Chapter

Semiotic Architecture of Viral Data

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Abstract

In the last 5 years, there has been great debate about digital communication and its role in electoral politics. The question on everyone's mind is: can viral and massive information on social networks change the voting tendencies and behavior of people? We expose a series of theoretical points from the perspective of semiotics and systemics, to understand these communication phenomena, which are hallmarks of the twenty-first century. We also include some cases of semiotic and systemic orientation and our proposal about natural and artificial communication through viral cascades.

Keywords: digital communication, elections, networks, semiotic, fake news

1. Introduction

This text deals with the new discourses of reality in which the main characteristic is the integral, ecological, and holistic vision. It is a worldview where everything is connected to everything. Such is the systemic approach. The idea of a system covers a general type of concepts, conceived by man as complex models of coherence, more or less identifiable and permanent in the real world [1, 2].

Semiotics is the doctrine of all signs, and a sign is something that is in place of something else in any of its properties. This definition creates a path to understanding the randomness of the meaning considering that 'something else' could be referring to anything in terms of technology for memory; for example, the writings and encrypted algorithms have an enormous diversity. Under this view, semiotics integrates Charles Sanders Peirce pragmatism thinking and ideas. From the semiotic framework, a sign is the meeting ground of the relations between elements of two systems, the transmitter, and the receiver, and only can happen in the social community. Each of these elements is entitled to enter—under given coded circumstances—into other correlation and thus form a new sign [3]. Instead, semiosis is a process in which an entity acquires meaning as icon, index, or symbol. Semiosis is a process of structural coupling between the elements of different systems. These systems are (A) a set of possible behavioral responses, (B) a set of states of things in the world, and (C) a set of signals correlated by arbitrary combining.

The term architecture refers to the frame of digital communication. This structure can reach a lot of levels: the defined libraries of algorithms, the processes that they can do, the time of the spread of bits, and the meaning of the data coded on bits. However, the level of our interest is the semiotic one or the meaning coded. We watch a massive response between bits, data, and receivers only on the semiotic

level. The theoretical issue of this kind of behavior is the continuous change of the meaning of the information point-to-point until it becomes fake in opposition to reality. The social importance of this behavior is the impact of the offline world. A lot of massive news turns into political and cultural energy: anger, despair, and polarization. Therefore, the control of digital communication is a topic of political power than nations and agents take advantage of them.

It should be noted that, with the development of Web 3.0, the semiotic processes have changed. Digital technologies, in addition to providing interaction and updating in real time, stimulate the development of long-range semantic networks, the interaction of large databases, and increasingly efficient algorithms to navigate [4]. This has caused effects or by-products. Super viral information of networks or cascade is the best example of this kind of outgrowths without control. The cascades are the best example of viral data, and we refer to them in the next pages.

The debate about cascades is if the tendency of information in a network is natural or not. The informal expression of social inclination in digital communication is trending. It refers to a topic currently popular or widely discussed on social media websites; they are today's top trending topics.

Current studies about digital propaganda have proved that some trendings are controlled by human trolls, bots, and algorithms. Most of them have political and hybrid warfare purposes [5–12].

But in this chapter, we will not go deep into political science. Instead, in the theoretical arena of systems research, Prigogine [13] postulated that dissipative systems are dynamic nonequilibrium open systems with internal gradients. They keep their low entropy condition stable by transporting matter and energy beyond their frontiers. They consume energy and present matter and energy cycles. Dissipative structures develop complexity exporting and dissipating entropy to their environment [14–16].

The systems we deal in social sciences, humanities, and arts are open systems. Open systems are those that transform one type of energy, matter, or information into another, as they adapt to their environment. The classic mechanic theory defines that in all open systems, change is irreversible. The shifts within open systems generate all kinds of disturbances at the atomic level, which lead to disorder in the molecular structures until the social macrolevel. These variances into the matter, energy, and information are an irreversible process. This process produces a kind of disorder in the fundamental structure and it is measured by its entropy.

According to Claude Shannon as Ilya Prigogine, entropy or disorder can be characterized as a statistical measure [13, 17]. Shannon's entropy "is a statistical parameter which measures, in a certain sense, how much information is produced on the average for each letter of a text in the language. If the language is translated into binary digits (0 or 1) in the most efficient way, the entropy H is the average number of binary digits required per letter of the original language" [17]. Our writing system has 26 letters to represent many languages. But if I use my alphabetic keyboard to do a translation to a writing system that only has 2 digits, as binary, I have to count how many times the digits of binary systems I need to combine to reach the best codification. The average of binary system required for each letter is 4.6. The formula is very simple: $\log_2 26 = 4.6$ bits per letter, which means that 4.6 bits is approximately the number of times the two digits can appear to represent each one of the 26 letters. In that way, entropy is a statistical quantification of how many entities we need to interpret System 1 with entities of System 2.

The concept of entropy used by Prigogine is a measure of the degree of knowledge we have of a system. Its function is to know the current status of any system. In theoretical sense, at the beginning of the universe, entropy was very low; in

other words, a certain type of order governed the beginning of all things. Thus, the evolutionary tendency toward order through disorder becomes a universal reaction that returns to the origin of everything [13].

In this case, we are talking about digital communication, one of the most ordered systems in the planet. Shannon's information theory establishes that to measure information it is necessary to calculate the range of the data produced by the source. In this approach, quantifying the spread of a text message is the best way to do that task. But Shannon's theory is not designed to explain the changes into meaning [18]. Occasionally, the sense of a message could be switched from its original meaning, by two factors: first, a translation effect, for example, if we do not speak or understand the coding language, and second, an exposition influence. Both factors are context condition of the communication and are not issues from communication theory. The dynamical behavior of meaning in social network has two features: move and stream thoughts. This dual behavior allows expanding or shading off the original meaning until twisting it.

