3 Language, subject and body for Artificial Intelligence in Psychology

Dioneia Motta Monte-Serrat, FFCLRP-USP, Unaerp

ORCID https://orcid.org/0000-0002-4266-8979

Carlo Cattani, Unaerp

ORCID https://orcid.org/0000-0002-7504-0424

*Abstract: Emotions, as a rule, are conceived as behavioral responses of an individual to events. In this Chapter, emotions are addressed for the implementation of artificial intelligence in Psychology (AIP), and, for this reason, we describe their complex aspects linked to Neurolinguistics, Computational Linguistics and Cognitive Computing. We assume that emotions are linked to brain dynamics, which is based on a cognitive linguistic structure. Knowledge of these fundamentals helps in understanding complex aspects of emotions, in developing AIP tools and in considering ethical issues. We establish the concept of language/cognition according to a unique architecture that exists in both humans and intelligent systems. We show that language, decision-making and emotions are linked to the concept of subject and that subjects are neither born nor developed but they are constituted within a context. We clarify that, according to Psychology and Psychoanalysis, a dynamic and morphogenic element acts in the constitution of the subject and the body, not just being configured as a biological phenomenon. In the end, we propose that approaching language/cognition as a dynamic system mediated by a dual constituent structure comprising logical organization and real-valued functions not only assists in the design of intelligent Artificial Psychology systems, but also assists in the consideration of ethical principles.*

*Keywords: Language universal structure. Brain dynamics. Subject. Body. Artificial Psychology*.

3.1 Introduction to interdisciplinarity among Computational Linguistics, Neurolinguistics and Cognitive Computing: making the interpretation of intelligent systems more intuitive

This chapter is inspired by an interdisciplinary approach, which proves to be a field of excellence for interconnecting emotion and cognition - since the individual's linguistic cognitive process is compatible with the expression of emotions - with artificial intelligence, AI - which also presents the same foundations of the linguistic cognitive process when using language and classifying emotions (Monte-Serrat and Cattani, 2021). We investigate the connection between language, emotion and cognition carried out by intelligent systems (so-called in this book Artificial Intelligence Psychology, shortly AIP), based on the dynamics of the human cognitive linguistic process.

The human cognition, although not fully deciphered, is responsible for the articulation of two fronts: the logical front (if P, then Q) and the axiomatic or contextual front (Monte-Serrat and Cattani, 2021). These two fronts make up the unique or universal structure of language, whether from individuals or from machines (Monte-Serrat and Cattani, 2021,2022). An understanding of the dynamics of the human cognitive linguistic process as integrative of the logical and axiomatic/contextual features of the linguistic cognitive process opens doors to new possibilities in the assessment of emotions (Artificial Psychology). The perspective of approaching emotions according to the universal structure of language makes it possible to analyze emotions under a semantic dimension, linked to a subjective context, and under a logical dimension, with both emotional perspectives being able to give rise or not to decisions (Monte-Serrat and Cattani, 2021; 2022). In this way, intelligent systems can deal with previously categorized emotions, or process information under a dynamic aspect. Better saying, on the one hand, intelligent systems absorb pre-established values ​​in a unified way (categorized emotions) or, on the other hand, they deal with the fluid values ​​of emotions (emotions captured according to contextual reality). In this Chapter, therefore, we present Computational Linguistics strongly linked to Neurolinguistics, Psychology and Cognitive Computing, so the system's interpretation will be more intuitive the better it learns to interpret the appropriate context of the emotion at play (Monte-Serrat and Cattani, 2022).

This Chapter articulates language, subject and body to assist in the development and use of intelligent systems aimed at AIP. Section 1 makes an interdisciplinary introduction showing the permeability of the universal structure of the cognitive linguistic process in the scientific branches of Linguistics, Neurolinguistics, Computational Linguistics, and Cognitive Computing, making it clearer how to achieve human intuition in the development of intelligent systems. The details of the elements of the cognitive linguistic process' unique structure and its connection with subjectivity are presented in Section 2. Section 3 discusses the concept of emotion and the role of symbolic mediation through language, distinguishing the concept of language from the concept of languages ​​spoken in the world. Section 4 articulates language, cognition and subject, showing that the cognitive linguistic process is the seat of emotions, both in the central nervous system of individuals and in the configuration of the algorithmic core of intelligent systems. Section 5 shows how to predict and measure subjectivity through emotions. The suggestion of an Artificial Psychology structured not only in logical categories, but also in real-valued functions is offered in Section 6. Section 7 draws attention to the dynamic system characteristic of the cognitive linguistic process and the possibilities that this understanding brings to the development of more intuitive smart tools. Section 8 provides an overview of the chapter's content, concluding that emotions go beyond logical categorizations, also arising from values ​​linked to the environment. In this case, Artificial Psychology systems need to articulate concepts from Psychology, Linguistics, Neurolinguistics and Psychoanalysis to Computational Cognition to encompass subjectivity. When dealing with subjects, developers and applicators of Artificial Psychology must be aware of ethical principles, since they are dealing with the core cognition and decision-making of intelligent systems’ users.

