late 19th and early 20th centuries with great contributions to the understanding of human cognition processes and, more specifically, how learning occurs (Pietarinen, 2021). Nöth (2013) organized Peirce's understandings of knowledge and how we learn and focused on explaining that communication is fundamentally educational to Peirce, as well as the signs used to communicate. According to Pierce's ideas, signs are not only instruments of communication, but also semiotic agents in themselves and by promoting interpretations regarding their objects, signs are representations of something, for someone, from some point of view and in this process of semiosis they generate meanings. Furthermore, signs are teachers of themselves since they have a self-correcting potential that Peirce interprets as their "life force of self-control" (Nöth, 2013).

Nöth (2014) clarified that the way new concepts are learned is related to the way signs are learned, according to semiotic understandings. Signs represent objects that link to feelings, previous experiences, and previous knowledge. Such objects can be words, images, gestures, memories, real-life scenarios, thoughts, or ideas. Furthermore, according to Peirce's views, the sign is composed of a triadic relationship between Representamen, Object and Interpretant. Therefore, when interpreting a sign, it is necessary to understand how these three elements are organized because the sign, through the "process of semiosis" (sign action), acts through a relationship that intertwines all of them as shown in Figure 01:

Figure 01: *The Relational Structure of the Elements of the Sign According to Peirce*

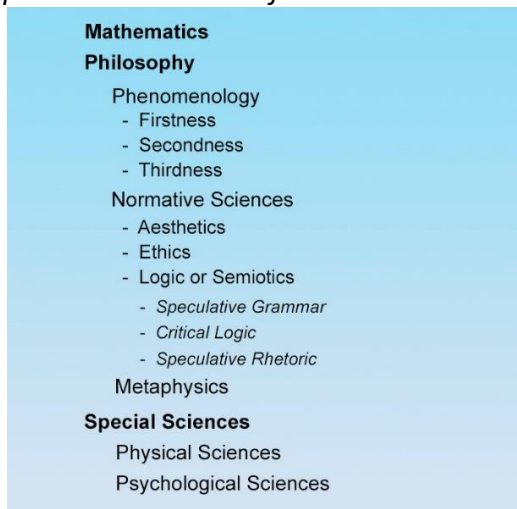


The concepts mentioned in this paper serve as a basis for understanding the complexity in the work of Charles S. Peirce. The following sections will address the phenomenology and semiotics in Peirce's philosophical architecture, the sign for Pierce, the process of semiosis, and finally the semiotic method.

Phenomenology and Semiotics in Peirce's Philosophical Architecture

Peirce's Semiotic Theory and classification of the Sciences are based on a logical structure linked to three phenomenological categories. In summary, Pierce believed that the sciences were divided into Discovery, Review, and Applied Sciences (Nöth, 2021). The first seeks to find the truth and is subdivided into Mathematics, Philosophy, and Special Sciences (Santaella, 1992). Mathematics is a science that has the highest level of abstraction of all of them and is the theoretical basis of Peirce's ideas. Pierce argued that Logic, also called Semiotics, had the same nature as Mathematics (Santaella, 1992). In contrast, Philosophy deals with questions of human experience and focuses on understanding the truth. It is divided into Phenomenology, Normative Sciences, and Metaphysics, as presented in Figure 02:

Figure 02: *The Philosophical Architecture of Peirce*



THE TRIADIC SIGN AND THE PROCESS OF SEMIOSIS OF CHARLES S. PEIRCE

Peirce's Philosophical Architecture is not just a proposal for the ordering of all sciences, but rather an axiomatic semiotic system that has a logical-relational character and that is explained as a method of investigation, when we observe their interconnections. Peirce believed that Logic, which is of the same nature as Mathematics, is the art of conceiving methods and, therefore, his research had as its basic foundation to find a "method of methods" (CP 7.59) that would be established by Logic. For him, Mathematics comes before Logic, in the classification of sciences, because it "constructs its objects in the form of hypotheses and extracts necessary consequences from them without however dealing with questions of fact" (Ibri, 1994, p. 3). Mathematics does not ask anything about the real world, it develops exclusively within human thought and is supported by reason. In its genesis, mathematics excludes any possible relationship with pure and simple experience and, thus, is considered the science that studies hypothetical states of things, where conclusions are constructed and its writings are to develop a basically mental point of view, just rich conclusions (Carolyn, 1979, p. 239).

