Attractor's Trajectories in the Discursive Emergence of Systematic Metaphor: *Reflections from a Reading Practice*

Trajetórias de atratores na emergência discursiva da metáfora sistemática: considerações a partir de uma prática de leitura

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Abstract: This paper investigates the nature of systematic metaphor as it emerges in the discourse produced after a silent reading activity, from a point of view that considers it as embodied and socioculturally situated, as well as the flow of attractors during the emergence of such metaphor. In this investigation, we are particularly interested in explaining the attractor concept in line with Complex Adaptive System (CAS) theory applied to discourse and in understanding how its movements direct and instruct the discursive flow. Our investigation, linked to the studies of systematic metaphors and language from the perspective of systems dynamics, springs from research developed by the Study Group on Language and Thought – GELP-COLIN, of the Federal University of Ceará, and is based on recent research related to CAS theory (Larsen-Freeman; Cameron, 2008; Cameron; Maslen, 2010; Almeida Júnior, 2016; Almeida Júnior; Pelosi; Bessa, 2019; Pelosi; Almeida Júnior, 2022). Analyses are based on the figurative language that emerged from the speech produced in a focus group interaction, after the silent reading of an opinion article. Results with focus on primary and secondary level attractors point to the emergence of several metaphors that translate attitudes, concerns and anxieties of the interaction participants.

Keywords: Systematic Metaphor; attractors; silent reading.

Abstract: Este artigo investiga a natureza da metáfora sistemática, tal como ela emerge no discurso produzido após uma atividade de leitura

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silenciosa, a partir de um ponto de vista que a considera como corporificada e socioculturalmente situada, bem como o fluxo dos atratores durante a emergência dessa metáfora. Nesta investigação, estamos particularmente interessados em explicar o conceito de atrator em linha com a teoria do Sistema Adaptativo Complexo (SAC) aplicada ao discurso e entender como seus movimentos direcionam e instruem o fluxo discursivo. Nossa investigação se vincula aos estudos das metáforas sistemáticas e da linguagem na perspectiva da dinâmica dos sistemas, fruto das pesquisas desenvolvidas pelo Grupo de Estudo sobre Linguagem e Pensamento – GELP-COLIN, da Universidade Federal do Ceará, e tem como base teórica recentes pesquisas relacionadas ao SAC (Larsen-Freeman; Cameron, 2008; Cameron; Maslen, 2010; Almeida Júnior, 2016; Almeida Júnior; Pelosi; Bessa, 2019; Pelosi; Almeida Júnior, 2022). Utilizamos como base para as análises a linguagem figurada que emergiu da fala produzida durante a interação de um grupo focal, após a leitura silenciosa de um artigo de opinião. Resultados, com foco nas trajetórias dos atratores de nível primário e secundário, apontam para a emergência de várias metáforas que traduzem atitudes, preocupações e anseios dos participantes da interação.

Palavras-chave: Metáfora Sistemática; atratores; leitura silenciosa.

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1 INTRODUÇÃO

Language as a dynamic and complex cognitive activity has enabled greater effectiveness to explain the multiple categories of analysis of cognitive linguistics studies, which emerge from structural couplings and integration of the interactional environment in which language is fundamental to move the subject through the flow of interactions in the construction of meaning. This flow gains multiple views when we consider the multisemiosis present in the texts that dominate this apparently chaotic and unstable universe.

The works of Larsen-Freeman and Cameron (2008) already pointed to the relevance of treating language no longer in a fragmented way (social, physical and cognitive), that is, as an inter-individual action that is analyzed from specific purposes carried out in the social practices, but as an open and integrated system that interact in more diversified contexts, fed by multimodal interactional stimuli that contribute to the production of meaning.

Based on this vision of language and on research carried out under the broad themes of Reading, Cognition, and Complex Adaptive Systems (CAS, from now on), this paper aims at discussing the nature of systematic metaphor, as it emerges in discourse produced after a silent reading activity from a viewpoint which considers metaphor as embodied and socioculturally situated.

We depart from a viewpoint which considers discourse a CAS, in which figurative language emerged during talk "freely" produced in a Focus Group interaction (FG, from now on), after the silent reading of an opinion article, contributes for the emergence of systematic metaphors which translate attitudes, concerns, and longings among other dispositions, of the interaction participants. As it will become clear through the text, we are particularly interested in explaining the concept of attractor in line with CAS theory applied to discourse, and will therefore focus on two kinds of discourse attractors which we name "primary attractors" (genres, events, contextual triggers motivated by intra/intersubjective aspects of agents) present in the system's initial conditions and "secondary attractors" (systematic metaphors, considered provisory and temporary stabilities of the system) and on how their movements direct and instruct the discursive flux.

In this context, we aim first of all at verifying the role played by primary and secondary attractors in the establishment and maintenance of the discursive interaction, then at analyzing the role of figurative language

in the emergence of meanings directly or indirectly related to a text read in silence, and at analyzing how such meanings are activated by metaphor-vehicles (initiators/triggers) and how they contribute for the emergence of systematic metaphors which translate attitudes, beliefs and values of readers as they think aloud in group (Zanotto, 2014).

With such objectives in mind, the data gathered by means of an independent analysis by the first author of the paper is compared with data gathered from talk emerging from a FG interaction with students of a government state school at Santa Maria, RS[1], conducted by the first author. The several methodological steps for text selection and data gathering will be explained below in the section pertaining to the methodological procedures.

Below, we present the theoretical basis that guided this analysis; then the methodological aspects; and, finally, some discussions about this investigation.

2 THEORETICAL BASIS

Our primary interest here is to agency reading comprehension ability by analyzing attractors in the discursive flux during the emergency of Systematic Metaphors (SysMets) by means of a theoretical and methodological proposal that focuses on the silent reading and discussion of the various interpretative possibilities of the meanings proposed by the text.

Learner agency, considering such a dynamic and complex context of meaning production, during the discursive flow in the emergence of SysMets present in multisemiotic texts, is the mediation and negotiation, present in language practices, which enables the reader to plan and select essential cognitive and metacognitive strategies, to choose different goals and interests and to establish relationships between multisemiotic texts and previous knowledge, experiences, values and beliefs (Leal *et al*., 2020).

> Learner agency refers to the feeling of ownership and sense of control that learners have over their learning. Learners who are agentive have a growth mindset. They believe that they are in control of their learning, and that they have the ability to learn and improve. Agentive learners take initiative, seizing and even creating opportunities to learn. They take risks, confident that they can learn from their mistakes. They are also resilient; they have the ability to adapt and persevere in order to overcome setbacks. (Larsen-Freeman *et al*., 2021, p. 6).

[1] Rio Grande do Sul, State of Brazil.