3.2. The unique architecture of language combined with subjectivity

Language (understood as a linguistic cognitive process, according to Monte-Serrat and Cattani, 2021), is a dynamical system that mediates between reality and mind, acting in the process of meaning construction, which, in turn, depends on a system of symbols and linguistic signs codified through rules of use (Araújo, 2011, p. 9-10). A dynamical system is a mathematical-logical model that connects causes (forces) and effects (variations of the kinematical state, as a function of time). A linguistic cognitive process is a logical model that connects causes (stimuli-events) and effects, i.e. the variations of the psychological-cognitive state of our mind, as functions of time (this can be seen from the progress of our memory that grows on time). It is important to highlight that the language sign system does not automatically assign meaning (although some linguistic theories consider it so), for this reason, language must be considered within its social context.

There is a diversity of views on what the human cognitive process is. Authors present a consensus that language is particularly complex; that it presents regularity (syntactic restrictions, semantic and pragmatic objectives, discourse etc.); that it can be modeled mathematically as a dynamic system (Elman, 1995, Kelso et al. 1988, Thelen,1988). Elman states that dynamic system modeling does not operate on symbols, but it incorporates dynamics into the system, allowing movement from certain regions to others and making certain transitions difficult (Elman, 1995, p. 196): “internal representations of words are not symbols but locations in state space […] and processing rules are not symbolic specifications but the dynamics of the system”.

We believe that there are two possibilities for working on language and emotion in AI: one possibility is to work with categorized emotions accompanied by syntactic and semantic restrictions; the other possibility is to model the dynamics of the system, making certain transitions in the construction of information difficult. This second possibility, contrary to what Elman suggests, may indeed interfere with the symbolization process, which is uniquely human, as the mental representation arises from the human experience exercised in each context of reality.

On the one hand, therefore, we have the “rules” of structural organization of language that link a repository of facts to individual words, adding restrictive regulations on how these links can be made so that these words are combined in the form of sentences (Elman, 1995, p.197). Sentences, once subject to grammatical rules, can be constructed into higher-level structures or broken down into dimensions that reflect syntactic, orthographic or phonological properties (Elman, 1995, p 197-198).

The dynamics of the cognitive linguistic process, responsible for the construction of meaning, must be considered. The “movement” of language features is connected to the time element, which can be predictable, when provided by syntax, or unpredictable, when provided by context interference (Monte-Serrat and Belgacem, 2017; Monte-Serrat; Belgacem; Maldonato, 2017). The importance of identifying the time element in research into cognitive processes, be they human beings or intelligent systems, lies in the interference of time on the "value" of the word in the discursive chain, which is an aspect linked to the construction of meaning. In short: language symbols are intrinsically context-free; they are always the same regardless of their use (Elman, 1995, p. 198). However, the context can change the meaning, as seen in the following two examples: “The dream is over” (phrase said by John Lennon when the group The Beatles dissolved); “The dream is over” (Mr. José from the bakery, when referring to a sweet bread called “dream” in Brazil). The same sentence changes its meaning when we change its context.

The study of cognition requires interdisciplinary scientific investigation of the mind and intelligence. Among the disciplines most used in these investigations are linguistics, neurolinguistics, psychology, philosophy, anthropology, computer science and artificial intelligence (AI). The term Artificial Psychology to describe the investigation of psychological phenomena through artificial intelligence, AI, refers, in this Chapter, to the fundamental structure of the cognitive linguistic process (dynamic relationship between the logical and axiomatic/contextual features of language, which can lead decision-making or not), including aspects involved in the perception of emotions. Psychology, therefore, which studies mental states and processes mixed with emotional perceptions, integrates the cognitive linguistic process (Monte-Serrat and Cattani, 2022). The basic human temperaments (melancholic, choleric and sanguine) are not detached from subjectivity. Therefore, there is no way to talk about a cognitive linguistic process without taking psychological or subjective aspects into account.

Neurolinguistics deals with the cognitive linguistic process as a physiological process (chemical, physical and mechanical functions of the body). Perlovsky (2016, p. 2) proposes the physical theory of mind relating cognition and language with thermodynamics and informational theories. He describes the mental model according to a functional hierarchy, which goes from sensory-motor activity (lower region of the hierarchy) to concepts of objects, contexts, situations. According to the author (op. cit.), language is seen as a system of different operators that help the brain translate the physical world into intelligible information for the biological body.

We know, however, that language cannot be reduced to sensory-motor activities, as individuals express themselves in different and unique ways. To Perlovsky’s perspective we can add subjectivity. Subjectivism in language refers to the concept of language proposed by Lacan (1957), that is, language as a complex formation that involves the conscious and unconscious. In 1949, Lacan takes advantage of Bouasse's optical scheme to describe the role of language mediation (as a symbolic plane) that links the real body of individuals to their imaginary body (understood as subjectivity).

AIP cannot disregard that subjectivity is not limited to the simple approximation of concepts and psychological states but involves sensory or motor data that are integrated into the individual's psychic life, generating a different order of operations in which symbolic activity intervenes (Monte -Serrat 2012). AIP must consider that subjectivity does not arise from emotions but has its origins in the human activity of representation (Le Gaufey, 1998).

3.3 Emotions and the role of symbolic mediation through language

Scarantino (2021) highlights the importance of recognizable theories of emotions conceived as phenomenologically salient responses of a subject to events in the reality that surrounds them, triggering behavioral changes. He describes emotions as complex tasks and states that there is still uncertainty as to whether emotions are rational.

