IOSR Journal of Research & Method in Education (IOSR-JRME)
e-ISSN: 2320–7388, p- ISSN: 2320-737x Volume 15, Issue 1 Ser. 3 (Jan. – Feb. 2025), 27-36
www.iosrjournals.org

Ecosystemic Epistemology And Cartography Of Chance: A Pandisciplinary Approach To Understanding Knowledge Ecosystems

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Abstract
This article aims to explore the potential of two approaches, Ecosystemic Epistemology and Cartography of Chance, demonstrating how they can be applied to analyze learning and innovation ecosystems, with a focus on promoting social and digital inclusion. To this end, the text is organized into three main sections: (1) the theoretical foundation of Ecosystemic Epistemology; (2) the methodological proposal of Cartography of Chance, with an emphasis on "if-then" rules; and (3) a case study illustrating the application of these concepts in the context of the EVA-City of Knowledge for Social Inclusion project. Adopting a transdisciplinary perspective, which the author now refers to as "pandisciplinary," the text explores how these approaches can contribute to the construction of learning and innovation models that integrate human, technological, and environmental dimensions. The article argues that Ecosystemic Epistemology and Cartography of Chance provide a theoretical-methodological framework capable of mapping interconnections between different actors, knowledge systems, and technologies, promoting social inclusion and equity in access to knowledge.
Keywords: *ecosystemic epistemology, cartography of chance, interdisciplinarity, pandisciplinarity.*

Date of Submission: 02-02-2025 Date of Acceptance: 12-02-2025

I. First Trail

In my book *Homodigitus, femina dáktólus*, which is yet to be released by Amazônica Edições in Manaus, I begin with a provocation: “Everything and nothing in the same place.” And I continue to provoke:

With the book “God or Chance”, which will certainly be part of this series of books we intend to publish through Amazônica Edições, perhaps you, dear reader, will come to understand why someone would begin a book presentation precisely with “everything and nothing in the same place.” After proposing the theoretical-methodological hypothesis of the “ecosystemic epistemology and cartography of chance,” which will also be the subject of a dedicated book, I began to observe “chances” with greater acuity. And I pondered: “Either it is the work of God, or it is mere chance.” From there came the idea of writing a book with accounts of these “chances” alongside more academic reflections on “Ecosystemic Epistemology and the Cartography of Chance”.

Other instances of chance are presented in the text, but those will be left for when you read my book. From that “Introduction” (which I hope will no longer be unpublished by the time this article is published), I must bring forth an excerpt—almost a (long) story— so that I may, in this article, explain what ecosystemic epistemology and the cartography of chance entail.

My first, let’s say, “academic” contact with the concept of “cartography of chance” (though at the time, I had no idea what it was) occurred when I read the text “Emotion and Subjectivity in Passion-Research in Communication: Methodological Challenges and Perspectives” by Maria Luiza Cardinale Baptista, who today, “by chance,” has become a dear friend.

I read Cardinale’s text with astonishment:

> "[...] While typing out ideas on my computer, I glanced up slightly, and one of the books on the shelf above me seemed to light up. It shone in a particular way. In short, it caught my attention. I deeply believe in something I call ‘cosmic conspiracy,’ and although I didn’t understand what that book could contribute to the workshop I was attempting to create, I paused my work and began to interact with it, saying: ‘Very well, what do you have for me? What do you want to show me?’ I flipped through the book and opened it randomly, where I found the following passage:"

What followed in that passage astonished me even more:

"I consider a tree. I may apprehend it as an image—a rigid column under the impact of light, or a

resplendent green softness against a silver-blue background. I may perceive it as movement—a flowing filament of vessels united to a pulsating core, the suction of roots, the respiration of leaves, the incessant exchange between earth and air, and even its dark, hidden development. I may classify it as a species and observe it as an example of a structural and living type. I may so radically dominate its presence and form that I see in it nothing but the expression of a law—laws that always resolve a continuous conflict of forces or laws governing the composition and decomposition of substances.

I may volatilize and eternalize it, reducing it to a mere number, a numerical relation. The tree remains, in all these perspectives, my object—it has its space and time, it retains its nature and composition. However, it may happen that, simultaneously, by its own will and by a certain grace, as I observe the tree, I enter into a relationship with it; it is no longer an "It". The force of its exclusivity has seized me. I must not renounce any of my modes of perception. I must not abstract anything to see it, nor must I forget any knowledge. On the contrary, image and movement, species and exemplar, law and number are indissolubly united in this relationship. Everything belonging to the tree—its form, its mechanism, its color and chemical substances, its 'conversation' with the elements of the world and the stars—is included in a totality. The tree is neither an impression nor a play of my representation or an emotional value. It presents itself 'in person' before me; it has something to do with me, and I, in a different way, have something to do with it.