The big question is if human behavior responds to laws of thermodynamics. The hypothesis of this paper postulates that semiosis organizes thoughts as networks, and networks help to dispel entropy and generate order. This happens through an intricate structure of individual and collective relationships. As proposed by Luhmann [19] in his time, we understand communication systems as relations between the relationships of semiotic systems.

The new existing analysis of information propagation in virtual environments overcame the impossibility of proofing such hypothesis. Today, it is possible to track the trajectories of information exchange through the topology of these networks, as described by the mathematician Barabási [20] and the physicist Albert [21]. It is also possible to apply Duncan Watts and Steven Strogatz's [22] small world networks, or through the sophisticated methods in Stanley Wasserman and Kethrin Faust's [23] classic book. The postulate "any two people can be connected in a maximum of six steps" of the sociologists Jeffrey Travers, Stanley Milgram [24], and Mark Granovetter [25, 26], is the basis for the applications of modern network theory. Our dissertation comes from this postulate too.

We postulate that the cascades are a kind of natural dissipative structures in the cultural level. The implication of this postulate is that mechanical laws of nature lead to cultural and social processes of semiosis.

This dissertation is argumentative and revolves around communication within cultures. We are interested in debating two aspects:

1. Does the difference between personal and collective interpretations result in dissipative structures?

2. Does culture generate information cascades to keep its dynamic equilibrium?

For all that has been said so far, readers have in their hands a text that consists of three parts (apart from this introduction and subsequent conclusions). In the first part, we deal with the concept of macroscopic communication level; the second part deals with the microscopic levels of communication; and, finally, we discussed dissipative structures of communication. In this way, the first two parts of this essay are theoretical-methodological; while, the last part, applies the concepts proposed throughout the text to specific cases. We present our preliminary results, to discuss whether it is possible or not to control trends with viral information.

2. The macroscopic level of communication

The prefixes "macro-", "mega-," and "micro-" can be a source of inaccuracy and confusion. Rosnay [27] implemented "macroscopic" as a conceptual instrument for the scale of observation and experience related to social phenomena, where life develops, and the scale in which ecological systems interact with socioeconomic environments. Within the systemic-cybernetic approach, an attempt to unify terminology has been in progress since the 1960s. Currently, the proposal uses the concepts "macrocosm," "megacosm," and "microcosm". In this way, there are three scales in which culture operates: temporal limits, limits of interpretation, and limits of life. Therefore, the processes of signification obey the laws of thermodynamics, the physical laws of the universe, and the complex structures by which we exchange and create meaning. In other words, social systems, at least complex social systems, generate events. These autogenerative processes would be located in the middle between biology, which includes the neuronal interactions of individual semiosis and interpretant signs, and the accidental developments that occur as a result of random encounters between systems and events. While the individual system responds to disturbances with its own determinism or internal laws, the ecosystem responds randomly or decentralized [28]. In this sense, the difference between event and element is basic, because "the notion of an element is a spatial ontology, while the notion of an event is a temporal ontology" [28].

Some systemic philosophers such as Brier [29], Wilber [30, 31], and Laszlo [32] named this model as "ecosystemic." Each of these authors has proposed a different scheme to represent the ecosystemic model with the different scales of time, life, and interpretation. Our theoretical-methodological proposal is that the trajectory of a particular meaning can be measured as a probabilistic trajectory along these temporal, interpretive, and life scales. From this perspective, based on the phenomenology of Peirce's experience, semiosis is the process by which a thing acquires meaning in such a way that the evolution and continuous adaptation of the signs, in the form of networks or semiotic systems, limit the time of semiosis [19, 33]. Therefore, deep symbolic correlations depend on person-to-person contacts, and long-range correlations are defined by their longevity in years. Luhmann [33] applied the mathematical formula for the growth of superconnected networks to characterize the organizational systems constituted by decision-making. These systems are interconnected by themselves through semiosis, which results in an isomorphism[1] with the structural coupling treated by Maturana [34]. In that sense, like Luhmann, we agree with the idea that we are not talking about structural coupling based on a closed process of self-reference [33].

Systemic-semiotics is based on the first-order cybernetics definitions by Guddemi [35]. Guddemi explains that the evolution of the concept *sign* is associated with Peirce's phenomenology of experience and associates the construction of signs with Maturana's [34] *structural coupling*, which is a path that enables the evolution of categories of experience: from pure experience or firstness, to second experience or secondness, to the third category or thirdness. In cybersemiotics, firstness is everything that expresses something as a level of consciousness and that habilitates the capacity to distinguish the objective of communication from its medium. Secondness corresponds to the classification of reality; it is the establishment of meaning, which depends on the biological properties of individuals. Thirdness is the socio-communicative interaction between individuals and can only be possible across social interaction; it is where the acknowledgement of the other takes

[1] We understand isomorphism is "a correspondence of elements one to one, preserving the operational characteristics of the systems involved" [36].

place. Brier [37] argues that it is not possible to "generate knowledge without first accepting the reality of the other, your own body and consciousness, as well as the language you use" [37].