Considering that this chapter articulates Computational Linguistics with Neurolinguistics and Cognitive Computing, it is not appropriate to approach emotion as isolated categories. Due to this complexity, we prefer to seek the foundations of the cognitive linguistic process to try to overcome aspects of emotions that can assist in the development of AIP tools and that is why language (taken as a process and not as spoken languages around the world) is considered in its dynamic aspect that articulates logical reasoning to environmental stimuli, and whose functions and properties must be fully considered in the development of an AIP.

The French philosopher Michel Pêcheux (1975) explains that sense, meaning, information, has a social, ideological and psychological trajectory that causes tension in the sedimentation of meanings. There is a “legal illusion” of what the individual is (Edelman, 1980, p. 14), that is, he is, namely, the “ideological representation of society as a set of distinct and free individuals” (Miaille, 1979, p. 111), endowed with an autonomous, entirely visible form (Pêcheux, 1975). From this perspective, subject and subjectivity are idealized and frozen in categories of “valuation of action” (Lagazzi, 1988, p. 20). According to Haroche (2010), “the subject of law, in bureaucracy, comes from the writings of the law and has nothing to say about himself”. Bureaucratically speaking, we can categorize individuals and their emotions (Monte-Serrat, 2012), however, fuzzy logic, an extension of classical Boolean logic, shows that in addition to the two categories true/false or 0/1, there are also intermediate categories, that is, something can be true or false only up to a certain point, assuming a value between 0 and 1. The concept of fuzzy logic can provide ways to solve the problem of teaching a machine to categorize emotions in a less idealized and more realistic way.

Subjectivity and emotion have to do with linguistic cognitive process and with the development of a Super AI. What we have in 2024 is AI still limited to specific tasks (e.g. image classification, audio transcription). For now, General AI that understands and learns any intellectual task does not reach the capacity of a graduate, engineer or researcher, on the contrary, it has produced alarming effects. While McCarthy, an American computer scientist, in 1956 first used “artificial intelligence” to refer to a computer that used mathematical logic, we, in this chapter, make it clear that, according to the foundations of the cognitive linguistic process, cognition is not restricted to logical characteristics. This question leads us to understand the paradox of AI: the more it automates data analysis, the more work is required of a human being to interpret edge cases, provide high-level scrutiny and give meaning to insights. An artificial intelligence that exploits only the logical characteristics of cognition will be increasingly dependent on the human element: AI lacks the development of algorithmic modeling strategies that also encompass the axiomatic (contextual) aspects of cognition.

Taking as a starting point the idea according to which the subject is neither born nor develops but is constituted in an articulated way at the social level (Elia, 2004, p. 36), we can understand that the subject is an "act of response” (Elia, 2004, p. 41), in relation to the environment (act of response corresponds to a symbolization process). Therefore, we propose that AIP promotes a hybridization of the concept of individual as "legal illusion”, as defined by Edelman (1980, p. 14) with the concept of subjectivity arising from stimuli originating from the environment (symbolization process for humans which is replaced by the tokenization process in terms of artificial intelligence). This way makes it possible to circumvent cognition under its fundamental dynamic aspects that combine logical features with axiomatic features (resulting from impacts that arise from the individual's contextual reality).

The categories of emotions have important methodological implications to be considered from the perspective of both fronts of the cognitive linguistic process. Prescriptive definitions of emotions may not necessarily be homogeneous, differing in terms of the spoken language and the context from which they were taken for categorization (Monte-Serrat, 2021). This phenomenon is due to the intermediation of human beings who, when experiencing a certain situation, represent it (symbolic process). This experience of symbolization is uniquely human and can give rise to emotions that are different from the ideally categorized emotions (disconnected from the original context). Symbolization, being a uniquely human process, has been offset by the human work of tokenization and categorization, behind the scenes of creating intelligent systems.

The role of symbolic mediation through language, as a dynamic process, promotes a confluence of heterogeneous domains within a great complexity in which emotions come from a different order of subjective operations that are not limited to logical reasoning. For Scarantino (2021), emotions score low in terms of rationality and fail when rooted in both theoretical approaches and common sense: an adequate appreciation of emotions in terms of rationality requires a series of distinctions.

Research dedicated to emotions cannot disregard the human symbolization process. It comprises a subjective organization that is not of the order of visual perception but results from the fact that the subject is the object of the other's gaze (Le Gaufey, 1998, p. 75). The study of emotions, therefore, considers a relationship that comes from outside, from human or artificial support (Roudinesco, 1998, p. 371). In the process of symbolization there is an identification of the subject linked to the field of the Other (Lacan, 1964b, p. 253), the effect of which results in a unity (something external joins something internal under symbols) that is given externally. The subject experiences an invisible cohesion through something visible, better said, the subject experiences a contour, a circumscription (Ildefonse, 2012). This description of psychology and psychoanalysis for the symbolic process carried out through language (understood as a dynamic process) directs our attention to the value of emotion, which cannot be understood as being solely logical.

3.4 Language, cognition and subject: the seat of emotions is the brain

Scarantino (2021) clarifies that although the physical seat of emotions is the brain, there is no way to match neural circuits to individual types of emotion. The author states that the brain is embodied and inserted into environments that are essential for it to implement symbols of different types of emotions. He (Scarantino, 2021) adds that emotions such as anger, fear and shame vary in terms of behavioral and physiological expression characteristics, as well as duration and intensity, making it difficult to measure distinctive behavioral patterns of emotions.