Let no one attempt to weaken the meaning of this relationship: relationship is reciprocity. Does this mean the tree possesses a consciousness similar to ours? I cannot experience that. But would you once again attempt to decompose the indivisible just because the experience seems successful to you? It is not the tree's soul or its dryad that presents itself to me—it is the tree itself" (Buber, 1974, pp. 7-9).

I did not even finish reading the entire text before reaching out to the author, inviting her to an event in Manaus. To this day, we remain friends.

At this point, the reader may wonder: why dedicate so many words and empty spaces to discussing chance? Only in this way, perhaps, can I explain why the thesis "At the Click of a Button: The Challenge of Traditional News Companies in the Information Market – A Study on the Positioning of News Companies and the Practice of Journalism in Networks in Manaus" remained "dormant" for over twenty years. The research led me to conclude, back in 2002 (the thesis was defended in March 2003), that "competition in the information market would be decided by a click."

Since then, I have begun to "observe" academic "chances" more closely. One day, while walking through the hallways of UFAM, heading toward the Banco do Brasil branch, I ran into Mirna Pereira Feitoza—now a professor at UFAM—who had previously earned her doctorate in São Paulo, gained significant recognition at "Folha de S. Paulo", and conducted doctoral research on video games. We engaged in light conversation, but I took the opportunity to discuss with her the "Graduate Program in Communication Sciences (PPGCCOM)" at the Federal University of Amazonas (UFAM), which had been proposed by me and a group of professors from the "Interfaces Research and Study Group".

Her eyes widened with a mix of skepticism and curiosity as I explained that the program had been placed "under review" and required adjustments to its concentration area, which had been deemed "not innovative enough" in the assessment by CAPES (the Coordination for the Improvement of Higher Education Personnel).

I informed her that I had initially proposed a theoretical-methodological hypothesis I had developed—*Communicational Ecosystems*—as the program's concentration area, but my proposal had been outvoted in internal discussions. Professor Mirna Feitoza's eyes lit up even more, and she told me, "That must be the concentration area for the program."

I left that encounter with the certainty that I had fought too little—or hardly at all—for the formulation and defense of the theoretical-methodological hypothesis I had proposed as the program's concentration area. I rewrote the proposal, gathered my colleagues, and we submitted the revised "APCN" (New Graduate Program Proposal) with the concentration area "Communicational Ecosystems". The result: approval, with an acknowledgment that the concentration area was highly innovative and brought a "breath of contemporaneity" to the field of Communication.

The "Graduate Program in Communication Sciences (PPGCCOM)" at the Federal University of Amazonas (UFAM) was a pioneering initiative in northern Brazil, designed to meet the growing demand for advanced training in communication and to strengthen academic research in the field.

In 2007, UFAM Launched the Call for Applications for the Master's Program in Communication Sciences, Establishing Itself as a Pioneer in the Region. The first academic master's program in Communication in the Northern Region of Brazil was approved by the Coordination for the Improvement of Higher Education Personnel (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – CAPES). The inaugural cohort began in March 2008. Until its closure by CAPES, the program played a crucial role in training specialized professionals in Communication, positively impacting teaching, research, and extension activities within public and private Higher Education and Research Institutions (IES) based in Amazonas and other states of the Legal Amazon region.

The program was initially structured into two research lines: “Networks and Communicational Processes” and “Languages, Representations, and Communicational Aesthetics.” These research lines were officially adopted in 2013 as part of the first reformulation of the program’s proposal. Previously, between 2008 and 2012, the research lines had been titled “Mediatic Communicational Environments” and “Scientific Informational Processes.”

The concentration area—unique among Graduate Programs in Communication in Brazil—has remained the same since the program’s foundation, with a revised formulation in 2012. The “Application for New Course Proposals” (APCN) for PPGCCOM was organized under the leadership of Professor Dr. Gilson Vieira Monteiro, who served as the program's first coordinator (2008-2011). From 2012 onward, the program has been coordinated by Professor Dr. Mirna Feitoza Pereira.