Systemic-semiotics is based on Guddemi's interpretation of Peirce's phenomenology of experience, unlike cybersemiotics, in which principles stem from biosemiotics and Luhmann's triple autopoiesis [33, 35, 37, 38] Nevertheless, the full consequences of these principles have yet to be determined, as does the role of cybersemiotics and systemic-semiotics in systems research. Deeper research needs to be conducted into Maturana's structural coupling in order to understand the difference between cybersemiotics and systemic-semiotics approaches:

> *"The organization of a system is only one aspect of the relations occurring in its structure and does not exist independently from the structure in which it happens. A system maintains its class identity and remains the same under these circumstances, even if its structure changes, but only if, throughout the structural changes, the system's organization is preserved" [34].*

Structural coupling is critical to understanding the direction in which changes occur and the moment they affect the levels of other scales. For example, the disproportionate growth of cells in a next-one-up structural level, the tissue, can produce far-reaching changes, which, in turn, affect the next fundamental tiers, as in metabolism or a living organism's development:

> *"I have named structural coupling to the dynamics of congruent structural changes that occur in a spontaneous way between systems in recurring actions (in fact, recursive), as well as the coherent structural dynamics that result from it. Living systems, as well the non-living environment in which they recursively interact, are systems structurally determined, with plastic structures that follow a course of change that emerges modulated by the flow of its interactions. As a result, living systems and their non-living environment change conjoined and congruently, forming a biosphere in the form of a multidimensional network of reciprocal structural coupling which emerges spontaneously as a result of the conservation of the autopoiesis of the living systems" [34].*

Cybersemiotics, as a type of second-order cybernetics, proposes an idea in which the production of signification in biological systems depends on structural coupling. Therefore, the study of meaning in humans must aim to complete the lack of knowledge about "the self-organization of cognition and the structural coupling of observers" [39, 40]. According to Brier [37], Peirce's semiotics combined with a cybernetic and systemic vision, such as that of Luhmann's, is what constitutes the cybersemiotics framework. However, an ontology based on Luhmann's theory of socio-communicative beings can only conceive biological systems autopoiesis. These systems perform complex tasks with an efficiency as yet out of the reach of artificial systems. In this way, the cybersemiotics theoretical background cannot solve the incommensurability among machines, consciousness, and artificial intelligence.

Bearing in mind that, in natural communication contexts, each iteration of the microcosm (the individual) with the macrocosm (the collective) involves feedback, and this process is evidence of how we update meanings with external data from our minds and personal experiences. Apparently, it is the cultural way in which we correct our mistakes or change our minds for decision-making. The systemic postulate is based on the idea that it is only at the level of macroscopic communication that semiosis is carried out, that is, the acquisition and updating of meanings. In traditional studies on transmission and acquisition of content, manipulation of behavior, and

insertion of consumption patterns, the macroscopic level is omitted, because behavior is thought to be an area for psychology or marketing. However, significant communication or the process of significance [41] is carried out at the macroscopic level.

Communication, at the macroscopic level, is the process of transmitting information from one point to another, whether it is in the public, private, individual, or collective, where the range of possible states is assigned to code and decode [42, 43]. For theoreticians such as Lacalle and Landowski, sociosemiotic concepts such as public and private spheres place communication in the center as an interface that regulates the transit of meaning between them. Furthermore, in social systems, communication implies conditions for assigning meaning within a range of possible states of the receiver, and this limit is cultural [44–46].

The methodological objective of the application of these sociosemiotic categories is to measure the degree of visibility of the subject in the communicative processes. Consequently, the visibility of the subject in the media defines the relations between the message and the communication channels through which the receivers get the information. In other words, the media largely determine the difference between the individual and collective interpretation of a sign, message, or speech and leave an evidence of that [47].

For semioticians like Charo Lacalle and Eric Landowski, the methodological objective of their socio semiotical categories is "to measure the degree of visibility of the subject in the communicative processes" [42]. Currently, in communication outlets hosted in social network's websites, the degrees of visibility of individuals are self-evident, whereas, over the twentieth century and the beginning of this century, the visibility of individuals as a concept was an empirical topic not yet comprehended. From a systemic approach, we can distinguish several scales in which "empirical individuals communicate, and systems of meaning make communication processes possible" [48]. Provisionally, we can divide the visibility of interactions as scales of semiotic organization: culture, society, community, and kinship, which we will explain below.

Culture refers to those interactions that correspond to the set of values and standards of a social system. These values and norms act as parameters of collective order and include beliefs (religious, esthetic, ethical, and philosophical), legal systems, political ideologies, technical practices, prevailing economic attitudes, etc. Culture polarizes strongly almost all individuals in the system, through reciprocal conditioning of behavior, which in turn. "The basic values and the resulting adaptative norms correspond to the autopoietic character of a given sociosystem, which must however adapt to internal and environmental change. It strongly polarizes nearly all the individuals in the system, through reciprocal behavioral constraints and, in turn, generates the behavior and attitudes needed to maintain its global coherence and efficiency and in some extreme cases secures its very survival" [1]. This graph relation corresponds to the organization of systems, suprasystems, and subsystems in which a social institution like language operates, as well as codependences and relevant points of interaction that can be observed [49], shown in **Figure 1** as collective and public networks.

Society involves the interaction of human systems using parameters of order. Keynon De Greene [50] explains the use of order parameters as follows: when applied to complex living systems, the establishment of order describes evolutionary limits and warnings for the survival of the system. The parameter order belongs to a macroscopic, emergent collective field, in which critical points of an infinite number of microlevel interactions occur. The parameter of order expresses the stochastic generation of new structural change, as well as the deterministic maintenance of the established situation or its structural constancy. The appearance of the parameter of order represents a significant loss for the degrees of freedom at the microlevel, so that the microlevel behavior follows the parameter of order. Languages, theories,