The difficulty of pointing out empirical evidence to classify basic emotions, and the difficulty of articulating emotions to assessments of contextual meaning can serve as a warning to researchers on the topic. The complexity in approaching emotions in terms of information processing leads to the attempt to approach the topic of emotion from the perspective of the foundations of cognition. Cognition is dynamic and occurs in only one way and not another: it articulates logical features with contextual (axiomatic) features (Monte-Serrat and Cattani, 2021; Monte-Serrat, 2022). Exploring emotions at the fundamental level of the cognitive linguistic process brings advantages and insights that prevent the researcher from deviating from the focus of their research, which becomes even more complex when encompassing the area of ​​artificial intelligence, AI. To explore emotions, we suggest adopting the bases of the cognitive process described by Monte-Serrat and Cattani (2021), which are the same, both in humans and machines, since the universal structure of language is axiomatic-logical.

Emotion refers to value and, according to Gernet (2002, p. 121-122), the notion of value is “abstract par excellence”, presupposing the valorization of classical faculties such as: attitudes, mental and bodily aspects. Gernet (2002, p. 127) assumes that in the different areas of value “we can recognize an 'intention'” which in turn presupposes a process of idealization. The linguistic use of the word “implies the notion of value [which] can relate to all kinds of ‘objects – even, occasionally, to human beings as “precious”’ (Gernet, 2002, p. 127).

Considering that the foundations of the cognitive linguistic process mix logical reasoning and experience in relation to a contextual reality, when studying emotions, it is necessary to appreciate them according to 'values'. According to Gernet (2002, p. 121-122) the notion of value is “abstract par excellence” and presupposes the valorization of classical faculties such as: attitudes, mental and bodily. So, the appreciation of emotions through mental or bodily attitudes occurs in the final stretch of the cognitive linguistic process - which begins by collecting stimuli from the outside to transport them to the central nervous system and, at the end, organizing them in a logical way which will trigger decision-making or not (Perlovsky, 2007). Given the different areas of value collected by the dynamics of the cognitive linguistic process, there may be the recognition or identification of an 'intention', which, in the structure of the cognitive linguistic process presupposes a process of idealization (Gernet, 2002, p. 127).

We may consider that if the linguistic use of the word (spoken or written discourse) “implies the notion of value [the word] can relate to all kinds of 'objects – even, occasionally, to human beings as 'precious'' (Gernet, 2002, p. 127). Thus, even on the surface of language (linguistic use of the word or written or spoken speech), when it is detected that an intention to relate something as 'precious' (decision making) was constituted, it can be inferred that, in the foundations of language (cognitive linguistic process), the axiomatic trait (relating to the subjective experience of contextual reality) goes through a process of idealization/representation, that is, it becomes logically organized as an action or intention to classify something as 'precious'. What we intend to clarify at this point is that, when an emotion stops being “abstract par excellence” and becomes “intention”, the emotion under study becomes easier to identify and categorize.

3.5 Predictability and measurability of the subject through emotion

Intelligent systems can, on the one hand, work with previously categorized emotions, arising from a static (categorized) context, while, on the other hand, the systems can process information collected from a dynamic contextual reality (Monte-Serrat, 2021). In this section, the general and contemporary aspects of the status of subjectivity are articulated with the social and technical dimensions of discourse. If discourse is understood as effects of meaning between interlocutors in a socio-historical context (Pêcheux, 1975), we recognize the importance of studying emotions from a discursive perspective, since subjectivity depends on the dynamics of the cognitive linguistic process (as explained in sections previous ones) and is not something previously given. Subjectivity (and, consequently, the emotions that arise from it) is constituted in enunciation (Elia, 2004).

Articulating subjectivity and discourse leads us to the theory of Discourse Analysis (Pêcheux, 1975) which points to two possibilities for categorizing subjectivity: i) discourse (effects of meaning between interlocutors) can be something idealized (disconnected from contextual reality) interfering equally in the constitution of the individual's subjectivity (subjectivity considered to be disconnected from contextual reality); ii) discourse (meaning effects between interlocutors) is linked to the dynamic context of reality, reflecting this dynamic in the dynamic constitution of subjectivity. The first category of subjectivity (which is constituted from idealized discourse, that is, disconnected from reality) is predictable and measurable, as the ideology is previously placed so that the subject is constituted in accordance with it (Monte-Serrat, 2012; Pêcheux, 1975; Althusser, 2010). On the other hand, the subjectivity that is constituted from contextual dynamics is unpredictable and, for this reason, difficult to measure.

Sherry Tukle's (1984) ideas about the influence of technology on identity help us draw some conclusions about emotions under interactions with artificial intelligence. Subjectivity in contemporary times and identity issues are objects of scientific interest to enrich studies on emotion. Monte-Serrat's doctoral thesis (2012) explains the implications of materialism and ideology in the constitution of subjectivity (subjectivity that comes from idealized discourse versus subjectivity that comes from discourse based on contextual reality). These categories of subjectivity are due to the subject not as something previously given, but as constituted in the enunciation, that is, in the discursive and symbolic scope (Lacan 1949; Pêcheux, 1988), related to the discursive linguistic process.