In Philosophy, Phenomenology studies any phenomenon. For Peirce, according to Santaella (2002), a phenomenon is a word derived from the Greek *Phaneron*, and is everything or anything that appears to perception and the mind (p. 7). That said, the phenomenon can be classified by the three Universal Categories formulated by Peirce: firstness, secondness, and thirdness (Jappy, 2016). Pierce (1974) concluded that, for the observation of phenomena, one must keep in mind three faculties:

> The first and foremost is that rare faculty, the faculty of seeing what stares one in the face, just as it presents itself, unreplaced by any interpretation, unsophisticated by any allowance for this or for that supposed modifying circumstance. This is the faculty of the artist who sees for example the apparent colors of nature as they appear. […] That artist's observational power is what is most wanted in the study of phenomenology. The second we must strive to arm ourselves with is a resolute discrimination which fastens itself like a bulldog upon the particular feature that we are studying, follows it wherever it may lurk, and detects it beneath all its disguises. The third faculty we shall need is the generalizing power of the mathematician who produces the abstract formula that comprehends the very essence of the feature under examination purified from all admixture of extraneous and irrelevant accompaniments. (p. 29)

When a phenomenon is observed, its characteristics are perceived by our senses and make the creation of meaning possible. For Santaella (2002), the phenomenon is directed towards someone and will produce in that someone's mind something like a vague and indivisible feeling. It is this indiscernible feeling that will function as the object of the sign. Santaella (2002) clarified that when perceiving a phenomenon, one perceives its quality, which is the sign in firstness. "But the quality is only a part of the phenomenon, since, to exist, the quality has to be incarnated in a matter" (Santaella, 2002, p. 47). The embodiment of this quality happens in the materiality of this object. According to Peirce (1983), that action and reaction are present in the category of secondness, which is not the concept, nor the quality perceived. Instead, it is an experience. It results most evidently from the reaction between self and not-self. It is something

that cannot be properly conceived because if it were conceived it would be a generalization; and to generalize would therefore be to lose the here and now that is its essence (Peirce, 1983, p. 105).

The sign presents itself in secondness and the conceptualization and formalization of the process occur in thirdness, which is characterized by the generalization, representation, and interpretation of phenomena. It is "the element of the intelligible phenomenon" (Peirce, 1983, p. 106), in which "infinity, continuity, diffusion and intelligence" also predominate (Peirce, 1983, p. 93). Thus, Peirce exemplified how cultural patterns are present in thirdness:

> An apple pie, then, is desired -- a good apple pie, made of fresh apples, with a crust moderately light and somewhat short, neither too sweet nor too sour, etc. […] For that, apples are wanted; and remembering that there is a barrel of apples in the cellar, the cook goes to the cellar and takes the apples that are uppermost and handiest. That is an example of following a general rule. She is directed to take apples. Many times she has seen things which were called apples, and has noticed their common quality. She knows how to find such things now; and as long as they are sound and fine, any apples will do. (Peirce, 1994, p. 131)

Returning to how Peirce understood the organization of the sciences (Figure 02), there are the Normative Sciences, which focused on the study of ideals, values and norms. The Normative Sciences are divided into Aesthetics, Ethics, and Logic or Semiotics. Aesthetics is everything that is admirable without a preceding reason, it considers things that ultimately lead to sensation (Peirce, 1983, p. 37). Santaella (1992) added that "admirable is a goal or ideal that we discover because we feel attracted to it, and we remain magnetized in it, committing ourselves to its concrete realization" (p. 127). Following that, ethics is the action or conduct that receives its first stimuli from aesthetics. Ethics, according to Peirce (1994) is the theory of ideal itself, "a traditional standard, accepted, very wisely, without radical criticism, but with a silly pretence of critical examination. The science of morality, virtuous conduct, right-living, can hardly claim a place among the heuretic sciences" (Peirce, 1994, p. 223). Finally, Logic or Semiotics helps to act reasonably and refers to the study of correct reasoning through critical self-control, which results in logical thinking (Santaella, 1992).