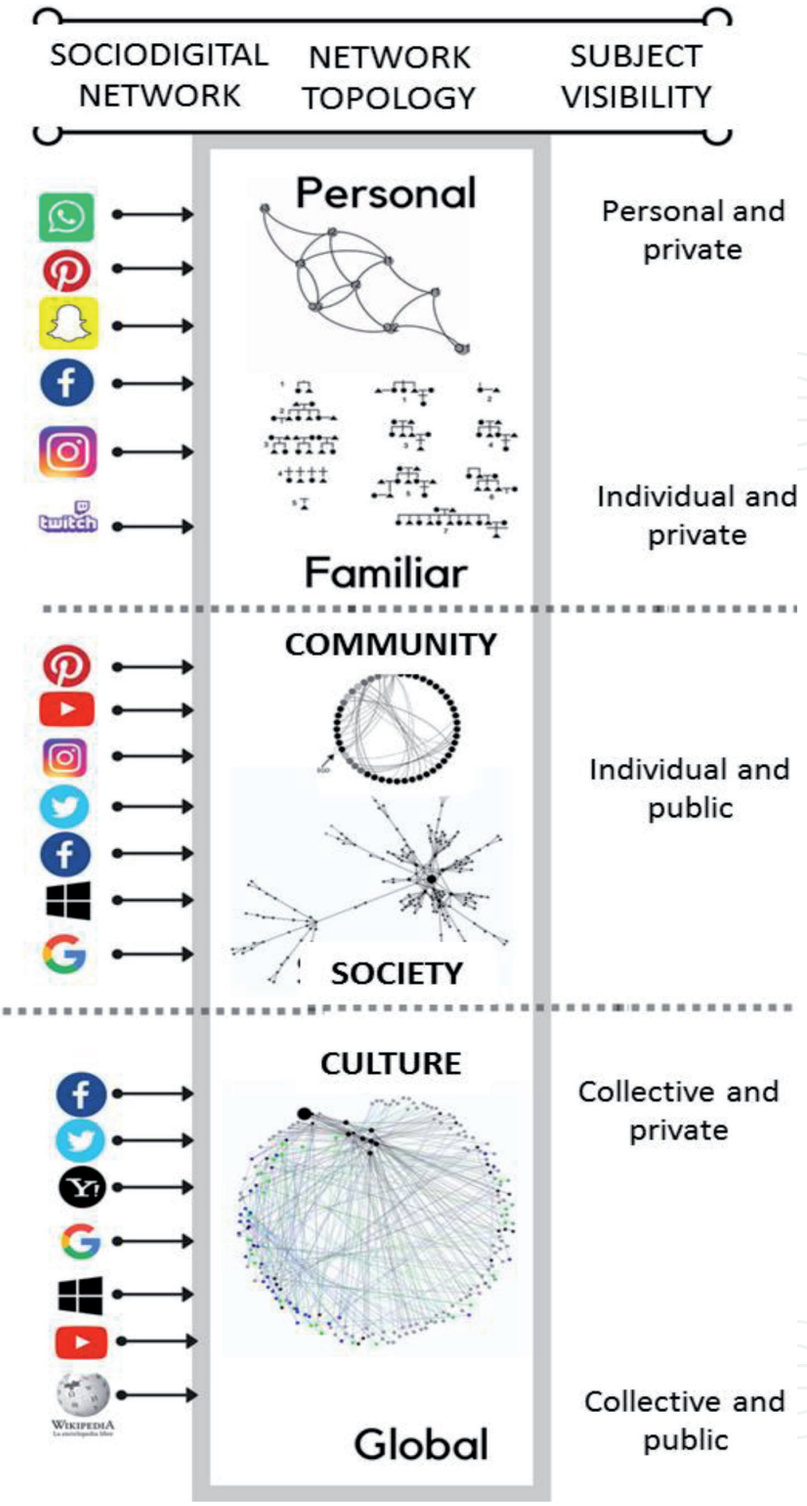

Figure 1.
The sociodigital networks and their macroscopic interaction: culture, society, community, family. Source: authors.

religions, political belief systems, economic belief systems, as well as scientific and social belief systems, such as the Newtonian paradigm, are exemplary parameters of order, shown in **Figure 1** as collective and private networks.

Community, in this sense, is a type of interaction between empirical individuals who share frames of reference, similar epistemologies, and the realization of similar tests to ascertain reality in a way that mutually validates their knowledge [51]. Communities are about "the structure made of interconnected individuals who live in similar environmental conditions" [52]. Individual members do not "necessarily have to be identical, even if they are all of the same general types. They may

very well perform different functions" [1]. Miller's theory of living systems places communities as interconnected organizations that, in turn, combine with societies [53–56] more individuals who share an identity and a common purpose, and who are committed to the joint creation of meaning through interaction [1], shown in **Figure 1** as individual and public networks.

The most stable social interactions occur within the family or kinship level. They have a lot of variety of states and are the atomic units of analysis to study communities. This type of organization regulates two types of relations, according to classic theory: consanguinity and affinity relations [57]. However, approaches like Dziebel's [58] and Fortes's [59] from a systemic perspective consider kinship as a regular or egocentric network, asserting the origin node, and focused on a single family member called ego [60]. Thus, kinship relationships in a virtual or physical community are the basis of cultural networks study, shown in **Figure 1** as personal and private networks.

Figure 1 is intended to clarify how the isomorphism of interaction operates across different communication interfaces and impacts the communication process. Isomorphisms from the biologic scale toward the social scale correspond to the interaction from real networks in the "network topology" column versus the social network website in the first column. Signs circulate across different scales of the network; therefore, they do not have the same communication level or share similar interactions, resulting in sign meaning not being the same as in their original semiosis.

According to Vallée [61], the multidisciplinary or transdisciplinary character of systems theory has, as its fundamental purpose, the finding of the structural isomorphisms between systems that belong to different disciplines or between representations of the same order. Wiener [62] refers to such isomorphisms as mere homomorphisms in his cybernetics work. The search for this type of isomorphism, or proper homomorphism, has led to the concept of a model that allows for the representation of a category of systems.

Nowadays, in the digital media of communication, the degree of visibility is evident through its network topology. While, in the past century, the concept of visibility and its graduation in the empirical subject was poorly understood. Note that the social network website Facebook operates across all scales, and consequently, the intimacy, privacy, and anonymity of individuals are exposed. For this reason, other social network websites where intimacy is not at risk have become more popular among young people [42].

A methodological division of the scales of symbolic organization is as follows: culture, society, community, and family, which have been explained widely in other essays [42].

Just as shown in **Figure 1**, and in **Table 1**, with these scales, it is possible to know the trajectory of a meaning through its network topology [42].