The Other Bend of the River

The doctoral dissertation of Professor Elias Souza Farias, titled “The Song in the Amazon and the Amazon in the Song”, was defended in 2017 in the Graduate Program in Society and Culture in the Amazon at the Federal University of Amazonas (UFAM). His research advisor was Professor Gilson Vieira Monteiro—that is, myself.

Interestingly, Elias Farias was not originally my advisee. He found himself without an advisor within the program—though I no longer recall the reason why. I simply remember telling him, "As long as you conduct your research through the perspective of ecosystems or complexity, as defined by Morin." He was in a kind of academic deadlock, a no-win situation, and ultimately agreed—though, at first, I am certain he was not entirely convinced.

From the UFAM dissertation database, the following passage summarizes Farias’s research:

"Farias’s study explores the song as a web of sounds, words, images, and rhythms that not only provide aesthetic experiences but also contribute to the construction of knowledge. From this perspective, listening to a song stimulates imagination, opens pathways for aesthetic perceptions, and elevates thought to a high degree of poetic sensitivity, triggering specific emotional reactions in different listening contexts."

Farias did not accept everything at first. Gradually, he began to understand the principles of complex thought and the concept of communicational ecosystems—which I had been advocating within PPGCOM at UFAM. At that time, I was coordinating both programs: Society and Culture in the Amazon (offering master’s and doctoral degrees) and Communication (offering a master’s degree).

Throughout the process, Farias faced several challenges that nearly led him to abandon his dissertation. His wife suffered from a severe illness, and he was unable to conduct interviews in the traditional manner he had initially planned. I kept telling him, "You are not going to give up." At times, I believed in him more than he did himself. In the end, it was worth it.

Farias’s dissertation strongly highlights the dialogical circularity inherent to knowledge and its interrelations. He argues that understanding complexity requires recognizing the coexistence of seemingly disconnected existential dimensions, such as reason and emotion, body and mind. According to his findings, "The poetic thought of songwriters and the representations embedded in their songs contain nuances that only the multidimensionality of art can provide."

For someone who had always adhered to Cartesian thinking, this shift represented a radical departure—a paradigm change beyond the last bend of the river.

Also from the UFAM dissertation database—likely written by Farias himself:

"Based on the premise that all the complexity inherent to human beings and their connections with life and the world can be poetically encapsulated in song, this study reflects on the conception of the Amazon as expressed through the poetic thought derived from the sound and poetic text of songs produced in Amazonas. The research considers the existence of an individual, a place, a context, and an imaginary construct, analyzing their interconnections.

Nature, humanity, society, and the contours of its cultural complexity in the Amazon serve as the backdrop for the reflections presented. Through the works and artistic trajectories of composers Adelson Santos and Celdo Braga, as well as an analysis of their lyrics and the musical composition of their songs, the study seeks to understand the perceptions and imaginaries constructed about the region. The research examines production conditions, the creative process, predominant musical genres, and the types of poetic-musical narratives proposed by these songwriters."

However, the most magical moment of all occurred during the dissertation defense. After this event, I began to seriously consider Cartography of Chance as a theoretical- methodological hypothesis.

Farias entered the defense room accompanied by a group of musicians. He had not told me what was about to happen. I only recall seeing this in his dissertation:

APPENDIX L
CD – THE DISSERTATION IN SONG
1 The Last Bend of the River – Elias Farias
2 Cabocla Longing – Elias Farias
3 Argument – Adelson Santos
4 Cabocla Soul – Adelson Santos
5 Dreams of Flying – Adelson Santos
6 Canoar – Celdo Braga/Célio Cruz
7 Native Chant – Celdo Braga
8 Amazonas Moreno – Celdo Braga/Osmar Oliveira
9 Traveler – Elias Farias/Antônio Machado
10 Singing is Necessary – Elias Farias

Farias, in addition to his dissertation, had produced an entire music album, which—until today—has never been recorded. And the first song on this never-recorded album was precisely The Last Bend of the River.

I remember vividly that Elias Farias presented his research in the traditional format, and at the end, he said, "I composed a song for the dissertation. After you evaluate my defense, I will sing it."

Since I had never heard the song before, I immediately intervened: "No way! You will sing it now."
I even took on the role of master of ceremonies:

"Ladies and gentlemen, presenting: Elias Farias and his band!" And so, he performed:
The Last Bend of the River– Elias Farias (song still unrecorded to this day)

I remember the boy sitting by the river, Watching the stars in the solitude of the waters, Swirling eddies of fairy dust.