The theory of Discourse Analysis (Pêcheux, 1988) discerns ideological effects (such as the transparency of language, the universality of meanings, categorizations of meanings and emotions), as ways of discriminating between what is individual and universalizing or generalizing subjectivity through fluid discourses that give a liquid aspect to modernization (Bauman, 2000; Lee, 2005). Intelligent systems provide instantaneity and a collective memory, constructing the image (subjectivity) as something that goes beyond the experience lived by the subject.

Artificial intelligence presents individuals with knowledge that is not obtained through the subjects' direct perception (visually or by experiencing reality) (Lacan 1966, apud Monte-Serrat and Tfouni, 2010, pp. 57-58). The 'knowledge' offered by AI to the user is distant from the contextual reality experienced by the individual and the latter's decisions and emotions, therefore, are rooted in the information previously offered by AI. The users interacting with the AI ​​support their emotions and decisions not from a knowledge of a reality experienced by the individuals themselves (Monte-Serrat and Cattani, 2023), but from a reality idealized and generalized given by the AI ​​tool.

Predictability and measurability of subjectivity/emotion through artificial intelligence, AI, has made use of (frozen/generic) categories of emotions. The optimization of AI tools in the assessment of emotions will be achieved when intelligent systems are able to consider that the subject is not something previously given (frozen or idealized category), but the subject (along with his emotions) is an effect of the discourse between interlocutors. In this way, there is a 'rupture' in the conception of subjectivity, as either it is seen as something idealized in categories, or it is seen as something that depends on the dynamics of the cognitive linguistic process.

This rupture in the conception of subjectivity for application in AI tools has an important effect on the discursive dimension. Through Machine Learning tools, systems assimilate data (frozen, ideally categorized) instead of assimilating the individual's emotional reactions in relation to their environment. From the perspective of the individual as a user of an AI tool, they will have their subjectivity/emotion or reaction influenced by a tool that offers 'automatic' knowledge (processed by the machine) of a given reality. The subject's decision-making, when reacting to knowledge idealized by the machine, can lead to worrying consequences, such as unethical, antisocial decision-making or can even lead the individual to the decision to eliminate their own life.

Another effect of the rupture in the conception of subjectivity for application in AI tools is related to the diversity of AI hallucinations. According to Mohit Sewak (2024), AI has no imagination but presents probabilistic errors that interfere with the cognition of the user who interacts with it. Intelligent systems disseminate information that is not based on received information or the real world, which is equivalent to human invention or imagination, which can generate disastrous human reactions such as depression, suicide, committing crimes, unethical attitudes and so on. Sewak (2024) lists some AI hallucinations: ignoring or contradicting data provided by the user, for example, memory failure or denial of basic facts; distorting input data; presenting a lack of fidelity to the source, adding facts; inventing facts or events out of thin air; and generating false information.

3.6 Artificial Intelligence in Psychology in a constituent structure of real-valued functions: language, subject and body

Considering the search for a structure of real-valued functions that brings consistency of human cognition to intelligent systems and corrects hallucinations (which cannot be confused with bugs to be fixed), we propose the understanding that language, subject and body are connected through the cognitive linguistic process (which has two fronts: the logical front and the axiomatic/contextual front) (Monte-Serrat and Cattani, 2021). The formation of subjectivity, emotions and decision-making has deep causes laid down in the foundations of language and cognition. It is from this structure of the cognitive linguistic process that we can build ethical and consistent intelligent systems. Although unraveling hallucinations is a complex task, we suggest discarding the surface complexities of language and cognition to consider a basic and simple path to improving technology - the path revealed by the fundamental and universal structure of the cognitive linguistic process with its logical and axiomatic fronts - redefining the capabilities of AI and its impact on users' lives.

We seek to change the paradigm to reflect on the design of intelligent systems under the conception that language and cognition are a dynamic process and this needs to be present in the core algorithm of AI. It's about rethinking the conditions under which AI is designed and what can be achieved with this different approach. We suggest that the legitimization of the use of the dynamics of the cognitive linguistic process in AI comes from the structural relationship that its two fronts (axiomatic and logical) guarantee the consistency of human cognition and decision-making. How to describe this universal structure in the algorithmic core so that intelligent systems are successful in avoiding bugs and hallucinations?

Sadegh-Zadeh et al (2024) suggest neural remodeling and investigation of plasticity of artificial neural networks with a focus on learning processes by examining regression and classification problems to improve performance through iterative learning and optimization. Monte-Serrat and Cattani (2024) describe some research related to the integration of physical and cybernetic systems aimed at introducing new functionalities to modify the configuration of autonomous driving vehicles, since it has been observed that the vehicle's driving behavior is subject to respond differently than the driver expects, causing accidents. The authors argue that knowledge of the structure of the cognitive linguistic process dispels uncertainties in the black box of new technologies, enabling coherence in decision-making carried out by cognitive computing.

Khan and Ishrat (2024), when describing challenges and suggesting solutions in Embodied Artificial Intelligence, explain that this type of AI interacts with the environment, as it results from the conversion of advanced computing with physical robotics. The authors state that Embodied AI differs from traditional AI, which focuses on autonomous tasks. Monte-Serrat and Cattani (2024), and Khan and Ishrat (2024) agree that the challenges of embodied AI lie in the integration of sensors into real-time data processing, highlighting that decision-making arising from the use of AI entails concerns regarding the safety and ethics.