Cybersemiotics advances that interactions are necessarily evolutionary, which is also congruent with the systemic-semiotics approach. Within the types of interaction described above, social systems are integrated and constituted. In human communication, an expression serves as evidence of autopoiesis of consciousness. The changes of connectivity across networks are proof of the need to structure communication in the form of intentional relationships with entities beyond the self.

The homomorphisms of interaction are individual-private, individual-public, collective-private, and collective-public, all of which determine the type of semiosis and the visibility of individuals. Interaction occurs within culture, society, community, and family, that is, regular networks within semiotic organization.

Figure 1 also illustrates the qualitative aspects referring to the nodes and their meanings, and quantitative features such as nodes of influence involving objects,

Empirical subject	Sociosemiotical concept	Communicative process	Sociodigital network
Individual	Private	Intimate diary	Facebook, Snapchat, Pinterest
	Public	Public figure	Twitter, Instagram, Facebook, Pinterest
Collective	Private	Intimate community, closed groups	Online conversation services: WhatsApp, Skype, Facebook, Pinterest
	Public	Public opinion—experts and amateurs	YouTube, Facebook, Flickr, Blogs—Tumblr, news, informative media

Source: Valle Canales [49].

Table 1.
Visibility of the subject in sociodigital networks.

persons, or signs as well as their degree of connectivity. The behavior of interactions is represented as an isomorphism of interaction network along with its homomorphisms.

In short, when messages operate at the macroscopic level, communication processes become irreversible, and the evidence is the events they generate. These events are an effect or by-product of the interaction of different sets of messages, experiences, and coherence with specific environments. Mathematically, we can abstract them and analyze them as cascades or *dissipative structures*.

The rule that operates at the macroscopic level is the following:

Rule 1: *when a difference of interpretation is large enough, between the individual and the collective, cascades of viral information arise, in which hundreds, thousands, or millions of subjects share facts (true, suspicious, or false).* In this way, a situation of nonequilibrium or instability of the original message creates long-range correlations.

However, before entering the dissipative structures, we will briefly recount what happens at the microscopic level. In other words, we will talk about the instability of the original message.

3. The microscopic level of communication

Semiotics studies the variety of possible semiosis [43]. Meanwhile, semiosis is the process of cooperation between three entities: a sign, its object, and its interpretant [48]. We can know these three entities in three ways: the concrete or existing object; the immediate object or the sign that the interpretant evokes in his mind in the form of an image of the concrete object; and the logical interpretant or the final meaning of the existing object. This process continues through the correlation with other signs in the mind of the interpreter, who is an empirical subject, and is expressed through a more complex sign (known as a symbol) that has a correspondence with the concrete object and various signs. Think of a politician and now meditate on the specific politician of your choice; think of all the ways you can communicate those ideas in your culture, and there you will have all the signs that make up the meaning of the politician you thought of.

Social networks function as mediators of meaning; this is a type of predicate: probably, or probably, or possibly the existing object is something in accordance with the elements provided by the media [47, 48]. But, in sociodigital networks, a meaning can be interpreted in a different way from the original message. This phenomenon is studied through interpretive semiotics [45, 63]. In interpretive

semiotics, the transfer of meanings is a recursive process that generates new interconnections between semiotic systems [64]. For this reason, in the fake news factory, we can find several examples of interpretative semiotics, to be noticed: translation processes, change of linguistic code, construction of verisimilitude, or naive iconism [41].

The transfer of messages from one subsystem to another modifies the original meaning accordingly. This process is very important, since it allows the classification of objects from an original semiosis to a current semiosis, coherent with the culture, space, and time of each individual [45, 47]. Peirce defined semiosis as an action or influence, which is or implies a cooperation between three subjects: a sign, its object, and its interpretant [47, 48]. This relative influence of three is not fixed in any way to the action between pairs. In this way, the interpretant signs belong to the microscopic level; that is why they are unstable, because, isolated, they are incomplete. They always require an object and a sign-vehicle. In the macroscopic communication circuit, a message can acquire different interpretations than those initially thought by the transmitter to communicate. In other words, the original semiosis will never be the same as the final semiosis once the subject introduces his message in the scales of macroscopic communication: family, community, society, and culture.

Based on the cultural perspective of Eco, the meanings change through the symbolic means of each culture. In this way, the information acquired in a virtual environment, by balancing its variety of states with the concrete known environment, generates by-products as a form of entropy to balance the interpretation of the contents. The semiotic competences of *dictionary* and *encyclopedia* define the possible ranges of the interpretation of each individual [45]. In order to codify signs, the competence of the sign production must respond to the conventions of each culture; this is the encyclopedic competence. On the other hand, the competence of dictionary operates on a personal level; it depends on our experiences and personal knowledge [41, 65].

According to Charles Sanders Peirce, the sign, object, and interpretant sign only can occur as an effect of social interaction. This trivalent interaction is the semiosis, and the result is the meaning. Consequently, semiosis needs a cultural environment and individual experience. All these processes are components of phenomenology of experience. In this way, human understanding begins at a personal scale and consolidates at the macroscopic level. At that level, we will find what, within the theory, is called a sign, the minimum unit of meaning (mum), or semiotic function. For example, the signs of different languages for the entity "political candidate" can result in the following outputs: የፖለቲካ እጩ, Amharic; палітычны кандыдат, Belarusian; ผู้สมัครทางการเมือง, Tai. In that way, there is a sign with the condition of a concrete and dynamic object. In other words, the object is the entity to which the sign refers. In the previous example, through experience, we know that the object "political candidate" can take a great variety of concrete assignments within a given space and time. In this way, this entity interacts and exists within a macroscopic (where it is enunciated) and microscopic (which enunciates) environment. In the third place, an interpretive sign is missing, and that sign depends on the interpretative qualities of each person. In theoretical terms, the interpretant sign cannot be known unless someone opened someone else's head and says: "Look! Here is the sign-political candidate". However, it would be the sign "political candidate" of that time and moment, and not of this other time and moment.