I remember the boy counting the bends of the river, Wondering how to grasp them in the immensity of the waters, Swirling eddies of the road.
He wanted to know, What comes next,
What comes next after the last bend of the river? (Repeat)

This moment solidified, in my mind, the power of Cartography of Chance as a theoretical-methodological approach.
After One Bend, Another Bend
And from this bend, a new river emerges. The last of the bends bends itself
To see the bends it never saw before. It bends to the wind,
It bends to the enchantment, It bends to the deception.

The river joyfully meanders beneath the blue, The river joyfully meanders beneath the blue, It reaches the curves of the ocean.
Perhaps there is a profane encounter,
Between the curves of a great ocean and the edges of the land. Or perhaps these curves of the land
Bend into shapes and folds, folds and digressions. At the last bluish bend of the planet,
I set sail once again.

He wants to know, What comes next?
What comes next after the last bend of the river? (Repeat)

After an invisible bend,
Gravity pulls a grand stained-glass spiral. The last of the bends dissipates
To enter the web in the shape of a spiral. It bends to Time,
It bends to the Temple, It bends to the Insane.

Life gently meanders beneath the light, Life gently meanders beneath the light, It reaches the curves of infinity.

Perhaps a deep mystery—
Are the curves of all worlds parallel rivers? Or perhaps these curves of space
Bend to the curves of chance in folds and dimensions. At the last bend at the end of the universe,
I embrace the immensity.

I embark on the spiral (Insane whirlpools),
I travel through the vastness (Profane whirlpools), I drift away from darkness (Deceptive whirlpools).
And order and disorder dissipate and balance themselves in a new way of ordering.
And cause becomes effect, and effect becomes cause, and everything always returns to circulate.
And the part is in the whole as the whole is in the part, and everything tends toward completion.
He wants to know, What comes next?

What comes next after the last bend of the light? The Most Astonishing Defense of a Dissertation Odenei de Souza Ribeiro, who was on the defense committee with me and whom I considered the "most reserved," threw the dissertation onto the table and declared:

"I no longer wish to evaluate the written work. This song says everything the dissertation needed to say."

He was immediately followed by Cássia Maria Bezerra do Nascimento, Rosemara Staub de Barros, and Maria Luiza Cardinale Baptista**. The committee members embraced and wept profusely.
To this day, I have never witnessed something as magical as that dissertation defense.

II. Cartography Of Chance As A Research Method

Since that extraordinary event at Elias Farias's dissertation defense, I have been certain: Cartography of Chance is more powerful than we imagine. However, I never had the courage to fully embrace it as a theoretical-methodological hypothesis. And if I didn't acknowledge it myself, how could others recognize it?

Today, in this article—after 2017, when I saw clear evidence that my hypothesis "held together"—I finally embrace Cartography of Chance as a research method. And I have more than enough elements to support my claim. Let's dive into it.

Serendipity is a concept that transcends the idea of mere chance and embeds itself at the core of scientific epistemology, creativity, and innovation. In the context of scientific and technological discoveries, serendipity should not be interpreted as mere fortuity, but rather as a phenomenon involving acute perception, cognitive flexibility, and an environment conducive to experimentation.

The notion of serendipitous discoveries refers to events where the search for specific knowledge leads to the unexpected identification of something relevant—often revolutionary—that transforms paradigms and expands epistemological horizons.

The origin of the term dates back to the story The Three Princes of Serendip, in which the protagonists make unintentional discoveries due to their keen insight and observation. This concept was extensively explored by Robert Merton and Elinor Barber (2004), who argue that serendipity is not mere chance, but a process in which a researcher, while searching for something specific, encounters an unexpected result and—critically—recognizes its importance.

This distinction is crucial, as there is a substantial difference between a mere accident and the ability to interpret it as a new scientific opportunity. According to Merton, science progresses, in part, because researchers remain open to unforeseen events, which often catalyze disruptive advancements.

In the study of scientific methodologies, Kevin Dunbar (1997) delved deeper into the idea of serendipity by analyzing cognitive processes in molecular biology laboratories. Dunbar observed that scientists frequently encountered unexpected data, but only those with a flexible research approach were able to reformulate their hypotheses and transform these findings into meaningful knowledge.

This process, according to Dunbar, is directly linked to what Thomas Kuhn (1962) termed paradigm shifts, as serendipitous discoveries often challenge established theoretical models, leading to scientific revolutions.