Shiv interviewed by Abrahams (Shiv and Abrahams, 2020) states that the emotional brain depends on the individual's mindset, which can tend towards risk-adverse behaviors or risk-tolerant behaviors. Shiv assures that emotion and motivation shape the formation of decisions, that is, our decisions, our behaviors are unconsciously shaped by the emotional system of the brain, and this is the fundamental premise of neuroscience and communication. This perspective is important because it corroborates the idea that reason is not enough for decision-making but depends on other elements arising from the environment. The way the brain (cognitive linguistic process) works is linked to instinctive brain systems, shaping decisions in the end.

Intelligent systems are not restricted to performing repetitive tasks, as they are equipped with logical reasoning and decision-making capacity. In this case, their algorithms rely on predefined rules that represent reality to unite thought, perception and action so that they perform tasks or make decisions autonomously. This intelligence is something limited and specific for certain tasks, which cannot be confused with human consciousness, which involves language, subjectivity and the body. Consciousness is the state of being aware, especially of something within oneself or of an external object, state or fact. Conscious AI must consider an ethical and socially responsible approach because of its potential to transform the lives and decisions of individual users of intelligent systems (Monte-Serrat and Cattani, 2023). What was once treated as a black box can now be understood considering the cognitive linguistic process, whose structure is universal, permeating humans and machines.

These conjectures lead us to conclude that real-valued functions are not found in the logical feature of the cognitive linguistic process, but are found in the axiomatic feature, which is linked to the environment (Monte-Serrat, 2021; Monte-Serrat and Cattani, 2024). Palacios (2024) writes about "Intertheory Relations in Physics" to show that the idea of ​​science that establishes a logical structure to reduce studied phenomena has not been sufficient and shows the need to use infinite limits to explain symmetry-breaking phenomena. The author argues that the subsumption of models to the field of experience correlates these models to structures that satisfy fundamental laws, encompassing the field of experience. She also argues that reductions in physics normally have a “local” character, that is, of models of a single system. The author suggests that there is a structural relationship between theories to be compared, but also between empirical facts on which theories can describe real systems. Mental states captured from physical states are represented differently in finite systems. This conception is in line with the conception that there may be an alternative position regarding the logical reduction of mental states. Nowadays, quantum mechanics is being applied to intelligent systems under the thesis that everything is, ultimately, made up of the same fundamental physical entities.

3.7 Linguistic cognitive process as a dynamical system

Human language is linked to the human cognitive linguistic system, which is equipped with subsystems that carry stimuli to the central nervous system (Copstead and Banasik, 2013; Monte-Serrat and Cattani, 2021). Conway (2020) discusses the learning that occurs with visual-motor patterns; auditory language-like material; non-linguistic auditory input, such as tones or musical timbre sequences; letter sequences; visual forms; and tactile input. As a dynamic system, the cognitive linguistic process undergoes changes over time. The stimulus captured by the subsystem (tactile, gustatory, auditory, visual), upon reaching the central nervous system, is organized rationally so that it becomes something intelligible. Considering that reality is not governed only by deterministic laws, at a quantum level the laws of physics are also considered probabilistic in relation to a given instant in time. Conway (2020) speculates how the brain learns environmental structure and suggests fundamental principles for understanding neurocognitive mechanisms. The author reviews research on this subject, showing two sets of associated neurocognitive mechanisms that underlie learning, one consisting of perceptual plasticity of the stimuli encountered and the other dependent on attention that integrates global patterns over time.

Understood as a dynamic system, the cognitive linguistic process allows credit for the possibility that the real value matrix can be represented by multiscale models. According to Palacios (2024), scientific modeling that requires the appeal to characteristics and properties of different mesoscale levels, admits that the world is divided into distinct levels (microscopic and macroscopic), and that the higher level (phenomenological) can be derived from the next lower level (microscopic). Palacios states that multiscale models are useful in modeling interdisciplinary systems.

Other possibilities focus on the real-valued functions of intelligent systems optimized according to quantum theory. Quantum physics has its foundations in the study of energy at the most fundamental level (electrons and photons) that acts on all scales. Extremely small objects, according to physics, can simultaneously present characteristics of waves and particles (wave-particle duality). Quantum physics is intended to explain the reactions between particles, as well as the forces with which these particles interact. Once accepted that language, subject and body are connected through the cognitive linguistic process, and that subjectivity/consciousness, emotions and decision-making have their origin in the foundations of language and cognition, we discuss the question posed by Ferrie (2024) on whether quantum physics provides consciousness. As we explained in the Section on "Emotions and the role of symbolic mediation through language", subjectivity, consciousness and symbolic representation are essentially human. This does not prevent a new science of consciousness for AI from being developed to imitate human consciousness, even if it only superficially imitates the interaction between the two fronts of the cognitive linguistic process: the logical feature with the axiomatic (environment) feature.

3.8 Conclusion

In this Chapter we exposed the universal structure of language according to the fundamental theory of neurolinguistics, showing that the human brain dynamics to form knowledge and lead to decision making are structurally the same as those of intelligent systems. We also show that Artificial Intelligence in Psychology which works with categories of emotions can incur errors in its predictions, since human emotions depend not only on logical categorization, but also on value operations linked to the context of the individual's reality. The complexity of emotions is approached in the light of Psychology, Linguistics and Psychoanalysis, clarifying that emotions are subjective and that the subject and body must be considered by Artificial Psychology. In this case, we propose an approach to language/cognition as a dynamic system with two fronts, one logical and the other axiomatic/contextual. The first consists of the logical organization of stimuli so that they can be understood. The second is linked to functions with values ​​captured from the environment. This conception of the 'core' of intelligence, whether human or machine, is intended to assist in the design and use of intelligent Artificial Psychology systems, making both developers and users aware that there may be interference in cognition, decision-making and emotions (addiction, emotional involvement, depression), which entails the primordial need to rethink Artificial Psychology considering ethical principles.