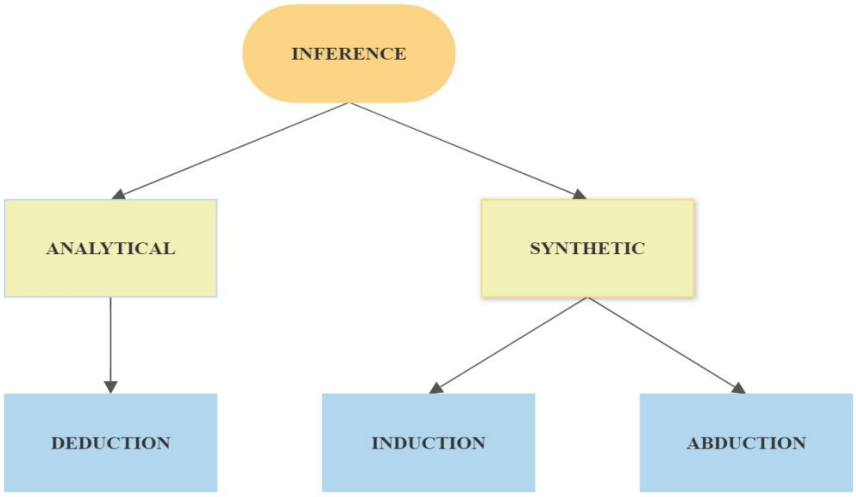
Santaella (1992) explained Peirce's semiotics, in its narrowest sense, as being the science of the necessary conditions to reach the truth. In the broadest sense, however, it is the science of the necessary laws of thinking. In other words, semiotics states that thinking and learning always happen through signs. Semiotics deals not only with the truth, but also with the general conditions of signs themselves, in addition to "the laws of evolution of thought, which coincides with the study of the necessary conditions for the transmission of meaning from one mind to another, and of a mental state to another" (Santaella, 1992, p. 132).

In Peirce's triadic structure, Semiotics is divided into three parts: Speculative Grammar, Critical Logic, and Speculative Rhetoric (Jarry, 2016, p. 13). The first is restricted to the study of the types of signs and the ways of thinking they allow, studying the elements that make it possible to describe, analyze and evaluate any existing process of verbal and non-verbal signs (Santaella,

2002). Logic refers to the laws of thought and the conditions of truth, taking “the various kinds of signs as a basis and studying the types of inferences, reasoning or arguments that are structured through signs. These types of arguments are abduction, induction and deduction” (Santaella, 2002, p. 3). And finally, there is Speculative Rhetoric, Pure Rhetoric or Methodeutic, which studies “the appropriate order or procedure for any investigation” and “analyses the methods that each type of reasoning originates; the way scientific research should be conducted and how it should be communicated” (Santaella, 1992, 2002). Next, concluding Peirce's Philosophical Architecture, there is Metaphysics that studies phenomena in thirdness. It concretizes the process of mediation between Phenomenology and Normative Sciences (Santaella, 1992, p. 131).

Peirce's theory is first and foremost a logical theory, meaning that his research paid special attention to logic (Jarry, 2016). For the author, every form of thought is linked to perception, developed from ethical values and standards, and is consolidated through logical principles. The reasoning of thought has characteristics that are established in firstness, secondness and thirdness, respectively, through the abductive, inductive and deductive logic (Quay, 2017). These logical inferences are organized into analytical and synthetic (Ormerod, 2022), as detailed in Figure 03:

Figure 03 - *Types of Peircean Inferences*



Analytical inference, also called explicative inference (Ormerod, 2022), involves inferences about the connections between signs and is related to reasoning that is based on rules and laws that are consensually accepted as true, leading to deduction. “In deduction, we start from a hypothetical situation defined abstractly by certain characteristics” and arrive at a type of inference that “is valid if, and only if, there is a relation between the state of affairs assumed in the premisses and that of the conclusion” (Peirce, 1983, p. 44). This inference determines what something should be. The analytical inference is the ultimate goal of scientific investigation

which, by determining the probabilities of occurrence of a phenomenon, enables a correct conclusion based on true propositions.