From a more philosophical and statistical perspective, Nassim Nicholas Taleb (2007), in The Black Swan, conceptualizes serendipity within the logic of rare and unpredictable events, arguing that great innovations occur in unplanned ways—but favor those who are most exposed to diverse experiences and ideas.

Taleb suggests that science and economics should structure models that incorporate uncertainty as an integral part of progress, rather than attempting to rigidly predict the future. In his view, serendipity is fundamentally antifragile—that is, it thrives in randomness and chaos, unlike systems that are overly planned and resistant to unpredictability.

III. Serendipitous Discoveries And Their Role In Scientific And Technological Innovation

Serendipitous discoveries are intrinsically linked to technological innovation and scientific development. Many of humanity's most significant advancements have resulted from unexpected encounters with unknown phenomena, such as Alexander Fleming's discovery of penicillin (1928) or Percy Spencer's invention of the microwave oven (1945). Both cases illustrate how the insight and curiosity of researchers played a crucial role in transforming the unexpected into applicable knowledge.

In highly innovative environments, such as research laboratories and technology companies, serendipity has been leveraged as an organizational strategy Google, for example, implemented the "20% Time" concept, allowing its engineers to dedicate part of their work schedule to personal projects, leading to innovations such as Gmail and Google News. This operational model is based on the premise that exposure to diverse contexts and non-linear challenges increases the likelihood of serendipitous insights.

Building Environments That Foster Serendipity

Given its relevance to science and innovation, serendipity can be cultivated through the creation of intellectually stimulating environments. Universities and research centers play a central role in this process by promoting interdisciplinarity and encouraging flexible approaches to knowledge.

Karl Popper (1959) argued that science advances through conjecture and refutation, and that discovering anomalies in theoretical models should be vieweda s an opportunity rather than a failure of the method.

Moreover, the development of collaborative networks and creative spaces—such as open innovation laboratories and multidisciplinary research programs—can enhance the conditions for serendipity to occur. Steven Johnson (2010), in Where Good Ideas Come From, highlights that major innovations often emerge from "liquid networks," where ideas from different domains intersect and recombine in unexpected ways.

Serendipitous discoveries represent a fundamental phenomenon for science, innovation, and the evolution of human thought. They are not mere accidents but rather events that depend on the observer's sagacity and cognitive flexibility to be transformed into meaningful knowledge.

Throughout history, numerous scientists and innovators have demonstrated that being open to the unexpected is one of the key drivers of progress. By creating environments that favor unplanned interactions and encouraging flexible epistemological approaches, society can expand its potential for making discoveries that transcend the linear logic of traditional research.

IV. Disruptive Events: Transforming Established Systems

Disruptive events are phenomena that profoundly transform established systems, promoting structural changes that alter technological, social, and economic paradigms. Disruption can occur in various contexts, including technological innovation, market dynamics, climate change, and sociopolitical revolutions.

Essentially, a disruptive event is not merely a variation within a system but rather an internal or external factor that destabilizes existing rules, forcing a reconfiguration of structures and relationships.

The concept of disruption gained prominence through the work of Clayton Christensen (1997) in The Innovator's Dilemma, where he coined the term disruptive innovation. According to Christensen, disruption occurs when a new technology or business model challenges established companies by offering more accessible, efficient, or innovative solutions, dramatically altering market dynamics. A classic example is the replacement of landline phones with mobile phones or the impact of Netflix on traditional video rental stores.

However, the concept of disruption is not limited to technological innovation. Thomas Kuhn (1962), inThe Structure of Scientific Revolutions, argues that disruptive events are intrinsic to science, occurring when new paradigms emerge and replace established theories. For Kuhn, science progresses through "scientific revolutions", which take place when accumulated anomalies in the dominant paradigm become unsustainable, leading to the adoption of a new theoretical framework that reorganizes knowledge within a discipline.

Disruption can also be analyzed from an economic and social perspective. Joseph Schumpeter (1942) introduced the concept of creative destruction, asserting that economic progress occurs through the replacement of old forms of production and organization with new ones. This process, while fostering growth and innovation, often has negative consequences for traditional sectors and workers unprepared for change.

The Industrial Revolution, for instance, was a disruptive event that eliminated artisanal professions while simultaneously creating new forms of labor and mass production. Serendipitous discoveries and disruptive events are two key forces driving scientific, technological, and societal transformations. While serendipity highlights the role of unexpected insights and intellectual flexibility in advancing knowledge, disruption underscores the profound structural shifts that reshape industries, sciences, and human behavior. Understanding and strategically fostering these dynamics is essential for creating environments that promote innovation and adaptation to change —whether in scientific research, technological development, or social evolution.