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In the context, the research is based on three different but, to our understanding, complementary theories – Complex Systems Theory (CAS) (Holland, 2004; Larsen-Freeman; Cameron, 2008; Capra; Luisi, 2014; Thurner; Hanel; Klimek, 2018), Cognitive Linguistics (CL) (Lakoff, 1987; Johnson, 1987; Lakoff; Johnson, 1980, 1999) and Metaphor-Led Discourse Analysis (Met-Led Discourse Analysis) (Cameron, 2007; Cameron *et al*., 2009; Cameron; Maslen, 2010). From a complexity perspective, it is based on the assumption that language constitutes a complex adaptive system and discourse is a complex dynamic language-using activity (Larsen-Frieman; Cameron, 2008). According to Alves da Silva and Soares (2022, p. 44), "the field of knowledge of complex adaptive systems (SAC) includes the study of chaotic dynamic systems, which are governed by equations, [...] but which reveal results completely random", such as the emergence of systematic metaphors and the trajectory of attractors, objects of analysis in this work.

Adopting a complexity perspective, language is a dynamic, open, heterogeneous, non-linear system, that results from the conscious interaction of agents with the social, historical, cultural, and behavioral environment that enables emergence, negotiation and the construction of meaning from of the discursive flow of perception, action and reflection in/on the ecosystem of social beings and language resources.

Table 1 — Examples of complex systems applied to language

Field	Spoken interaction	Examples
Agents	Speakers, their language resources.	Students, teachers, focus group.
Dynamics	Conversation dynamics, negotiation of understanding, perception.	Classroom discourse, participation patterns, tasks, triggers.
Heterogeneity	Speakers' backgrounds, styles, discourse topic.	Abilities, personalities, learning demands.
Organization	Dyads, speech communities.	Class, group, grammars, curricula, metaphor.
Non-linear	Patterns of understanding are uncertain.	Emergence of many metaphors, many behaviors.
Adaptation	Shared semantics, pragmatics.	Imitation, memorizing, focus group or speakers' behaviors.
Emergent behavior	Discourse events, idiom, specific languages, e.g. "Portuguese".	Metaphor, meaning, group behavior, lexical choices.

Source: Adapted from Larsen-Freeman and Cameron (2008, p. 37).

Under this view, the speech or talk communication produced by interacting participants engaged in a discourse event is understood as a

dynamic and unstable process in constant fluxes and movement and not as a ready-made object (Gibbs Jr.; Cameron, 2008; Larsen-Freeman; Cameron, 2008; Alves da Silva; Soares, 2022). We agree with the perspective pointed out by Larsen-Freeman and Cameron (2008, p. 162) that discourse, here envisaged as resulting from the Bakhtinian principles of dialogy and alterity, is a complex dynamic language-using activity product of "multisemiotic" texts, in this case the talk-in-interaction produced by the focus group, which emerge from attractors in the trajectory of a dynamic system in the intertwining that becomes tangible in the production of meaning. For Larsen-Freeman and Cameron (2008, p. 163), when we consider "two people engaged in talk, their 'conversation' emerges from the dynamics of how they talk to each other, while what they say reflects and constructs who they are as social beings".

In this sense, the initial conditions of discursive activity that involve the flow of primary attractors are understood in terms of intra/intersubjective triggers that go beyond the immediate context in which talk-in-interactions occur; and secondary attractors that form attractor basins and stabilization points are understood as systematic metaphors engendered by the evolution of metaphor vehicles (triggers) in the discursive flux. Regarding primary attractors, after perception of the stimulus, the flow can begin both from the inside to the outside, based on information (triggers) already stored in memory, and from the outside to the inside, based on information from the interaction environment.

Cognitive aspects of the research assume that cognition as a more encompassing phenomenon underlies discourse emergencies. This would explain the flow of primary attractors in two directions, as the relationship between cognition and discourse is understood as complementary. This way discourse emerges and reaches a certain stability as a result of top-down (cognition-discourse) and bottom-up (discourse-cognition) processes in which metaphor is significantly present and performs significant roles. Following Met-Led DA (Cameron, 2007; Cameron; Maslen, 2010), we adopt a discourse view in which the connection between linguistic metaphors and conceptual metaphors emerge in the close-knit dynamics between *language-and-thought*, understood as an inseparable whole.

Figure 1 — Dynamics of metaphor emergence

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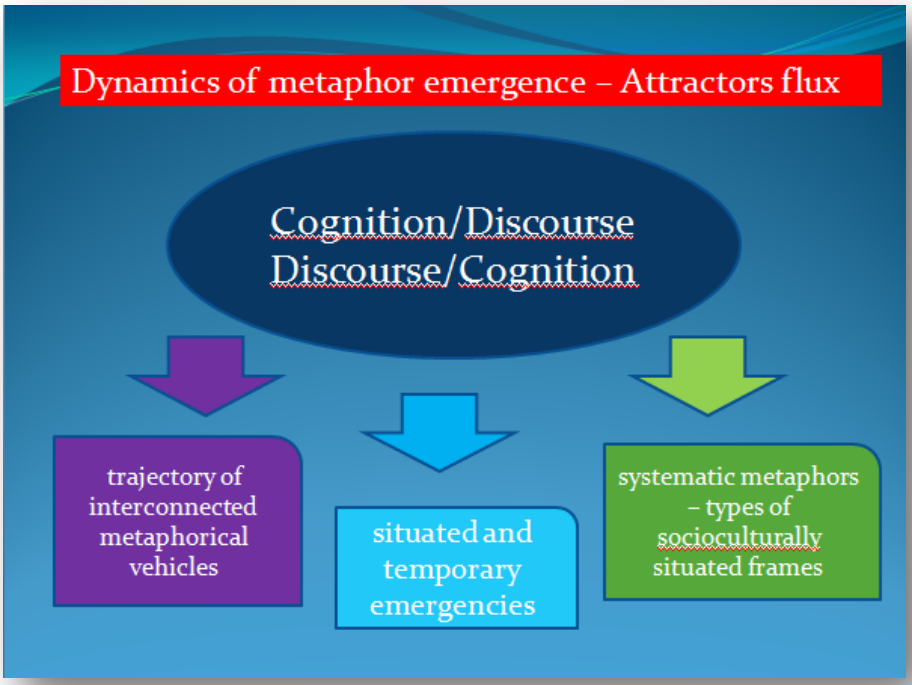

Source: Authors (2021).

In the next section, we explain the concept of emergence as a fundamental phenomenon in CAS and the topological nature of attractors in the discursive space in which metaphors emerge during the process of thinking aloud in group as proposed by Zanotto (2014).