Synthetic inferences, sometimes called ampliative (Ormerod, 2022), do not classify phenomena in laws and rules. Instead, they synthesize the data into an integral and unique thought whenever there is a succession of concordant conclusions or alignment between facts or cases (Laurentiz, 1991, p. 48). This type of inference is “a process of discovery that increases the amount of information in the system of signs, for instance, abduction and induction” (Ormerod, 2022, p. 11). Abduction relates to observing a phenomenon and adopting a conclusion that leans toward another more definite conclusion (final conclusion). It is a process of searching for possible generalizations that indicate paths to be followed, but it is not the generalization of the phenomenon itself because this reasoning, as previously mentioned, is deduction. Inductive reasoning emphasizes the investigation process that natural and cultural phenomena undergo. Peirce (1983) stated that induction “shows that something is actually operative” (p. 46).

The abduction resulting from the synthetic inference is where the creative process takes place. It is from this inference that new ideas emerge. New hypotheses are built from habits and happen when new responses to observed phenomena are detected. This allows *insights* to happen and new hypotheses to be formulated. For Peirce (1975), the abduction or hypothesis occurs when we are faced with a curious or intriguing circumstance, capable of being explained by the assumption that it is a particular case of a certain general rule, and so the assumption is adopted. The abduction suggests that something might be valid. “Abduction starts from weak premises that, after passing through the experimental endorsement of induction, become strong and, therefore, support other thoughts” (Laurentiz, 1991, p. 48) and, finally, are established as rules and laws to be observed by deduction.

The Sign According to Peirce

A sign can be defined as something that represents something else to someone from a point of view. In fact, in further detailing the concept of the sign as a complex structure, it becomes evident that the sign is composed of three elements that are related and cannot be observed separately. The sign, above all, is a relationship that is presented by the representamen (sign itself), the object and the interpretant. Thus, the representamen is the firstness for the sign, the object is the secondness, and the interpretant is the thirdness (Figure 01 presents the triadic and relational structure of the sign).

As explained by Peirce (1983), the sign is something knowable, which, on the one hand, is determined by something other than itself (its object). Simultaneously, the sign itself determines an existing or potential mind (named as the interpretant created by the sign) (Peirce, 1983, p. 121). Santaella (2001) complemented this idea by stating that the sign is anything of any kind (a word, a book, a library, a scream, a painting, a museum, a person, an inkblot, a video, etc.) that represents something else, called an object of the sign, and which produces an interpretive effect in an actual or potential mind, being this effect called the interpretant of the sign.

Expanding a little further on the complexity that involves the definition of a sign, it is possible to say that the sign is something that, from a specific point of view, represents something for a certain interpreting mind. When connected to this mind, the first sign creates a process of semiosis. After that, there is a second moment in which the interpreter creates another sign that is called an interpretant, where the thing represented is replaced by the object and, in this way, sign, object and interpretant form the triadic relationship of the sign.

The sign is a representation that is a relationship created from a previous sign. Indeed, the meaning of a sign is another sign. Nöth (2013) clarified that Peirce's semiotic theory studies the process of semiosis that reaches the interpreting mind and is not a theory that focuses on studying the sign itself. Thus, the semiotic theory is “the doctrine of the essential nature and varieties of possible semiosis” (Peirce, 1983, p. 135).

The intention to represent an object is inherent to any sign. A sign replaces an object and can only exist as a representation that exists in an interpreting mind. Therefore, a sign represents its object in some specific way and never in its entirety, meaning that it partially represents an object according to the particularities of an interpreting mind.