V. Disruptive Events In Sociology And Technology

In the field of sociology, Ulrich Beck (1992), in Risk Society, argues that advanced modernity generates unpredictable risks, such as global economic crises, climate change, and technological advances with uncertain impacts. Beck suggests that disruptive events, such as pandemics or ecological disasters, not only affect society but profoundly transform its institutions, demanding new models of governance and adaptation.

Currently, digital technology has been one of the primary drivers of disruption. Erik Brynjolfsson and Andrew McAfee (2014), in The Second Machine Age, describe how advancements in artificial intelligence, automation, and big data are causing a revolution as significant as the Industrial Revolution. Examples such as job displacement by robots, market digitalization, and the rise of cryptocurrencies illustrate how technological transformations can profoundly restructure entire sectors.

Contemporary disruptive events also include climate change and its implications for geopolitics and the global economy. Naomi Klein (2014), in This Changes Everything: Capitalism vs. The Climate, argues that the climate crisis is a disruptive event that demands a fundamental revision of production and consumption models, challenging traditional capitalism to find sustainable solutions.

Disruptive events are inevitable and shape the future of societies. Whether driven by technological innovations, economic crises, or sociocultural transformations, they demand resilience and adaptation for individuals and institutions to thrive amid change. Studying disruption allows us to understand how systems evolve and how we can anticipate or mitigate their impacts, ensuring that the benefits outweigh the challenges posed by these radical transformations.

VI. Correlation Between Disruptive Events, Serendipity, Cartography Of Chance, And Virtuous Learning Ecosystems (Evas)

The interrelationship between disruptive events, serendipity, cartography of chance, and Virtuous Learning Ecosystems (EVAs) can be understood within a broader epistemological framework that involves transformation, unpredictability, and innovation in knowledge and learning. These concepts share a common foundation: recognizing complexity and the non-linearity of change and discovery processes.

Disruptive events, as analyzed by Clayton Christensen (1997) and Joseph Schumpeter (1942), profoundly alter established systems, leading to structural reorganization in different domains, whether in economy, science, or education. Disruption can occur through the introduction of an innovative technology, a systemic collapse, or an external shock, forcing societies and institutions to adapt.

Serendipity, studied by Robert Merton and Elinor Barber (2004), is a fundamental concept for understanding how certain disruptive events lead to innovation. Discoveries such as Alexander Fleming's penicillin (1928) and Percy Spencer's microwave oven (1945) demonstrate that many scientific and technological revolutions emerge at the intersection of chance and perception. This means that disruptive events can be leveraged through serendipity—the ability to recognize unexpected opportunities and transform them into concrete advances.

Cartography of Chance, a concept developed by Gilson Vieira Monteiro, proposes that unpredictability can serve as an organizing and structuring principle, especially in the fields of learning and research. Unlike Cartesian models of planning and prediction, cartography of chance acknowledges randomness and the non-linearity of knowledge construction processes.

When disruptive events occur, cartography of chance can be used to map previously invisible connections, helping individuals and institutions transform initial chaos into new developmental pathways. In other words, cartography of chance functions as a heuristic method, allowing serendipity to be systematically incorporated into innovation and learning processes.

Virtuous Learning Ecosystems (EVAs), another concept developed by Gilson Vieira Monteiro, are educational environments that promote interactivity, interdisciplinarity, and personalized learning through technology and collective intelligence. EVAs operate as dynamic networks, open to experimentation and emergent learning, providing fertile ground for productive disruption and structured serendipity.

In EVAs, cartography of chance can be applied to identify hidden patterns, fostering learning approaches that adapt to the emerging needs and interests of learners. Thus, learning environments are not rigidly structured but flexible, enabling unexpected discoveries to be organically incorporated into the educational process.

The interconnection between disruptive events, serendipity, cartography of chance, and Virtuous Learning Ecosystems points toward an innovation and knowledge model that values unpredictability as a driver of transformation. While disruption creates conditions for profound change, serendipity and cartography of chance provide tools to interpret and navigate these changes, and EVAs create the structures that turn emergent knowledge into applied learning.