3 THE PHENOMENA OF EMERGENCE AND TOPOLOGICAL ATTRACTORS

To explain the concept of attractors, we must first explain a fundamental and characteristic process of a SAC: the emergence generated by the self-organization of the system. According to Luhmann (2016, p. 54), based on Maturana and Varela, self-organization (autopoiesis) constitutes the formation of the unity of systemic elements. Regarding this aspect, Larsen-Freeman and Cameron (2008) state that:

> [...] sometimes self-organization leads to new phenomena on a different scale or level, a process called emergence. What emerges as a result of a phase shift is something different from before [...]. (Larsen-Freeman; Cameron, 2008, p. 59).

Emergence arises, then, through interactions between agents forming a complex unit, that is, a random set of agents with individual properties and behaviors that, when interacting within the system, intertwining, give rise to dynamic experiences resulting from the movement

of attractors in the system in phase space, generating structural couplings that update the system. Structural coupling is the engine of autopoiesis, as it consists of the interaction of the organism with its environment and, in doing so, ends up changing its internal structure and the structure of the environment with which it is interacting (Luhmann, 2016). One of the most interesting aspects of these relationships is that they can change based not only on different degrees of flexibility variability around them, but also on agents' choices or events based on uncertainty or unpredictability.

> CAS are formed by a large number of active cells or units, with diversified characteristics of shape and capacity, which interact with their ecosystem. The changes in behavior patterns that emerge can be identified as emergence phenomena. (Holland, 2004, p. 68).

Still, according to Holland (1999, p. 121), "Emergence is above all a product of coupled, context-dependent interactions". For the emergence to happen from the intertwined (coupled) interactions resulting from the behavior of attractors, it is necessary that they move through the state spaces, which are abstract mathematical spaces in which we can perceive the variables (ordered patterns) of a complex system. Larsen-Freeman and Cameron (2008, p. 46) point out that the term phase space and state space are often used interchangeably, but "the use of 'phase space' should be restricted to spaces with at least one dimension that reflects the change over time". From this consideration of the researchers, we claim that the state space concerns the system, while the phase space concerns the topology[2] of the attractors in their trajectories. To better understand this difference, we analyzed the traffic light example (Figure 2), proposed by Larsen-Freeman and Cameron (2008, p. 47), in which the four color patterns (red, yellow, green and red/yellow) and the other technically possible parameters (yellow/green, red/green, green/yellow/red, no lights) [3] are conceptualized as system state spaces, that is, a set of all possible states while each system variable associated with a different coordinate or parameter (green/red) is the phase space. According to the authors, "the state space of a system is a visualization of all possible states that the system could be in" (Larsen-Freeman; Cameron, 2008, p. 47). Another important conclusion from the traffic light example is to observe that the phase spaces are related to the trajectory of the attractors in the system.

[2] The topology of attractors describes the layout of the behavior and the paths that the system prefers, as well as how the phase spaces are distributed and connected until the emergence of a new behavior.

[3] We followed, *ipsis litteris*, the example of the researchers (Larsen-Freeman; Cameron, 2008, p. 27, 48), including the classification of races and the emergence of possible behaviors.

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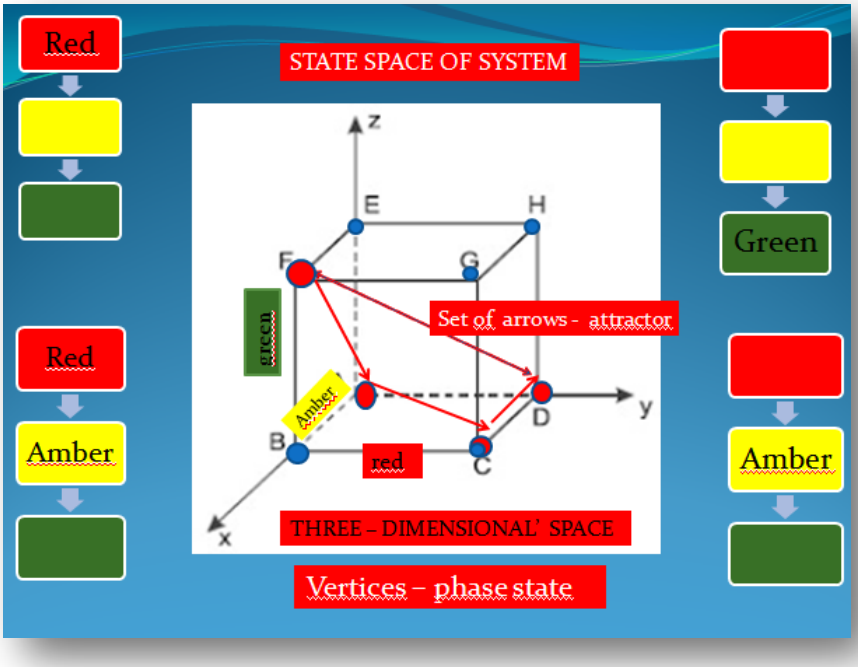
Figure 2 – The trajectory of the traffic light through its state space/phase space



Source: Adapted from Larsen-Freeman and Cameron (2008, p. 17, 48).

After explaining the state and phase space in the complex system and still as an example of this kind of emergence of the system, we can illustrate these concepts further with the long periods of drought (2019/2020) in the Pantanal biome, in the Center-West Region of Brazil (Santos; Henriques, 2021; Costa, 2021). Due to deforestation in the Amazon, the amount of rainfall has been reduced and, consequently, there has been a fall in the water level of the Paraguay River, the main source of water in the Pantanal. The drought, which was a natural phenomenon in that region, but which occurred sporadically, has become constant due to the increase in temperature on our planet, the large number of deforestation in the Amazon region and the fires that spread across the Amazon and Cerrado regions due to lack of rain. These changes within the system have altered the phase spaces and the flow of attractors, giving rise to new scenarios and enabling not only self-organization or syntropy [4], but also altering the interactions between agents within the system.

The emergence results from the entanglements[5] of the attractors' trajectory to a preferred region of the system. Larsen-Freeman and Cameron (2008, p. 47) point out that the state space is "constructed by putting

[4] Syntropy or negative entropy is the opposite concept of entropy. While the latter refers to the tendency towards chaos, the syntropy refers to the ability of a system to organize itself.
[5] The entanglement is a process of crossing the trajectories to attractor basin, resulting in the emergence of new behaviors (construction of meaning) from small changes in the initial conditions of the complex systems.

together all possible states of a system, and each point in state space is described by a particular set of system parameter values". These parameters or patterns of the dynamics of the system are coordinates of each phase space, and based on the previous example, we can define some of these parameters: (level of the Paraguay River, rains in the Pantanal); (River Paraguay water level, wind circulation); (River Paraguay water level, deforestation, reduced rainfall), etc. The coordinates changes, give rise to new patterns and changes in the Pantanal biome landscape (drought, problems in fauna and flora, impoverishment of the soil, hunger of local populations, etc.).