Finalizing the understanding of the elements that make up Peirce's Philosophical Architecture, we will find the Special Sciences, which are the Physical and Psychological Sciences that deal with particular phenomena and their specialties. In the first we study Physics, Astronomy, Chemistry, Biology, Geology, in short, the material universe confining itself to phenomena as they occur. The second, psychic science, deals with the processes and products of finite minds; These are the Human and Social Sciences such as: Psychology, Psychoanalysis, Linguistics, History, Art Criticism and Literature, among others. The physical sciences are the sciences of things as such and the psychic sciences are those of things governed by the intellect (Santaella 1992, p. 142).

The Complexity of the Sign in the Process of Semiosis

The semiotic theory, which deals with the process of semiosis, is based on trichotomy and the classification of signs based on the three phenomenological categories previously mentioned. For a sign to be considered as such, it must be analyzed in itself, for its qualities, in relation to the object to which it refers, and for the effects that it is able to produce in its interpretant. The sign must be understood as a relationship that is established between its three elements: representamen, object and interpretant.

With a higher level of complexity and relationship, the sign can be observed in firstness through the foundation (representamen), immediate object and immediate interpretant; through the dynamic object and dynamic interpretant in secondness; and in thirdness through the interpretant itself or the final interpretant. These relationships happen simultaneously because, despite this subdivision for study purposes, each sign is unique and all levels of understanding happen at the same time. As the sign is always evolving, it is a sign at a certain

moment and, soon after, when a small change in its meaning occurs, it evolves and becomes another sign. Santaella (1985) explicated that, at first, the relationship between the foundation, the immediate object and the immediate interpretant constitute the first stage of the sign that is defined in the present instant. When it evolves, generating another sign in the interpreting mind through the dynamic object and interpretant, it becomes another evolved sign that refers to the same object. That said, successively and in constant evolution, a sign generates another sign which, in turn, generates another sign and thus infinitely transforms itself and affects the interpretant. Therefore, the totality of signs that represent a certain object, if it were possible to put all of them together, would constitute all the possible representations of that object. However, this is certainly impossible to achieve because the sign is always in process and, as such, does not stop evolving and incorporating other meanings.

To deepen the knowledge about the complexity of the sign, the elements that compose it will be detailed below. Again, it is relevant to highlight that this subdivision is merely theoretical and that any sign must be understood in a process of semiosis and continuous evolution.

The Sign

The foundation of a sign (representamen) brings the possibility of the existence of the sign, it is a quality perceived by the interpreting mind. “It is a property or characteristic or aspect of the sign that enables it to function as such” (Santaella, 2001, p. 42), however, it is configured as a qualisign that can be a quality and that “cannot actually act as a sign until it is embodied” (Peirce, 1994, p. 367).

The sign at the initial perception stage is a *qualisign*, then it becomes a *sinsign*, and finally a *legisign* (Jappy, 2016, p. 48). As a *qualisign*, quality stands out. Next, it becomes a sinsign (where *sin* means single, simple) that “is an existent thing or event which is also a sign” (Peirce, 1994, p. 367). Finally, it becomes a *legisign*, meaning that it “is a law that is a sign. This law is usually established by men. Every conventional sign is a *legisign*” (Peirce, 1994, p. 367). These three elements are classifications involving the sign in relation to itself.

In visual representations, a colour can be indicated as a qualisign because it has simple qualities that suggest meanings. In general, colours are associated with certain sensations and are capable of influencing our feelings. For example, some say that the colour red can be used to increase hunger. In fact, red acts at a higher frequency, therefore, it is more stimulating, so the sense of hunger is attributed to it. Guimarães described the power of colours in the story told by Londoners of what happened on the Blackfriars Bridge, in London. The bridge became famous for the many suicides that happened there. In the 1980s, however, the red bridge was green and the number of suicides dropped by 75% after that (Guimarães, 2000, p. 115).

By identifying and associating colours with meanings, a *sinsign* is established. The *sinsign* is the singularity of the *qualisign.* For example, if a person thinks that blue means tranquility, seriousness, and refers to the masculine gender while pink links to softness and refers to the

feminine gender, it is because he/she perceives these colors in these singular ways. Finally, the sign presents itself as a *legisign* when it is a law. *Legisigns* intend to represent something based on pre-established conventions. For example, an underlined word or phrase on the internet is considered a hyperlink. This is meant to affect user behavior and, as the user participates in the process (understands what it means and engages in activities associated with it), he/she starts to assume an active role in relation to that type of communication.