The rule that operates at the microscopic level is as follows.

Rule 2: *if the concrete object and the interpretant sign are separated, it is due to its inconsistency with the macroscopic context. As the difference of states in the*

interpretation gets bigger, the distance between them will grow exponentially as they circulate within the macroscopic level until reaching different regions. Thus, the approximation to equilibrium is the result of the decrease in the difference of interpretations, and this implies a transformation in the original semiosis. Consequently, the initial information has been modified; the objective and object of the original system can become completely different from its intention, emotion, or reason.

4. The dissipative structures of communication

Digital communication is a system of dynamic states designed to create information, whose by-product is entropy. Therefore, a way to dispel such entropy is necessary. The main objective of incorporating these presuppositions is due to the isomorphism that we have used throughout this text to explain how viral information and its social action emerge. We talk about Ilya Prigogine's theory about dissipative structures [13–16]. Ilya Prigogine postulated that matter and energy are transformed throughout a trajectory that begins at a microscopic and unstable level. The next level is the irreducible statistics by which a rupture in the temporal symmetry takes place; that is, once it enters this process, neither matter or energy can be reduced. Finally, at the macroscopic level, energy and matter find balance, and the final result is irreversible [13].

This succession, instability (chaos) → probability → irreversibility, involves properties of probabilistic evolution that can be measured [13]. In the dimension of culture, that evidence is observed through virtual environments and their statistical evolution in their network topology.

Under these criteria, we understand dissipative structures as by-products of an interpretative semiosis, which operates when there's a big difference in the interpretation between the public and the private. These structures are what network literature calls information cascade. Sun et al. [66] were the first to research this type of cascade phenomena with real Facebook data. According to these authors, the models of statistical evolution have contributed to the comprehension of how diseases are transmitted and, also, of how ideas between people are transmitted through diffusion structures. These can be small chains at the level of a family or peer conversation, or it can very well scale to the famous cascades of viral information, which, in its more outstanding cases, have effects on the objects of a concrete environment, and over the objects of a virtual environment [67].

From theory, network's interaction and topology allow observing the time of propagation of false or fake news, so that it is possible to place them within the Harry Wiener index [68].

According to the Wiener index,[2] there are at least two network structures through which the news can be disseminated: (1) a structure that has great depth; the propagation is slow and from person-to-person but, in a moment, it reaches a concentration point that triggers a rapid viral spread; (2) the second structure implies a rapid propagation, of long-range but little depth and its lifetime is very short.

The first kind of structure is known as "string-like," while the second kind is commonly denominated "viral" [69–72]. Nevertheless, it must be noted that the behavior itself of the propagation shows a notable difference between an artificial and a natural viralization.

[2] Wiener index carries the name of Harry Wiener; in his time [68], he named it "number of trajectory." It is the most antique topological index related to molecular ramification.

4.1 Artificial viralization

During Mexico's federal elections in 2018, information played an important role in the campaign period for the presidential office. This reached such extensions that 97 communication companies asked for the initiative "Verificado" [73], to confront the amount of false news circulating through digital media. The origin of this project refers to two circumstances: the first was a citizen effort facing the 2017 earthquakes in Mexico City; secondly, in response to a growing concern about the possible intervention of foreign governments in the electoral process [74–76].

The following are the three parameters used by the Verificado team to choose the news: (1) news of the 2018 electoral period; (2) news shared more than a thousand times; and (3) false, misleading, or unverifiable news for its content. The data corresponding to "false news" had 155 entries; some are grouped into a single note, and seven of them are not news but announcements [73]. We grouped the data by name; for that, it was necessary to determine the width in the variation in the amount of news propagated per day. It should be considered that the period between March 12 and June 30, 2018, consists of 110 days, while the official period of the campaign lasted only 89 days: from March 30 to June 27, 2018. Therefore, the generation of false viral news was not continuous, but only a few days of the race. Of the complete sample, only eight of the 155 false messages were published around 24 million and 350 thousand times by Facebook[3] accounts in the span of 6 days. That makes them superviral news. However, the number of times shared, their viral propagation period (from 6 to 80 days), and the content of the notes show that they constitute an anomalous case; it is not natural in human communications. It is remarkable that the content of these eight superviral fake news, which managed to be shared by Facebook accounts millions of times, refers to candidates different from those of the ruling party.

Five were on Andrés Manuel Lopez Obrador, two on Ricardo Anaya, and one on Jaime Rodriguez Calderon "El Bronco"; none mentioned the official party candidate (PRI). According to the data found in Verificado-2018 and the Facebook counting algorithm, it is shown that the total of false and misleading information was shared 120 million times. The main theme was a campaign against the former presidential candidate, Andres Manuel Lopez Obrador, who, despite the viralization of false information, won the elections. Illuminated by the data, and contrary to what some North American academic circles have predicted about the manipulation of behavior through viral information, the result in Mexico was in the opposite direction. In the particular case, everything indicates that there is no interaction between people; we are dealing with an algorithm of propagation between ghost accounts (or web robots).

A social network study carried out by Alber-Laszlo Barabasi and Peter Ruppert [76], which Aristegui Noticias (digital news) presented during the 2018 electoral campaign [77], shows several important qualities of the ghost accounts that fictionally followed the candidates: at least 50% of the accounts were bots. These accounts would, mainly, promote positive publicity about the PRI candidate and, also, propagate negative information about other candidates they followed (especially about the candidate of the Movimiento de Regeneración Nacional, [MORENA]). These all mean that someone made an effort to create an informatic automata to repeat fake information millions of times within a closed system; this is no different from repeating a name thousands of times in an empty room (or in our mind). In structural terms, this does not reach out of the microscopic level of communication. In most cases, this information caused laughter or disgust; only in the least cases, it caused the wished effects of a modification in behavior in favor of a candidate.