In reality, emergence results from the trajectory, known as the attractor, which is a mathematical representation of the behavior of the system over time. Understanding the topology of these states, landscapes and particular modes of behavior that the system prefers is to understand the paths taken within the system that led to the emergence of new behaviors and the patterns of activity from changes in the initial conditions of the system and possible structural couplings. In the previous example, the parameters (global warming, deforestation, fires, prolonged drought, etc.). When we speak of language as CAS, this emergence materializes through the production or understanding of a specific language or multisemiotic signs/triggers. According to Beaugrande (1997), these activities are strategies used by agents to select, specify, move and adapt the choices of triggers to the discursive flow of each context defined in and by discursive practices in interaction in the environment of language use.

From the example of the drought in the Pantanal, we observe that the change of anthropic origin in the environment, that is, varied and punctual alterations, allow new trajectories for this set of patterns towards which a system tends to prefer and represents the dynamics of system in the long term. With each new change in the system, this flow changes, or does not allow the probability of new landscapes to emerge from these shifts (prolonged and recurring droughts) in the Pantanal biome.

An attract in CAS theory is a dynamic flux (i.e. a long-term behavior intrinsic to the system). They are trajectories that occur inside the system and which result from internal and external agents' incidence. Attractors movements do not follow pre-established rules. They occur in an apparent chaotic fashion. Nonlinearity in the discursive flux can be understood as an emergence in the sense of vector movements that cannot be predicted a priori from the parts, because it involves numerous actions that are guided by cognitive social, emotional, historical aspects, among others. Thus, complexity results not only from non-linearity, but also depends on a large number of elements with many degrees of freedom, many feedback cycles

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and high degrees of interconnectivity. The dynamicity involved in attractors trajectories underlie the unpredictability of the discourse which emerge in the discourse event (Larsen-Freeman; Cameron, 2008).

This idea of stimuli/triggers and flow that move attractors in phase space in relation to language as SAC was already considered by Salomão (1999) when she states that language from the point of view of Cognitive Linguistics and from the sociocognitive perspective, should be conceived as an:

> [...] operator of socially located conceptualization through a cognitive subject, in a real communicative situation, who produces meanings as mental constructions, to be sanctioned in the interactive flow. [...] the guiding hypothesis is that the linguistic sign (in concomitance with other signs) guides the process of signification directly in the context of use. Due to its balanced emphasis on all available forms of knowledge (grammar, conceptual schemes, communicative frameworks) this hypothesis is called sociocognitive. (Salomão, 1999, p. 64-65, emphasis added).

The forms of knowledge proposed by Salomão (1999) would be the phase spaces preferably covered by the attractors, from an initial trigger. Here in CAS terms, we understand these spaces as metaphor-vehicles (MetVs) trajectories in the discourse flux which lead to stable though provisory and temporary system spaces, the so called systematic metaphors (SysMets), in Met-Led DA.

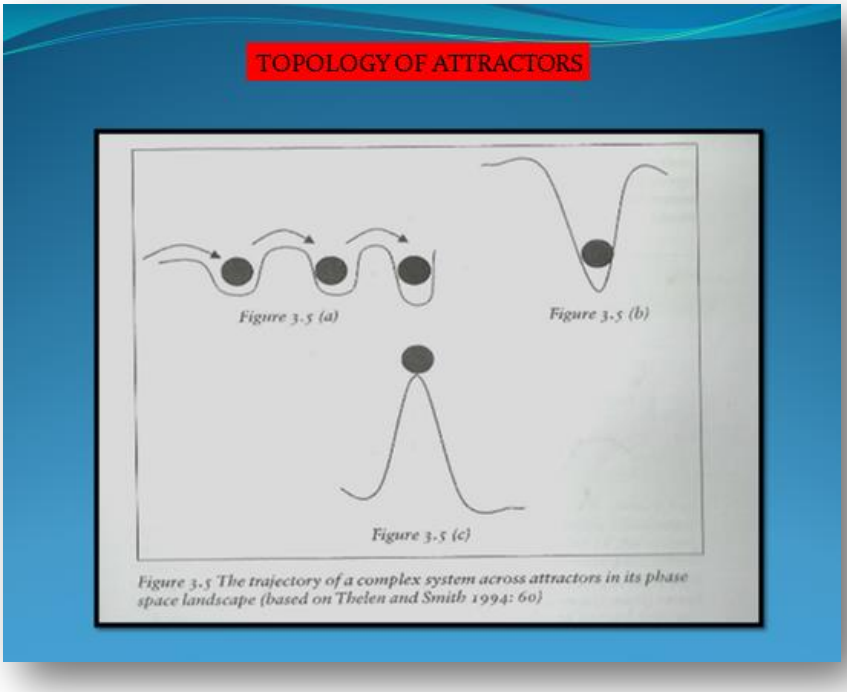
Over the last twenty years, according to Capra and Luisi (2014, p. 148), "the phase space technique has been used to explore a wide variety of complex systems", mainly in mathematics and in computing. Scientist and mathematicians using calculations with non-linear equations solved by computers found that the number of attractors is very limited. Their shapes, as the researchers state, "can be classified topologically and the general dynamic properties of a system can be deduced from the shape of its attractor" (Capra; Luisi, 2014, p. 148).

According to Capra and Luisi (2014), there are three basic types of attractors: punctual, periodic and strange. Larsen-Freeman and Cameron (2008, p. 57-58) propose the following classification according to complexity theory that can occur in the state space of complex dynamic systems: fixed point attractors, cyclic attractors, and chaotic attractors. In addition to labels, punctual or fixed-point attractors are the simplest type that represents a system movement into a stable equilibrium. The researchers use the metaphor of a ball rolling in a well in the state space landscape (Figure 3 (b)), and propose that "when the system enters a fixed point attractor, it eventually settles into a single mode of behavior or stops altogether"

(Larsen-Freeman; Cameron, 2008, p. 57-58). Using the traffic light example, if the red/yellow and green patterns did not undergo any change and if they were always repeated, we would have a point attractor. Another classic example of this attractor is the equilibrium of demand and supply in economics: at this point, the price has reached the level where the quantity supplied is equal to the quantity demanded, it is useless to increase the price or reduce it, as this behavior is limiting, the attractor has reached market equilibrium. The punctual or fixed point attractor is considered the simplest type, as they are very specific situations that the system will always prefer, for example, the situation of water evaporation: the higher the temperature, the faster the water evaporates. This relationship will always be proportional and real; and the trajectory is always a line in state space (+x,+y) or (-x,-y).