The object

The sign represents an object which is something that exists. Peirce (1994) claimed that an object is "perceptible, only imaginable, or even unimaginable in one sense" (p. 363). For instance,

> the word "*fast*," which is a Sign, is not imaginable, since it is not *this word itself* that can be set down on paper or pronounced, but only *an instance* of it, and since it is the very same word when it is written as it is when it is pronounced but is one word when it means "rapidly" and quite another when it means "immovable," and a third when it refers to abstinence. (Peirce, 1994, p. 363)

Santaella (1985) indicated the existence of two objects: the immediate and the dynamic. The immediate object has characteristics of firstness. It is the object as the sign itself represents it and its existence depends on its representation in the sign (Peirce, 1994). Overall, colours, shapes, sound, text, and their typologies are immediate objects. As a continuous concept, the sign needs the relationships between all its elements to be materialized.

The dynamic object concerns "what determines the sign and to which the sign applies. Every particular dynamic context is the 'reality' that surrounds the sign" (Santaella, 2001, p. 45). It is "the reality which by some means contrives to determine the sign to its representation" (Peirce, 1994, p. 1502). In addition, a distinction must be made between the immediate object (the object as represented in the sign) and the real object, or rather dynamic, which by the very nature of things the sign cannot express and can only indicate, leaving to the interpreter to discover it through collateral experience. (Peirce, 1983, p. 111).

The second trichotomy is determined by the object and classified into icons, indexes (or indices), and symbols (Jappy, 2016). Concerning the object, the icon is identified in the quality of the sign and is in firstness. It is the quality that is observed in the object that allows the sign to be a sign (Peirce, 1994). Hence, "any material image, as a painting, is largely conventional in its mode of representation; but in itself, without legend or label it may be called a *hypoicon*" (Peirce, 1994, p. 377). Peirce (1994) also divided iconic signs into images, diagrams, and metaphors. Images are signs in firstness. Diagrams are relationships of the parts of something through elements analogous to the parts themselves, and the metaphor represents the sign by a rule related to the representamen through the representation itself.

Images are also indexes. They are signs which refer to the object and denote by the virtue of being actually affected by that object (Peirce, 1994). In addition, due to their nature of secondness, indexes carry with them icons that belong to firstness. It is known that without the elements of firstness there would be no way for secondness to occur. Next, the symbol is a sign denoting by the virtue of a law, usually an association of general ideas. It operates in the sense of representing the sign from a convention. Therefore, it is in itself a law or general type, it is a legisign (Peirce, 1994, p. 367). Icons suggest, indexes indicate, and symbols represent.

The Interpretant

The interpretant is the effect that the sign has on the interpreter's mind. For Peirce (1994), a sign "is directed to someone, that is, it creates in that person's mind an equivalent sign or perhaps a more developed sign" (p. 43). That sign created in the person's mind is the interpretant of the first sign, and the interpretant is divided into immediate, dynamic, and final interpretant. They are constantly intertwined and do not function in isolation.

The immediate interpretant "is an objective property of the sign to signify, which comes from its foundation, from a character that is its own" (Santaella, 2001, p. 47). "The immediate interpretant, which is the interpretant as it is revealed in the right understanding of the sign itself, and is ordinarily called the meaning of the sign" (Peirce, 1994, p. 1502). The dynamic interpretant, on the other hand, is the actual effect the sign has on the interpreting mind. It is what the sign connotes and denotes. Schmidt (2022) and Santaella (2001) described three types of interpretants according to Peirce's classification of the sign:

- The Emotional Interpretant, which is realized through a quality of feeling, therefore in firstness;
- The Energetic Interpretant, which requires physical or psychological effort to exist, needs a physical or mental action, therefore is considered of secondness;
- The Logical Interpretant, which works as a rule or a law in the process of semiosis, therefore in thirdness. The logical interpretant is in the logical and intellectual meaning of the signs.