[3] This number was obtained through Facebook's algorithm: https://graph.facebok.com.

4.2 Natural viralization

A case of natural viralization, during the same elections, was *#NoAlPeriodismoSicario* (no to hitman journalism). On a macroscopic scale, a person can share a *fauxto*,[4] what is colloquially known as a meme. On 5 May, the journalist Ricardo Aleman shared a meme with the heading: *"Les hablan"* (they are talking to you). Next, the text in the image read: *"A John Lennon lo mató un fan. A Versace lo mató un fan. A Selena la mató una fan. A ver a qué hora chairos"* (John Lennon was killed by a fan. Versace was killed by a fan. Selena was killed by a fan. We are waiting, *chairos*). In a matter of hours, a reaction was viralized against the communicator with *#NoAlPeriodismoSicario*. The version of the journalist was that sharing this *fauxto* was a warning for the alluded candidate. According to his interpretation, the viral response against him was evidence of a violation of his freedom of speech [78]. This case had a microscopic stable message; in the personal and familiar context of the journalist, magnicide ideas are funny. However, on a macroscopic level, by interacting and establishing diverse trajectories in networks, the meaning of a dark joke became a call to assassinate the candidate. On the macroscopic level, the journalist has the editorial voice of several media. This is why it resulted unthinkable, for network users, the conduct of this communicator in ethical terms.

The difference between the interpretation of the communicator and the interpretation of the users was huge, even contrary. On the microscopic scale, the category and class of the message of the journalist are protected by his freedom of speech. After the cascade effect, which included him being fired of several media, the journalist shared a series of answers to excuse his actions: *"Televisa decidió cancelar la relación laboral con Ricardo Alemán! No la comparto pero la respeto. Toda empresa tiene derecho a contratar a quién convenga a sus intereses! Ganó el linchamiento y el reclamo de censura! Los demócratas de Morena!!!"* (Televisa decided to cancel the work relation with Ricardo Aleman. I do not share it but I respect it. Every company has the right to hire whoever matches their interests! The mob law and the claim of censorship won! The democrats of MORENA) [79].

This is not the first phenomenon of such nature seen in Mexico. Just like the journalist, Ricardo Aleman, TVUNAM's former director, Nicolas Alvarado [80], was in the middle of a controversy for a comment he published on national media (concrete and virtual). The mediatic mob law these people were subject of has a close relation to the dissipative structures that are generated around their original messages. Entering the macroscopic scale, they are exposed to natural forces of tension and distension, which we observe as probabilistic evolution in the network models. In this sense, the information generated, the contents that emerge, and the changes of the concrete original object not only modify the behavior of people but can also have social action as an effect. These long-range effects are those that permit to see a new political class coming, one completely different from that of the twentieth century.

According to the data of the Verificado-2018 site, in total, the false and misleading information was shared 120 million times. Its central theme was a campaign against the candidate Andrés Manuel López Obrador, who despite the virality of the information won the elections.

The INE (Federal Electoral Institute), the electors list of Mexico consists of 41,316,706 women and 44,637,006 men, that is 85,953,712 million citizens. However, in the 2018 election, only 56,611,027 citizens voted.

[4] Friggeri et al. [67] define fauxto as an analysis unit of cascades, which corresponds to an image that has been intentionally altered; the image can be a picture or a heading, for example, a quote or a saying. They are called colloquially "meme."

The candidate with the highest number of false news spread on the networks obtained 30,113, 483 votes, in other words, 53% of the electoral preference voted by Lopez Obrador. The other two candidates of the National Action Party (PAN) in alliance with the Party of the Democratic Revolution (PRD), and the official party (PRI) obtained 22 and 16%, respectively. The implications of this fake news anonymous behavior are at least two:

Some American politicians and scholars predicted that there exists a supposed manipulation of human behavior through viral and false information in the networks. The result in Mexico was in the opposite direction to its predictions.

The debate about the cascades of viral information is still valid. Is the massive data capable of transforming people's behavior? Is it possible to change the voting trend with fake news?

The explanation belongs to a microscopic level. The answer is into the processes of spread within social and cultural interactions.

The social and cultural scenarios are two types: digital and fleshly. A virtual environment consists of matter, energy, and mainly information. Meantime, a concrete situation is composed of primary material, energy, and less information.

The microscopic level has a probabilistic evolution over macroscopic interactions. This feature allows measuring the semiosis evolution through statistical concepts applied to Network theory. The principal notion is the 'dynamic temporal network' (dtn) [70] because data of a dtn set mathematical topologies. It is possible to predict the probabilistic evolution of cascades across five topologic properties [70]: features of the content, root characteristics of the original poster, sharing characteristics, structural characteristics, and temporary characteristics.

These properties are necessary to generate viral behavior. From the scope of systemic-semiotics, they are semiotic units. It is essential to know the limits of our analysis, which in this case are the smallest parts of significance. Umberto Eco called the minimum unit of meaning. They resemble the everyday objects of a culture insofar as they participate in semiosis. The minimum unit of meaning has an upper and a lower limit of interpretation. In this way, there is a logic of understanding within the microscopic level and it becomes different at the macroscopic level.

These fluctuations of significance are the structures of the meaning. The minimum unit of meaning changes with the semantic attributes of each category and class, and the relationship shifts all the time between the sociosemiotic interfaces. They only can occur in a natural network, viral or not.