A cyclic or periodic attractor corresponds to periodic oscillations (Figure 3 (a)), the system moves in several different phases spaces, like the pendulum. In the example of water, there may be oscillations in the speed of evaporation, which will determine the change in temperature of landscape. If we have very low temperatures, there will be no evaporation and the trajectory will be different. Larsen-Freeman and Cameron (2008, p. 54) use the example of the dynamics of the prey-predator system, "populations of prey and their predators tend to settle into periodic movement between two or more states".

Figure 3 — The trajectory of attractors through its state space/phase space – Three types of attractors



Source: Larsen-Freeman and Cameron (2008, p. 51)

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The last type of attractor is what interests us the most, since the classification we assume for the linguistic attractors seems to be an attractor of the strange, chaotic or Ueda type. This attractor is a trajectory in a two-dimensional phase space that produce patterns that are almost repeated, but not completely. According to Larsen-Freeman and Cameron (2008, p. 57), it corresponds to "a region of the state space in the system's behavior becomes quite wild and unstable, as even the smallest perturbation causes it to move from one state to another". A characteristic of this attractor is that its dimensionality tends to be very low, even if the number of system variables involved in its trajectory is high. Capra and Luisi (2014, p. 151), remind us that chaotic behavior is "deterministic (known input set) and standardized, and strange attractors allow us to transform apparently random data into distinct visible forms". An important concept regarding the types of attractors is the "basin of attractors" or "basins of attraction", as all trajectories that start within a certain region of phase space will sooner or later lead to the same attractor. This region is called the basin of attraction. The attraction basin is the phase space of the system where each attractor fits according to its topological characteristic, it is up to the analyst to identify and classify it according to the described trajectory (Capra; Luisi, 2014).

Therefore, we can say that the attractor represents the behavior of the complex dynamic system over time through its trajectory in the phase spaces, being intrinsic to the system. So, it is wrong to think of the attractor as an entity or a distinct element of the system, which attracts the system to a certain portion of phase space.

In addition to the types above, we assume in this work that the attractors, in the case of the relations between language, mind and world in the initial conditions of the discursive activity in which multi-agents[6] act – speakers and signs or multisemiotic and sociocognitive stimuli – directly from the communicative event, involve the flow of perceived primary attractors in terms of external or internal triggers and intra/intersubjective that go beyond the immediate context in which interactions between multi-agents occur; and secondary attractors that form attractor basins and stabilization points that, as proposed in this work, cause the emergence of systematic metaphors engendered by the self-organization of metaphor vehicles (triggers) in the discursive flow in the phase space that the system prefers.

[6] Holland (1999, p. 122), uses the term multi-agent as a characteristic of CAS.

Table 2 — Examples of primary and secondary attractors applied to language

Types of Attractors	Definition	Examples
Primary	Internal or external movement produced from the initial conditions of the system by the action of the multi-agents (exogenous and endogenous): producers and readers, communicative situation, genre, title, discursive topic, multisemiotic stimuli (sounds, graphemes, colors, drawings, music), belonging, emotions, metaphorical vehicles, etc.	Conversation, language production, independent of semiosis, text comprehension, stimuli from linguistic signs, etc. Coordinates: (signs, gender), (signs, emotions), (signs, belonging).
Secondary	Internal movement and intertwining of attractors through the phase spaces: grammatical, textual, cultural, social, behavioral, etc., forming a basin of attraction after the intertwining of the discursive flow of the attractors. There are several variables that form a single system preference attractor. This behavior emerges for the production of meaning through language.	Grammar phase space, cultural, historical, behavioral phase space, etc. Basin of attractors and coordinates that produce a vector that represents the emergence of the behavior of the complex adaptive system. Paired coordinates: (genre-type-compositional structure), (signs, aggregation, values, ideology).

Source: Authors (2022), based on Holland (1999, 2004), Larsen-Freeman and Cameron (2009), and Capra and Luisi (2014).

After this contextualization about emergence, attractors and phase spaces in the construction of a systematic metaphor from a CAS perspective, we can describe the movements of the dynamic and complex system with the following metaphor: THE MOVEMENT OF AN ATTRACTOR IS AN ELECTRIC CURRENT WHICH LIGHTS UP A LAMP FROM A SWITCH. The agents are the elements that open the circuit (through triggers) for the passage of current in the switch-phase/neutral/return-lamp system, the light traveling through all the copper wires is the attractor, each stage of the circuit are the phase spaces, the lamp is the basin of attraction, and the light produced in the tungsten filament inside the lamp is the emergence.

In the specific case of language, we observe that there will always be several triggers and variables involved in moving the discursive flow, called attractor. These initial triggers are what we call primary attractors. Note that the attractor is not “the point” (Figure 3), but the trajectory from that point (gender, lexicon, phonemes, color, affection, etc.). In fact, the point

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corresponds to the coupling of countless coordinates that are restricted to an attractor, "a folded surface in a space of 50 dimensions. This, of course, represents a high degree of order" (Capra; Luisi, 2014, p. 151). The secondary attractors are, in fact, the product of the bifurcation of trajectories through the phase spaces in search of the preference of the system that lead to a basin formed by multiple coordinates, or a set of patterns or regularity of form, content, emotions, semiosis, culture, etc.

After this synthesis about attractor types and emergence, we explain the methodological procedures for mapping the primary and secondary attractors involved in the emergence of the systematic metaphor (SysMets) in the Focus Group (FG) interaction.

4 METODOLOGICAL PROCEDURES

As previously reported, the aim of our study is the investigation of the nature of systematic metaphor, as it emerges in the discourse produced after a silent reading activity from a point of view that considers it as embodied and socioculturally situated, with emphasis on the flow of attractors during its emergence. The methodology chosen is of an exploratory nature, based on a quali-quantitative approach that uses focus groups techniques for data collection.

Procedures for data collection involved the following steps: 1) corpus construction; 2) texts selection; 3) text formatting and feeding into Atlas.ti[7]; 4) an exaustive analysis, by the first author of this article, of the opinion article "Os Muros" by Selvino Heck; 5) focus group (FG) interaction with the participants of the research after the silent reading of the same opinion article, the text chosen for this stage of the research reported here; 6) comparison between the discourse topics and metaphor-vehicles, conceptual metaphors and image-kinesthetic schemas found in the text analysis conducted by the researcher and the ones identified in the discourse emerged in the FG interaction; and 7) analysis of first and second order attractors found in the emerged talk. These procedures are synthetized below.