That said, the percept produces a sign for an interpretant that is linked to a feeling, requires an effort of some kind, and is related to a logical element of interpretation. All communication can lead to emotional, energetic, and logical interpretants (Jarry, 2016). For example, emotional interpretants can be present in the differentiation of qualities of a sign (colour, texture, or movement of images) in the language used on a web page. The energetic interpretant is responsible for generating an action, for instance, the redirection of a web page user when clicking on a hyperlink. Finally, the logical interpretant is the one that produces some meaning in the interpreter's mind based on the values and culture of the interpretant. All knowledge is acquired through the process of semiosis that acts through signs in various moments of interpretation through emotional, energetic, and logical interpretants. Therefore, communication or knowledge always materializes in this process where the percept acts.

In addition, any interpretation process is not limited to all identified interpretations of a given sign. Instead, this is an infinite process and, according to Peirce (1983), the ultimate level in the interpretive process is the interpretant itself or the so-called final interpretant. The final interpretant is unattainable by the very structure of the sign, which is something in continuous development. The process of semiosis, in which the sign materializes as such, presents itself in a dynamic way where the interpretations carried out by an interpreting mind never end, so the sign is always open to new possibilities of interpretations. Santaella (2002) explained that the final or logical interpretant happens when the sign is interpreted by an interpretative rule internalized by the interpreter. Without these interpretive rules, symbols could not mean. The symbol is associated with the object it represents through an associative habit that is processed in the interpreter's mind, an association that establishes the connection between the sign and the object.

Through the process of semiosis, different interpretants can constantly emerge as this is the very nature of the sign. According to Sukenik et al. (2021), for instance, purple ink to dye clothes was originally difficult to produce as it was only found inside the shell of a rare sea snail. Since it was rare, only those of nobility like kings, queens, and clergy could wear purple clothes. Consequently, the use of purple clothing was associated with wealth and social status. This is a clear example of how the meaning of a sign is learned through the lenses of the culture of the interpreter.

The Semiotic Method

Peirce believed that the classification of phenomena accounts for the nature of human cognition that is presented through verbal, gestural, sound, imagery signs, and written language (Santaella, 2001). Peirce's method allows for the identification of certain particularities in the semiosis process by considering the social, cultural, political, psychological, and historical issues that involve the sign. Without these considerations, the understanding of learning is out of context. The method of analysis of semiotic processes based on Peirce's studies and categories created by him is based on firstness, secondness and thirdness (Jappy, 2016). These features are found, respectively,

1. in the qualities of signs, where the qualitative elements that are found in the foundation, immediate object, and immediate interpretant predominate;
2. in the signs and their relational elements. This means that a sign must be analyzed for its connections, meanings and associations with the object it represents as well as with the interpretant. The interactions between sign, object, and interpretant materialize as to determine the characteristics of the sign, is fixed in the dynamic object, and must be interpreted by the dynamic interpretant;
3. Lastly, in general terms, a sign is predominantly related to elements internalized through rules and laws. The final interpretant is described as the possible interpretations that determine the process of semiosis and the inability to obtain all possible meanings since they change each time a new observation is made by the same interpreter or by another. (Candello & Hildebrand, 2008, p. 66-71).

At all times, the relational character of the sign must be highlighted, and all its elements (the foundation; immediate and dynamic objects; and immediate, dynamic, and final interpretants) should not be observed separately. Furthermore, according to Peirce's method, the sign is continuously evolving so a sign generates another sign which, in turn, generates another sign, and so on. Having said that, the process of semiosis is a continuous and endless process.

The Sign and the Learning Process through Online Education

Peirce's semiotics applies to any form of knowledge production and, particularly, becomes relevant when applied to the production of content for education and online education. Peirce's thought is comprehensive and allows us to deepen our reflections when we produce educational knowledge. The use of videos in this educational modality is also very significant and provides valuable insights when we are constructing meanings to make online communication more effective. According to Peirce, the method of scientific investigation allows us to generate actions and signs, in a process of infinite semiosis, and as we intend to reflect on this educational modality we must, initially, consider the negative and positive aspects that are associated with this format of teaching and learning.