Thus, learning and innovation are not linear and predictable processes but dynamic phenomena that require more flexible and adaptable models. EVAs, by embracing cartography of chance and fostering serendipity, represent a significant advancement in how we handle disruptive events in science, education, and society.

Ecosystemic Epistemology: A New Approach to Knowledge

Ecosystemic Epistemology is based on the premise that knowledge is not produced in isolation but

rather within complex and interdependent networks involving multiple actors, types of knowledge, and technologies. Inspired by biological ecosystem theories, this approach views knowledge ecosystems as open, dynamic, and adaptive systems, in which diversity and interconnection are essential for innovation and resilience.

According to Fritjof Capra (1996), natural ecosystems are characterized by their ability to self-organize and adapt, principles that can also be applied to knowledge ecosystems. Capra argues that understanding living systems requires a holistic approach that integrates biological, social, and cognitive dimensions.

In this sense, Ecosystemic Epistemology proposes a pandisciplinary perspective on knowledge, one that transcends disciplinary boundaries and integrates different forms of knowledge.

Edgar Morin (2000) also contributes to this discussion by advocating for a "reform of thought", one that acknowledges the complexity and interdependence of social and natural phenomena. According to Morin, modern science has fragmented knowledge into isolated disciplines, losing sight of the totality and interconnectedness of systems.

Thus, Ecosystemic Epistemology seeks to restore this ecoholistic vision, integrating scientific, traditional, and technological knowledge into a single knowledge ecosystem.

VII. Ecosystemic Epistemology And The Ecology Of Knowledge

Moreover, Ecosystemic Epistemology engages in dialogue with the theories of the "ecology of knowledge," proposed by Boaventura de Sousa Santos (2007). Santos argues that modern science has marginalized other forms of knowledge, such as traditional and local knowledge, which are fundamental to solving complex problems. By recognizing the importance of these forms of knowledge, Ecosystemic Epistemology promotes a more inclusive and democratic vision of knowledge.

VIII. Cartography Of Chance: Mapping Unexpected Connections

Cartography of Chance is a methodological proposal aimed at mapping unforeseen connections and fortuitous encounters that occur in knowledge ecosystems. Inspired by the concept of serendipity, this approach acknowledges that many scientific and technological advances arise from unexpected discoveries and chance interactions between different actors and knowledge domains.

The term serendipity, coined by Horace Walpole in the 18th century, refers to the ability to make fortunate and unexpected discoveries by accident (Merton & Barber, 2004. In science, many of the most significant advancements resulted from fortuitous events, such as Alexander Fleming's discovery of penicillin.

Thus, Cartography of Chance seeks to identify and map these unforeseen connections, highlighting how they contribute to the emergence of new knowledge and innovations.

To achieve this, Cartography of Chance employs network analysis and data visualization tools, which allow for the representation of interconnections between different actors and knowledge systems. These tools are based on complex network theories, which study the structure and dynamics of interconnected systems (Barabási, 2002). According to Barabási, complex networks are characterized by non-linear topology, where some nodes (or actors) play a central role in maintaining the system's connectivity.

"If-Then" Rules in Cartography of Chance

"If-then" rules are fundamental to understanding Cartography of Chance as a research method. Originating from conditional logic and widely used in computer science and artificial intelligence, these rules allow the modeling of causal relationships and predicting behaviors in complex systems (Russell & Norvig, 2020).

In Cartography of Chance, "if-then" rules are used to map the conditions that lead to the emergence of unforeseen connections and serendipitous discoveries.For example, an "if- then" rule could be formulated as follows:

- "If a researcher from a specific field interacts with a professional from another discipline, then the probability of generating new ideas or innovative solutions increases."

This rule emphasizes the importance of interdisciplinarity and knowledge diversity in fostering innovation.

Additionally, "if-then" rules can help identify behavioral patterns in knowledge ecosystems. For example:

- "If a central actor in a knowledge network is removed, then the system's connectivity may be significantly affected."

This rule illustrates the importance of central nodes in maintaining the structure and dynamics of complex networks.

Furthermore, "if-then" rules enable the creation of predictive models that can guide innovation policies and strategies.

For instance:

- "If investments are directed towards fostering collaborative networks between universities and companies, then the probability of technological innovations emerging increases."

These predictive models are fundamental for managing innovation ecosystems, as they allow anticipation of the impacts of different interventions.

IX. Case Study: The EVA - City Of Knowledge Project For Social Inclusion

The "EVA - City of Knowledge for Social Inclusion" project is a concrete example of the application of Ecosystemic Epistemology and Cartography of Chance.