The application of Artificial Intelligence in Psychology to intelligent systems will probably increase user addiction and dependence on interacting with practically magical tools. The reason for the intensification of this user dependence on AI stems from the phenomenon that the user 'feels seen'. The algorithm trained to make suggestions according to the user's tastes awakens an enchantment in the individual and an obsession that ends up driving their choices and decision-making.

However perfected and like humans, both in decision-making and in the expression of emotions, intelligent systems must be framed in the warning that Nzongo (2024) makes: Although technology is a primary element in many social issues, its factors cannot take precedence over AI's impacts on social, ethical and political issues. Recommender systems change the user's choices and decisions, which can lead them to become addicted to artificial intelligence technology, preventing them from interacting socially. This example given by Nzongo (2024) shows that intelligent tools cannot be developed only according to stakeholders' preferences, but rather according to what users want and need. Monte-Serrat and Cattani (2023) show that designers are those who translate human needs into the core of the intelligent system that, subsequently, will interfere with users' emotions and decision-making. What would the future of society be like if Artificial Psychology was not aligned with ethical principles? Chaos.

REFERENCES

Althusser, L. (2010). Ideology and ideological state apparatuses (notes towards an investigation) (1970). *Cultural theory: an Anthology*, 204-222.

Araujo, I. (2004). Do signo ao discurso. *Introdução à filosofia da linguagem*. São Paulo: Parábola Editorial.

Bauman, Z. (2000). *Liquid Modernity*,Cambridge: Polity.

Conway, CM (2020). How does the brain learn environmental structure? Ten core principles for understanding the neurocognitive mechanisms of statistical learning. In Neurosci Biobehav. doi: 10.1016/j.neubiorev.2020.01.032

Copstead, LE; Banasik, J.,2013. Pathophysiology, 5 Ed., Elsevier Inc.

Edelman, B. (1980). *La Practica Ideologica del Derecho*, Madrid: Editorial Tecnos, 1980.

Elia, L. (2004). *O conceito de sujeito*. Rio de Janeiro: Jorge Zahar, 2004.

Elman, J. Language as a dynamical system (1995). In *Mind as motion*: explorations in the dynamic’s cognition. Robert Port and Timothy van Gelder Editors, Massachusetts Institute of Technology. Access on 6th October, 2024. Retrieved from [https://books.google.com.br/books?hl=pt-BR&lr=&id=e6HUM6V8QbQC&oi=fnd&pg=PA195&dq=language+as+a+dynamical+system&ots=S3U8yARtXk&sig=KjJEqgGCGne3\_4jCjhmEDkjQr\_I#v=onepage&q=language%20as%20a%20dynamical%20system&f=false](https://books.google.com.br/books?hl=pt-BR&lr=&id=e6HUM6V8QbQC&oi=fnd&pg=PA195&dq=language+as+a+dynamical+system&ots=S3U8yARtXk&sig=KjJEqgGCGne3_4jCjhmEDkjQr_I)

Ferrie, C. (2024). Does Quantum Physics gives us consciousness ? In Medium, Sep 29, 2024. Accessed on 27 January 2025. Retrieved from https://csferrie.medium.com/does-quantum-physics-give-us-consciousness-08a2ab965495

Ildefonse, F. (2012). L’*agalma* et le dieu. Retour sur le dossier platonicien. *Colloque International Agalma ou les figurations de l’invisible*. Approches comparées. Coordinatrice Professeur Cléo Marcello Carastro, Maître de conférences à l’EHESS, INHA, Paris, 13 et 14 février 2012.

Kelso, J.; Mandell, M.; Shlesinger, M. (1988). *Dynamics Patterns: the self-organization of brain and behavior*. Singapore: World Scientific.

Khan, W., Ishrat, M. (2024). Embracing the Future: Navigating the Challenges and Solutions in Embodied Artificial Intelligence. In: Raj, P., Rocha, A., Singh, S.P., Dutta, P.K., Sundara Vadivazhagan, B. (eds) Building Embodied AI Systems: The Agents, the Architecture Principles, Challenges, and Application Domains. Information Systems Engineering and Management, vol 14. Springer, Cham. https://doi.org/10.1007/978-3-031-68256-8\_13

Lacan, J., 1949. Le stade du miroir comme formateur de la fonction du Je telle qu’elle nous est révélée dans l'expérience psychanalytique. *In* Revue Française de Psychanalyse, Presses Universitaires de France, France, Octobre 1949, 449-455.

Lacan, J. (1964) O sujeito e o outro (I): A alienação. In LACAN, J., *O seminário – livro 11 – Os quatro conceitos fundamentais da psicanálise*, Rio de Janeiro: Jorge Zahar, 1998.

Lacan, J, 1966. Propos sur la causalité psyche. *In* Écrits. Tome I. Paris: Le Seuil.