O Signo e o Processo de Aprendizado através da Educação On-line

Peirce's semiotics applies to any form of knowledge production and, particularly, becomes relevant in the creation of content for online education. Peirce's thinking is comprehensive and allows us to delve deeper into our reflections when contemplating educational knowledge. The use of videos in this educational modality is also highly significant and provides valuable insights when crafting online communication. According to Peirce, the scientific research method enables the generation of actions and signs in an infinite process of semiosis. As we approach the field of educational knowledge, we must consider that there are both negative and positive aspects related to online teaching and learning.

When applying semiotic theory to online educational production, we identify crucial aspects that shape this type of teaching and learning. Traditionally, online education is perceived as of lower quality, and according to Nogueira and several other researchers she cites (Bacow et al., 2012; Betts & Heaston, 2014; Dow, 2008; Dumford & Miller, 2018; McQuiggan, 2012; Perry & Pilati, 2011; Wingo et al., 2017), online instruction involves student isolation, lacks interactivity between instructors and students, assumes that effective learning does not take place, generates insecurities regarding technologies, and increases the workload for instructors (Nogueira et al., 2023).

On the other hand, Nogueira et al. identify positive aspects in this mode of teaching. According to these researchers, there is flexibility in terms of learning schedules and locations,

ease of access to course materials, independence in organizing and managing learning, self-discipline, customization of the content to be studied, interaction with people worldwide, access to updated knowledge, and financial savings for companies offering such courses (Nogueira et al., 2023). Indeed, online education provides more accessible, flexible, and personalized learning opportunities, although we can still identify many challenges and drawbacks in this teaching and learning process. Despite these difficulties and advantages, the annual research conducted by the Canadian Digital Learning Research Association in 2021 indicated a 78% growth in online teaching courses (Johnson, 2019).

The process of semiosis as the action of the sign is composed of three constituents that are related to Peirce's three universal categories: the foundation of the sign (firstness), the object (secondness), and the interpretant (thirdness) (Nöth, 1995, p. 67). The first is related to a second, which is the object to which the sign refers or gives rise; the two are capable of determining a third, which is the interpreting mind. Thus, we find Peirce's universal categories grounded in the three correlates of the sign (foundation, object, and interpretant), which are closely connected to the three categories in the work of this American philosopher.

Next, we will highlight some relevant points in the process of online education when we observe signs. These signs can be icons, indices, and symbols in relation to their object. Icons resemble what they represent (for example, an image of an object), indices have a causal or contiguous relationship with the object (for example, a graph showing the progression of something), and, finally, symbols have a conventional relationship with the object (for example, a word). Videos for online education must correspond to the concepts and phenomena of reality to allow for more accurate interpretations. And, when producing content for online education, we must emphasize the importance of understanding how different members of the community interpret and assign meaning to visual and verbal signs.

The ongoing process of meaning generation must be considered when creating educational videos. Students continue to interact with the content over time, revisiting and reinterpreting information. Semiotic theory can also be applied to the analysis of feedback provided by educational material. Understanding the nature of the signs used in feedback contributes to more effective communication. By incorporating semiotics into the production and analysis of content created for online education, educators can develop more meaningful content, promoting a deeper and more effective understanding among students.

Addressing another aspect, we find that online learning can be divided into asynchronous and synchronous. Asynchronous learning occurs when it takes place at different times and locations (Irvine, 2020). Typically, a learning management system (an online platform and its software) is used to share class materials, facilitate communication between course members, collaboration, and the submission of news or assignments, discussion forums, and the use of emails. Asynchronous learning supports independent learning activities, such as practical exercises, group discussions, and artifact creation (Shamir-Inbal & Blau, 2021). When learning happens at the same time but in different locations, it is called synchronous learning (Irvine,

2020). Typically, a video conferencing tool is used to host an online session in which the teacher and students participate simultaneously, communicating through audio, video, and messages.

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Additional Readings

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