Developed at the Federal University of Southern Bahia (UFSB), EVA aims to create a learning and innovation ecosystem that promotes social and digital inclusion by integrating education, research, and technology.

The case study of EVA - City of Knowledge for Social Inclusion illustrates how these approaches can be applied in practice, contributing to the creation of knowledge ecosystems that integrate human, technological, and environmental dimensions.

It is believed that by adopting a transdisciplinary and holistic perspective, it is possible to construct learning and innovation models that foster social inclusion and sustainability, in alignment with the challenges of the 21st century.

Through Ecosystemic Epistemology, the EVA project recognizes the importance of local and traditional knowledge while simultaneously valuing the contributions of digital technologies and advanced sciences.

Meanwhile, Cartography of Chance has been used to map unexpected connections between different actors and knowledge fields, identifying opportunities for innovation and collaboration. Ecosystemic Epistemology and Cartography of Chance offer an innovative theoretical-methodological framework for understanding knowledge ecosystems in complex and dynamic contexts. These approaches emphasize the importance of diversity, interconnection, and chance in knowledge construction, promoting a more inclusive and equitable vision of learning and innovation processes.

Pandisciplinarity

In October 2014, though I do not recall the exact date, at the First International Seminar on Society and Culture in the Pan-Amazon: Interdisciplinarity, Challenges, and Perspectives, I was invited to deliver the opening speech, as I was the Pro-Rector of Research and Graduate Studies at the Federal University of Amazonas (UFAM) at the time.

I made some notes and titled my opening speech: "Interdisciplinarity and Complex Thought."

I reflected on how the dominant positivist approach began to be challenged by the German philosophy of nature movement in the 20th century, which included quantum physics, phenomenology, systems theory, cybernetics, and structuralism.

In France, Lupasco (1951), with the principle of logic and the antagonism of energy, and Bachelard, were pioneers of what could be called dialectical epistemology, that is, a non- Cartesian approach to knowledge.

I drew attention to the importance of Paul Karl Feyerabend, who published the essay "Against Method" (1970), followed by "Science in a Free Society" (1978) and "Farewell to Reason" (1987).*

However, complexity would only become the ‘darling’ of new scientists with the introduction of the term “complexity” into scientific discourse, which was celebrated as the birth of a NEW SCIENCE in 1990, with Edgar Morin's Introduction to Complex Thought.

I then turned to Morin to define discipline, something that professors, especially university faculty, still fiercely defend today:

"A discipline is a category that organizes scientific knowledge; it institutes division and specialization within it, and it is responsible for the diversity of the domains encompassed by the sciences."

Discipline tends toward enclosure. This leads to the need for overflows and possible interferences, opposing the historical closure of science.

Piaget, with the "Circle of Sciences," established the interdependence among various sciences. This marked the first traces of multidisciplinarity.

- Multidisciplinarity, therefore, occurs when a research problem involves multiple subjects; all processes are addressed simultaneously, but each corresponds to a specific discipline or social organization.
- Multi- or pluridisciplinarity is the study of an object by multiple disciplines at the same time. As Peneau defines it, "it is the juxtaposition of various disciplines that deal with the same object, but without a clear pursuit of connections."

Interdisciplinarity, however, is an attempt at integration. It addresses the challenges found in pluridisciplinarity, such as:
- Isolation between disciplines,
- Fragmentation of knowledge,
- Segmentation of expertise.

Interdisciplinarity is an effort to create bridges and dialogues between disciplines. In this approach, the object of study benefits from these exchanges, and, presumably, each involved discipline benefits as well.

Thus, interdisciplinarity involves both pluridisciplinarity and transdisciplinarity:
- In pluridisciplinarity, the foundations, models, and methods of each discipline are not questioned.
- In transdisciplinarity, there is a dialogue among disciplines, addressing the complexity of the field and borrowing methods from other disciplines.

This makes it imperative to build bridges and foster dialogue among the sciences. However, it also presupposes that something occurs through and beyond the disciplines. In this context, the researcher is actively involved in the relationship.

Closing Remarks

I conclude this article as I concluded my speech in 2014:

"Who knows? Perhaps, HERE, we are initiating the birth of PANDISCIPLINARITY?! A SUCCESSFUL SEMINAR FOR ALL OF US! PANWORK!"

May this have been a PANREADING for all of US and for OUR collective understanding.

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