5. Conclusions

Systems research is divided into three important categories: systems thinking, systems science, and systems engineering. Following this argument, the cybersemiotic approach serves as a systems thinking ontological foundation that studies consciousness. On the other hand, the systemic-semiotics approach is a foundation for systems science that studies semiosis. Systems research is a new way of doing science, sometimes called "postmodern" science, although in quite a different sense than the meaning of postmodernity in the liberal arts. The incorporation of semiotics and cybersemiotics as components of systems research occurred at a time when those disciplines were broadly fragmented and divided, in particular semiotics, and were confronted in open debate with formal linguistics. In other words, the rules of cooperation, and the consolidation of axioms and epistemic concepts about the

processes of semiosis, surpassed a fragmented scientific community to such an extent that in some scientific circles it is often said that philosophy, its actions, and epistemic concepts are extinct.

Transdisciplinarity, nonetheless, demonstrates how knowledge evolves for the benefit of intelligence in new environments. The inscription of semiotics within the foundations of systems science alongside meta-theories, meta-methodologies, ontology, epistemology, axiology, category theory, and praxiology, among others, situates it in its rightful position to answer a most important question: how and why do we signify reality?

Semiotics is the doctrine of all signs, and a sign is something that is in place of something else in any of its properties. This definition creates a path to understanding nature's randomness and poses the real phenomena as open problems. Under this view, semiotics integrates Charles Sanders Peirce pragmatic thinking and ideas.

Systems research, cybersemiotics, and systemic-semiotics are very close to one another: cybersemiotics' scope is an important foundation of systems thinking because of its basis as a second-order cybernetics, rooted in human context and interest in intentionality. On the other hand, a systemic-semiotics' scope is a foundation of systems science and is related to a first-order cybernetics.

About the original question of this essay, is it possible to control electoral preferences through viral information-false, misleading, or true? Yes, but only when the interaction and the degree of communicative efficiency are through real individuals and not through bots. In the cases of natural viralization, it was possible to change and modify behavior, even to lead a population toward social action. On the contrary, the cases of artificial viralization are equivalent to repeating a message a million times inside an empty room.

In essence, we measure the efficiency of a communicative situation. How reliable are we communicating? Abstractly, a dynamic system of equilibrium is a kind of communicative event "e". It is equal to the sum of its communicative efficiency "η" and its entropy "ξ". Under the rule (1): *When a difference of interpretation is large enough, between the individual and the collective, cascades of viral information arise, in which hundreds, thousands, or millions of subjects share facts (true, suspicious, or false)*, as shown in Formula 1:

$$e = \eta + \xi \tag{1}$$

The initial entropy in an original semiosis is 0, but as soon as it comes into contact with the macroscopic level, that entropy can grow or decrease according to the difference between the original interpretation and the massive interpretation. Therefore, entropy would be the sum of all the information chains around a category, class, and relationships between them. The rule that operates at the microscopic level is the rule 2: *if the concrete object and the interpretant sign are separated, it is due to its inconsistency with the macroscopic context. As the difference of states in the interpretation gets bigger, the distance between them will grow exponentially as they circulate within the macroscopic level until reaching different regions.* Network theory allows the trackability of the probabilistic evolution as shown in Formula 2:

$$f(x) = R \tag{2}$$

In the formula, $f(x)$ is a function that changes over time. The result is numerous interconnected nodes, defined by (R) [70]. The final size of the cascade is the size of $f(x)$. Within the statistical properties of cascades, the increase always responds

to exponential growth. It usually is characterized as a power law. The probabilistic evolution is (P) and has a growing rate. It is the representation of the inverse of the percentage of nodes, raised to the approximate amount of information cascades or total dissipative structures, as shown in Formula 3:

$$P = \frac{1}{R^{\xi}} \tag{3}$$

The probabilistic evolution in the macroscopic level shows that the consequent results are irreversible, as the theory predicted [13–16, 28]. Because the communication circuit operates as follows: The initial stage of the signs begins with a message entering into the channel of conversation. The user conduces to match up all the uncertain data through gathering and connecting knowledge with his experience. This behavior creates control parameters. And it is followed by data that emerge attenuated or amplified.

It is the stage of the initial semiosis, and at this time, the semiosis is weak.

The next phase is the generation of disturbances or dissipative structures. Whether they arise or not will depend on the discords between individuals and the interpretation of information. Then, the processes can be measured with the tools of the graph and network theory (as propagation processes).

Finally, the difference between individual interpretations generates dissipative structures as an output.

A complex system has a complex behavior only at the collective, macroscopic level. So it is made up of public, private, collective, and individual networks and without central control, that is without leaders. This property allows generating parameters of control for messages. Consequently, it modifies the behavior of the people.

The decentralized control properties account for the sudden emergence of newly organized states of information, such as discovering new words or meeting in a lynching. Meanwhile, human trolls and web robots have leader, central objective, and centralized control. Accordingly, it is unlikely that an artificial network, such as a web robot, will manage to change people's behavior on its own. They repeat a message in an empty box.

This kind of advertisement campaign is based on creating bots to repeat massively false information inside a closed room, and it comes from the sentence attributed to the Nazis: "repeat a lie with enough frequency and it will become true." The saying attributed to the Nazis preserves a remote relation to an irrational vision from the twenty-first century. Youngsters of this new century are conscious that the effects, in reality, do not depend on wishing something a thousand times, saying hundreds of times a name, or sharing thousands of times a news in an empty room.

The interaction with reality has changed the rules of communication. The clearest example of the new communicative situation of the Web 3.0 was that the only candidate that played the rules of Web 3.0 took the themes of national interest from the macroscopic level and made them his political banner. Even a narrative about a "mafia of power" emerged, the victims of said mafia and their heroes. The narrative of the mafia of power consolidated itself as a consequence of thousands of dissipative structures along a territory during a long period of 15 years. It generated virtual and concrete networks, long-range and deep, with string-like structures.

In our opinion, natural long-range and deep networks are the reason for the massive vote for a candidate, just as it is the reason for the colossal failure of publicity without theory. Thus, the next step in a cybersemiotic investigation or systemic semiotics cut should be about the role of the natural long-range and deep networks in the semiosis process.

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