4.1 Corpus construction, text formatting and initial analysis

The genre opinion article, originally chosen from a corpus composed by 52 texts of four different genres, was selected for this stage of the research. The 52 texts which compose the corpus were selected by visits

[7] Atlas.ti is a computational program designed by the University of Berlin, Germany, for data organization and qualitative and quantitative analyses with multimedia resources. For more information, please visit: www.atlasti.com.

to online sites of different national newspapers, such as *O Jornal do Brasil* (Rio de Janeiro), *O Povo* (Fortaleza-Ceará) and *Zero Hora* (Porto Alegre-Rio Grande do Sul). Among the samples gathered, the article "Os Muros" (The Walls)[8], written by Selvino Heck, was chosen to be analyzed. This exemplar, as well as all the other texts belonging to four different genres (opinion article, chronicle, fable and poem), were adequately formatted[9] and fed into Atlas.ti. For the purpose of the research stage reported in this paper, we will focus only on the procedures involving the text "Os Muros".

4.2 Analysis of the text "Os Muros" prior to the FG interactions

An exhaustive initial analysis of the text was performed by the first author of this paper, according to the methodological steps of Metaphor-Led Discourse Analysis (Met-Led DA)[10]. The theoretical basis provided by Cognitive Linguistics was relevant in other to focus on the Primary and Secondary Attracters (PSA) that would be responsible for the discursive flux and systematic metaphors (SysMets) emerged through the students talk around the text read and other related subjects. The PSA identifications were accessible by the Discourse Topics (DTs), Metaphor Vehicles (MetVs), Metonimies (Metons), Image-Cinesthetic Schemas (ICS), Conceptual Metaphors (CMets) and Primary Metaphors (MPs) identified in the participants talk.

Based on the various topics, metaphor-vehicles, conceptual metaphors, primary metaphors, metonymies, and schemas identified by the researcher, a comparison was performed afterwards between the results gathered by the first analysis conducted by the researcher and the analysis of the talk, which emerged in the interaction among the students after the silent reading of the text. Moreover, MetVs which were semantically related were organized in analyses categories (i.e. families) to make possible cross-analyses and comparisons of data gathered by the researcher analysis and those which emerged by the FG interactions with the participants. The categories **ACTION**, **BLOCKAGE**, **THINGS**, **CONSTRUCTION**, **STATES**, **LINKAGE** and **MOVEMENT** were identified and served as a basis for comparisons and contrasts to be made through the analyses.

[8] The text is available at http://www.jb.com.br/sociedade-aberta/noticias/.
[9] For a detailed description of transcriptions and text formatting before feeding into Atlas.ti, please read the following article by the first author.
[10] Met-Led DA procedures for text analysis is provided in a chapter of the book *Metaphor Analysis* listed in the reference section of this paper.

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4.3 Focus Group (FG) interaction and analyses of the text and talk

Twenty-one high school students[11], ranging from 15 to 21 years-old, from a state school at Santa Maria, Rio Grande do Sul, Brazil, participated in the research. They read the text silently after a brief contextualization of the text and its theme by the first author of this paper. After approximately ten minutes, the students finished reading and, motivated by the moderator, engaged in talk around subjects arising from the reading and other topics, which sprang from the text read. This part of the procedure involved the methodological steps proposed by Zanotto (2014) for the GTA (Group Think Aloud) technique. The talk was recorded and afterwards transcribed and formatted according to the Met-Led DA (Cameron; Maslen, 2010) and Atlas.ti procedures. It was then fed into Atlas.ti and the same procedures applied in the analysis of the text previously explained were performed. The data was then compared with the one gathered by means of the initial analysis of the text and a considerable larger number of MetVs and DTs were identified in the FG interactions.

Next, we discuss some of the results of the analysis with emphasis on the role played by the PSA in directing the discursive flux and contributing to the emergence of the SysMets identified in the analysis reported here.

5 ANALYSES AND RESULTS

Data gathered through the initial analysis of the opinion article by the first author of this paper was compared with data emerged during the FG interactions conducted after the silent reading of the text, showing that MetVs emergence was much more significant in talk than in the analysis of the text by the first author, as each reader presents an open horizon of understanding in the system/environment relationship, so the flow of attractors can explain this difference in MetVs and DTs.

We emphasize that this difference from silent reading to the participants' conversations in relation to the data analyzed by the first researcher occurs because several phase spaces were preferentially covered by the primary attractors who, based on the initial triggers (stimuli of contextualization of the theme, reading of the text, genre, the beginning of the conversation on the topic and other subjects that arose during the interaction), were intertwined and generated a flow of secondary attractors that formed the basin of attraction from which the systematic metaphors (SysMets) emerged. These triggers are activated by perceived stimuli, based

[11] The performance of only one of the groups is analyzed in the present paper.

on a communicative event, and allow the flow of attractors both from outside the environment into the system, and from inside the system to outside the environment in the search for specific stimuli (selected from information stored in memory). We call this event based on a particular communicative situation (research situation of a FG to identify SysMets based on opinion article genre) **text** from the perspective of SAC. According to Pelosi and Almeida Júnior (2023):

> Texts are socio-interactive perceptual communicative events (visual, auditory, tactile, olfactory, sensory) that evoke mental images of narrative experiences immersed in different (con)textual situations materialized in concrete statements that move the non-linear and probabilistic trajectory of related primary and secondary attractors to the communicative situation, to the genre, to the lexicon, to the experiences, to the emotions, to the ideology, etc., to the preference phase space of the system, producing a dynamic process of emergence of enunciative-discursive meanings at a given moment in reality. This discursive flow is an initially random movement that divides phase spaces that become nodes in a complex network that emulates and emerges meanings from a basin of attraction that produces intertextual and interdiscursive relationships of meaning. (Pelosi; Almeida Júnior, 2023, p. 73).

To illustrate with only two discourse aspects this entanglement of attractors, while only 07 DTs were identified in the analysis, a total of 17 DTs emerged in participants' talks. These results show that the flux of primary and secondary attractors based on stimuli received from the environment generated distinct and constitutive movements (difference between element and relationship) for the construction of meanings and for the emergence of systematic metaphors. It is not unnecessary to point out that the emergence arises through interactions between agents forming a complex network, that is, a random set of agents with individual properties and behaviors that, when interacting within the system, intertwining, give rise to dynamic experiences resulting from the movement of attractors in the system in phase space, generating structural couplings that update the system.