Lagazzy, S. (1988). *O desafio de dizer não*. Campinas: Pontes.

Lee, R. (2005). Bauman, liquid modernity and dilemmas of development. In *Thesis Eleven*, Number 83, November 2005: 61–77 SAGE Publications, London, Thousand Oaks, CA and New Delhi. Publications and Thesis Eleven.

Le Gaufey, G. (1998). *El lazo especular. Un estudio traversero de la unidad imaginaria*, trad Graciela Leguizamón, Argentina: Edelp SA.

Miaille, M. (1979). *Uma Introdução Crítica ao Direito*, trad. Ana Prata, Lisboa: Moraes Editores.

Monte-Serrat, D.; Tfouni, L. (2010). A dimensão política do sujeito na cadeia discursiva. L&S Cadernos de Linguagem e Sociedade, v. 32. DOI https://periodicos.unb.br/index.php/les/article/view/10470/9225

Monte-Serrat, D. (2012). *Literacy and legal discourse*. PhD Thesis. University of São Paulo, Brazil. Accessed 24 January, 2025. Retrieved from https://doi.org/10.11606/T.59.2013.tde-14032013-104350

Monte-Serrat, D.; Belgacem, F.B. (2017). Subject and Time Movement in Virtual Reality. In *International Journal of Research & Methodology in Social Science* Vol. 3, No. 3, p.19 (Jul. – Sep. 2017) www.socialsciencepublication.com. Accessed on 6 October 2024. Retrieved from <https://zenodo.org/record/1322579#.W_qxf3pKglK>

Monte-Serrat, D.; Belgacem, F.; Maldonato, M. (2017). Decision making: The complexity of choice processes. *International Journal of Research & Methodology in Social Science*, *3*(4), 22-30.

Monte-Serrat, D. (2021). Operating language value structures in intelligent systems. Advanced Mathematical Models & Applications, 6(1). Accessed 28 January 2025. Retrieved from http://jomardpublishing.com/UploadFiles/Files/journals/AMMAV1N1/v6n1/Monte-Serrat.pdf

Monte-Serrat, D; Cattani, C (2021). *The natural language for artificial intelligence*. Elsevier – Academic Press, 233 p.

Monte-Serrat, D.; Cattani, C. (2022). Applicability of emotion to intelligent systems. *Information Sciences Letters; Natural Sciences Publishing: New York, NY, USA*, *11*, 1121-1129.

Monte-Serrat, D.; Cattani, C. (2023). Towards ethical AI: Mathematics influences human behavior. *Journal of Humanistic Mathematics*, *13*(2), 469-493.

Monte-Serrat, D. M.; Cattani, C. (2024). Unraveling What is at Stake in the Intelligence of Autonomous Cars. In *Machine Learning for Cyber Physical System: Advances and Challenges* (pp. 195-217). Cham: Springer Nature Switzerland.

Nzongo, F. (2024). AI needs design consciousness. My thoughts on ethics and human-centric design in AI advancements. Published in UX Collective, Mar 18, 2024. Medium. Accessed 26 January 2025. Retrieved from https://uxdesign.cc/ai-needs-design-consciousness-1ee50288a957

Palacios, P. (2024). Intertheory Relations in Physics. In Edward N. Zalta & Uri Nodelman (eds.) The Stanford Encyclopedia of Philosophy, Spring 2024 Edition). Accessed 26 January 2024. Retrieved from <https://plato.stanford.edu/archives/spr2024/entries/physics-interrelate/>.

Pêcheux, M. (1975). *Les verités de La Palice*. Linguistique, sémantique, philosophie (Thèorie), 280p. Paris: Maspero.

Roudinesco, E. (1998). *Dicionário de psicanálise*, trad. Vera Ribeiro, Rio de Janeiro: Jorge

Zahar.

Sadegh-Zadeh, S. A., Bahrami, M., Soleimani, O., & Ahmadi, S. (2024). Neural reshaping: the plasticity of the human brain and artificial intelligence in the learning process. *American Journal of Neurodegenerative Disease*, *13*(5), 34.

Scarantino, A.; Sousa, R. (2021). Emotion, *The Stanford Encyclopedia of Philosophy*(Summer 2021 Edition), Edward N. Zalta (ed.). Access October 2024. Retrieved from <https://plato.stanford.edu/archives/sum2021/entries/emotion/>

Sewak, M (2024). Unmasking the Surprising Diversity of AI Hallucinations. In Medium, 10 December 2024. Accessed on 26 January 2025. Retrieved from <https://levelup.gitconnected.com/types-of-ai-hallucinations-e733e7b208ac>

Shiv, B; Abrahams, M (2020). Feelings First: How Emotion Shapes Our Communication, Decisions, and Experiences. In Insights by Stanford Business, Think Fast, Talk Smart: The Podcast. A production of Stanford Graduate School of Business. November 20, 2020. Access on 26 January 2025. Retrieved from https://www.gsb.stanford.edu/insights/feelings-first-how-emotion-shapes-communication-decisions-experiences

Thelen, E., Dynamical Approaches to the Development of Behavior (1988). In Kelso, JA;

Mandell, MF; Shlesinger, MF, *Dynamic Patterns in Complex Systems*(pp. 348-369),

Singapore: World Scientific, 1988

Turkle, S., *The second self*: Computers and the human spirit. Cambridge, Mass: MIT Press, 1984.