From the systematic metaphors identified, we can build a topology of the role of attractors during the process of discursive interaction. In fact, the discourse becomes tangible from the complex networks that are created by each space, phase and flow of attraction that result in the emergence of the metaphor. According to Holland (1999, p. 121), "emergence is above all a product of coupled, context-dependent interactions". If we want to visualize the product, that is, the systematic metaphors, we must study the behavior of the attractors as they move through phase spaces so

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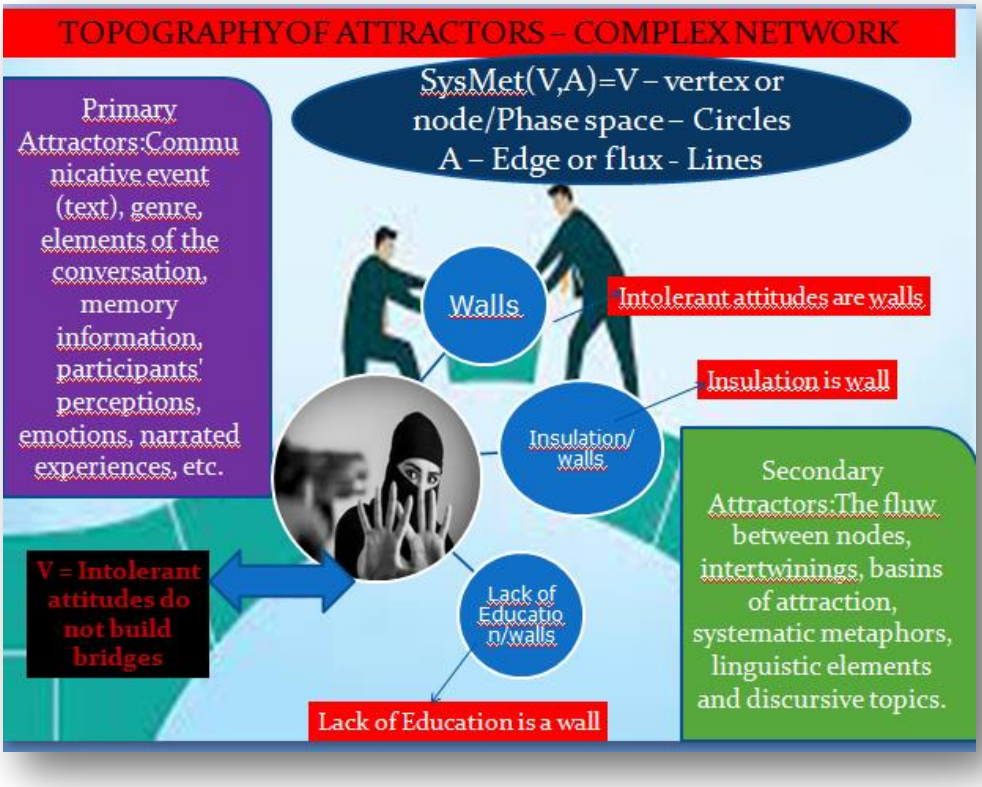
that we can perceive the ordered patterns of a complex system such as language and its production of meaning.

Figure 4 — Topology of attractors

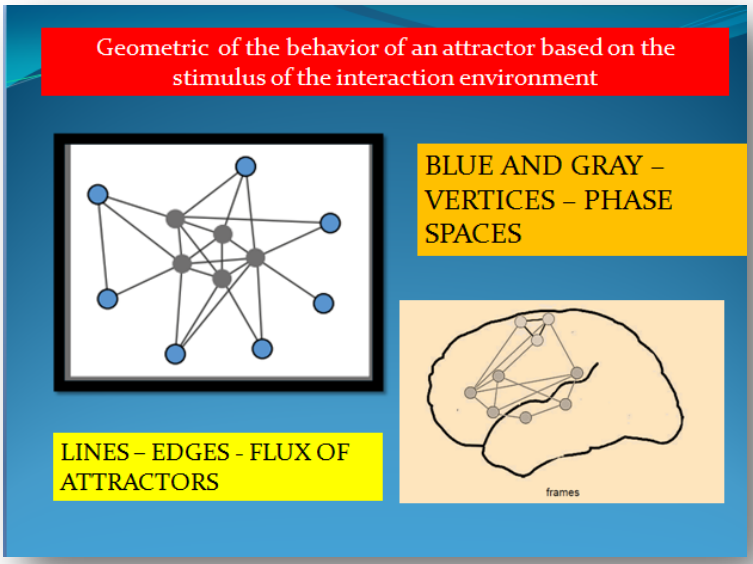


Source: Authors (2022), based on Holland (1999, 2004), Larsen-Freeman and Cameron (2009), and Capra and Luisi (2014).

In Figure 4, based on the examples selected from the research, the topography of the attractors is represented, formiing a geometry of specific phase spaces (see Figure 5) as a result of the behavior of the primary and secondary attractors based on the stimuli received from the interaction environment (stimulus of reading the text, conversational stimuli, behavioral stimuli, etc.). The mathematical description is as follows: we have two ordered pairs resulting from the conversations: A = (intolerant attitudes, walls), and B = (intolerant attitudes, bridges). These patterns generated by the behavior or flow of attractors were produced by the following ordered pairs formed by a vertex (phase space) and an edge (behavior of attractors): V = {walls, isolation, lack of education}, and A = {walls and bridges}. The complex network of ordered pairs were: (intolerant attitudes, walls), (intolerant attitudes, lack of education), (intolerant attitudes, isolation), (virtually approaching, bridges), (intolerant attitudes, not bridges). These patterns of interaction formed a basin of attraction or an intertwining that gave rise to the following systematic metaphors identified by the first

researcher: SysMet1: ISOLATING YOURSELF, NOT SHOWING INTEREST IN OTHERS IS BUILDING WALLS; SysMet2: PRECONCEPTUAL ATTITUDES BORN FROM LACK OF EDUCATION BUILD WALLS AND PREVENT THE BUILDING OF BRIDGES; SysMet3: GETTING CLOSER TO OTHERS VIRTUALLY OR IN PERSON IS BUILDING BRIDGES.

Figure 5 — Geometric example of the behavior of an attractor based on the stimulus of the interaction environment



Source: Authors (2023), adapted from Sandoval Escobar (2017, p. 142).

Due to space restrictions, we highlight only one of the analysis categories and try to point out the role played by the discourse attractors in maintaining the discursive flux that led to the emergence of the SysMet identified. Now we move on to analyzing of the role of figurative language in the emergence of meanings directly or indirectly related to a text read silently and analyzing how such meanings are activated by metaphor vehicles (initiators/triggers) and how they contribute to the emergence of systematic metaphors that translate readers' attitudes, beliefs and values when thinking aloud in groups.

Again, when the number of MetVs are compared, the total emerging from group discussions added up to a much larger number of 105 MetVs, when compared to only 47 MetVs identified by the researcher's analysis of the text. For the other elements analysed (i.e. image-cinesthetic schemas, conceptual metaphors, and metonymies) differences were not significant. While the exhaustive text analysis conducted by the researcher led to the identification of one SysMet, *INTOLERANT ATTITUDES BUILD*

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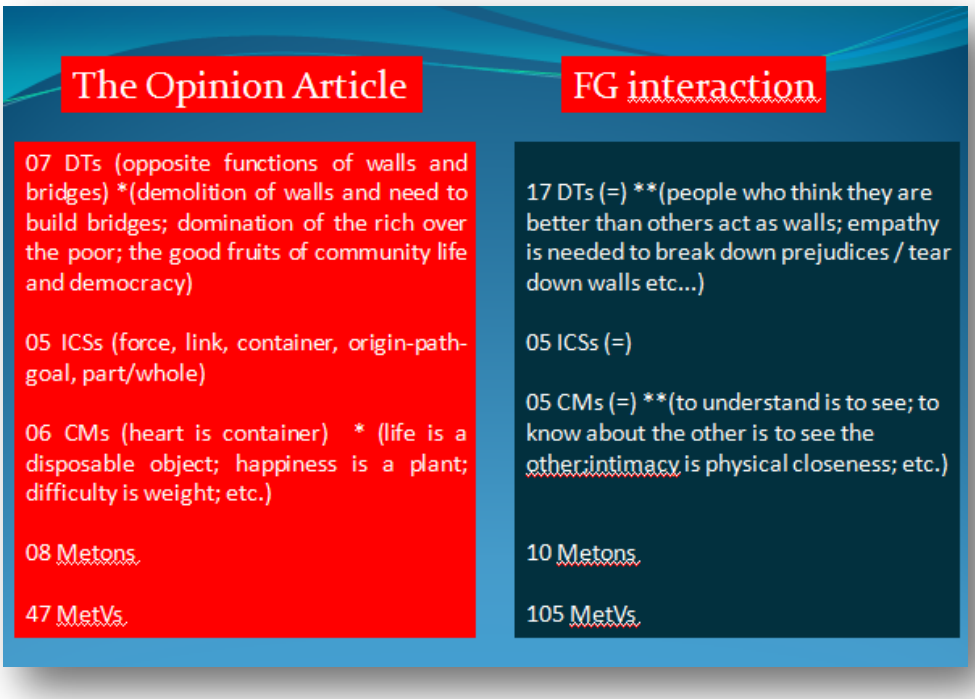
WALLS AND IMPEDE THE CONSTRUCTION OF BRIDGES, the talk interaction based on the students' silent reading served as basis for the identification of three SysMet: SysMet1: *TO ISOLATE ONESELF, NOT SHOWING INTEREST IN THE OTHER PERSON IS TO BUILD WALLS*; SysMet2: *PREJUDICED ATTITUDES SPRINGING FROM LACK OF EDUCATION BUILD WALLS AND IMPEDE THE CONSTRUCTION OF BRIDGES*; SysMet3: *TO APPROACH THE OTHER VIRTUALLY OR IN PERSON IS TO BUILD BRIDGES*.

As already highlighted in the method and procedures section, the MetVs were grouped into the following analyses categories: **ACTION**, **BLOCKAGE**, **THINGS**, **CONSTRUCTION**, **STATES**, **LINKAGE**, and **MOVEMENT**. These were identified and organized in family groupings according to semantic proximity among the MetVs emerged. Such categories served as basis for comparisons and contrasts to be made through the analyses.

Our focus is in the **MOVEMENT** category. As highlighted in Figure 6 below, the number of MetVs related to this category was significant. As shown in the figure, some of the MetVs in this category were: "bridges point to"; "bridges are open"; "bridges attract"; "build bridges"; "walls distance people"; "bridges attract people", among others.

Figure 6 — Relationship between the researcher's analysis and the focus group



Source: Authors (2022).

A brief analysis of the talk produced by the participants talk analyzed here show how attractors moved by triggers (MetVs) contributed

to the evolution of the discursive flux and to the temporary stabilities of the system as SysMets emergences.

We highlight below some of the interactions excerpts in light of CAS theory applied to the discourse which emerged in the FG interaction leading to the emergence of one of the SysMets *TO ISOLATE ONESELF, NOT SHOWING INTEREST IN THE OTHER PERSON IS TO BUILD WALLS*, the metaphor whose analysis is chosen to be reported here.

5.1 Focus Group (FG) interaction and analyses of the text and talk

- Duda and Rafaela add, respectively: "I think that for them we are in a closed wall" (l. 412, Duda) and "we prefer to stay more at home, you know?" (l. 415, Rafaela).
- Duda's observation reveals the reuse and expansion of VMet "walls" in a metonymic-metaphorical sense. For her, her and her friends' attitude of withdrawal and isolation from their colleagues is "being behind a closed wall" (l. 412).
- Finishing this sequence, Ludmila (l. 417) recognizes that her elementary school classmates are "out there" and, repeating the moderator's speech, recognizes that, yes, "there is a wall" (l. 417, 419).

From the excerpts of the conversations above, we observed that the use of the VMet "wall" served as a trigger to activate a flow of attraction related to individual behaviors that produced the following patterns: (wall, shut up), (wall, isolate oneself), (wall, move away), (wall, close). These ordered pairs reflect experiences related to the phase space of "forms of social behavior" that are externalized in a situation of lack of interest that causes isolation, represented here by the word "wall", in the discursive flow of the interaction.

6 CONCLUSIONS

During our research journey, we verified through the technique of reading in a low voice an opinion article that was later taken for interaction in a focus group that figurative language plays a fundamental role in the emergence of systematic metaphors for the production of meaning than was read and contextualized during the interaction process. The language here was worked from the perspective of Complex Adaptive Systems (CAS) and thus it was possible to produce, from the systematic metaphors that emerged, the topography of the primary and secondary attractors in the establishment and maintenance of discursive interaction.

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In comparison with the independent analysis of the first author of the article and the data collected from the conversation emerging from the Focus Group (FG) interaction, the number of discursive topics and metaphorical vehicles were much higher during the conversation about understanding the article of opinion. In this context, it was possible to describe, through the random and chaotic trajectory of the attractors, the production of a tangle of coordinates, in an entropic situation, which resulted in the identification of the Msis that resulted from a syntropic scenario of almost equilibrium of the system/environment. This point also deserves a more comprehensive study for a more effective analysis of the establishment of structural coupling and the specific type of geometry of the attractors' behavior with the vector concept of discourse, in the view of CAS.

In particular, we believe that the agency of reading in understanding the metaphorical language present in the texts was crucial for the emergence of meanings licensed by reading, and that the free discussion of the text has contributed to the formation of a metacognitive attitude in readers and made it possible to better identify the intertwining of attractors in the emergence of systematic metaphors.

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