COMMUNICATION & SOCIETY

Special

Start making sense. Sociosemiotic contributions to the understanding of Generative Artificial Intelligences

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Submitted
May 8th, 2024
Approved
September 4th, 2024

Communication & Society
ISSN 0214-0039
E ISSN 2386-7876
www.communication-society.com

2024 – Vol. 37(4)
pp. 293-308

How to cite this article:
Scolari, C. A. (2024). Start making sense. Sociosemiotic contributions to the understanding of Generative Artificial Intelligences, *Communication & Society, 37*(4), 293-308.
https://doi.org/10.15581/003.37.4.293-308

Abstract

The article delves into the symbiotic relationship between sociosemiotics and AI research, specifically focusing on Generative Artificial Intelligences (GenAI). As GenAI gain traction in verbal and iconic creation, in the context of various cultural and communication theories, sociosemiotics emerges as a key framework for understanding these processes. The article addresses questions such as: How have the relationships between AI research and sociosemiotics evolved? How can sociosemiotics contribute to the understanding of GenAI? If Umberto Eco (1986) distinguished between general semiotics and specific (or applied) semiotics, what would be the main characteristics of a semiotics of Generative AI? In this context, the article's objectives encompass three dimensions: 1) Tracing the intertwined evolution of sociosemiotics and AI research over 75 years, spotlighting the textual and sociosemiotics contributions; 2) Proposing a series of possible sociosemiotic interventions in the realm of GenAI; and 3) Reflecting on the emergence of an applied semiotics of GenAI. Ultimately, the article encapsulates the intricate interplay between sociosemiotics and GenAI, paving the way for novel insights into AI's semiotic foundations and its multifaceted implications in contemporary digital creation.

Keywords
Artificial intelligences, semiotics, generative artificial intelligences, sociosemiotics, communication.

1. Introduction: Between AI and semiotics

In the second half of the 20th century research on Artificial Intelligences (AI)[1] went through different phases and paradigms, an evolution characterized by a series of 'winters' and 'summers'[2]. The initial phase of AI, known as the first AI summer or the golden years, emerged shortly after AI's inception, fuelled by optimism in problem-solving and reasoning. The symbolic AI paradigm dominated until the 1980s when sub-symbolic AI gained prominence, and which now continues to garner attention (Mitchell, 2019). The current and third AI summer expresses a combination of symbolic and sub-symbolic paradigms known as "*in-between* methods" (Ilkou & Koutraki, 2020, p. 1).

Research on AI has always been multidisciplinary, with philosophy, engineering, mathematics, cognitive science, and psychology all playing crucial roles in its evolution (Forbus, 2009; Luger, 2023). Luger (2023) underscores the influence of language philosophers like Ludwig Wittgenstein, Rudolf Carnap, and Alfred Tarski, alongside contributions from cognitive psychologists, linguists such as Noam Chomsky, and pragmatic philosophers like Charles S. Peirce. Notably, while these figures are closely tied to the semiotic tradition, Luger does not explicitly mention semiotics itself. This article aims to rectify this omission by exploring the intricate connections between semiotics and AI research.

Semiotics also went through different transitions. For many years, it was identified as the "science of signs within social life," a definition rooted in Ferdinand de Saussure's semiological proposal, originally published in 1916 (Saussure, 2011). However, in recent decades the field has extensively drifted towards a textual-based discipline that studies the processes of meaning production and interpretation. This vision, less focused on the micro dimension of the sign and more open to the textual sense making dynamics, has marked the development of a consistent part of semiotic research in the second half of the 20th century.

Even if "AI is an ever-broadening field that has implications for semiotic theories," Walsh Matthews and Danesi (2019) considered that "as far as can be determined, it has hardly attracted the broad attention of semioticians in any significant way" (p. 199). These authors consider that, apart from the cybersemiotic movement (Brier, 2007; Vidales & Brier, 2021), until now semioticians' interest in AI has been marginal and limited to specific interventions. However, it may be useful to recover those works that are almost marginal with respect to mainstream AI research. Beyond cybersemiotics, a transdisciplinary field that examines the relationship between information, cognition, and communication in living and non-living systems, researchers like Dmitry Pospelov and Eugene Pendergraft made systematic contributions in the 1970s in computational semiotics (Meunier, 2022), a field that proposed "a new kind of approach to intelligent control and intelligent systems, where an explicit account for the notion of sign is prominent" (Gudwin & Queiroz, 2005, p. 397). The early interest of semiotics in AI was also demonstrated by the publication in 1989 of a special issue of *Semiotica* dedicated to the subject, edited by Marcel Danesi.

This article describes and reflects on the relationships of semiotics and AI research, with a special focus on the contributions of sociosemiotics. As there are thousands of AI applications operating in different fields, this text will only focus on Generative Artificial Intelligences (GenAI), a type of technology that can create various forms of content like text (ChatGPT, Gemini, etc.), imagery (DALL-E 2, Midjourney, etc.), audio (JukeBox, MuseNet, etc.), or video (Sora, Synthesia, etc.). Why focus on GenAI? Because it closely aligns with the semiotic traditions of

[1] Considering the variety of applications, methods and paradigms, throughout the article the use of the term "AI" should be understood in the plural ("Artificial Intelligences").

[2] In the context of AI history, 'summers' refer to periods of heightened optimism, increased funding, and significant advancements in AI research, driven by breakthroughs and the promise of transformative applications. Conversely, 'winters' denote phases of disillusionment, marked by reduced funding, stalled progress, and scepticism about the feasibility of AI's ambitious goals, often triggered by unmet expectations and technical challenges (Mitchell, 2019).

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researching textual and narrative objects and plays a fundamental role in the new digital practices of media content creation. At a time when GenAI are becoming more and more popular as powerful verbal or iconic creation instruments, semiotics positions itself as one of the most thought-provoking interlocutors for understanding these processes.

In this context, the objectives of the article are:

- To briefly map the parallel evolution and crossroads between semiotics and AI research in the last 75 years, paying particular attention to the contributions of textual and sociosemiotics.
- To propose a series of possible sociosemiotic interventions in the field of GenAI.
- To reflect on the possible constitution of a specific (or applied) semiotics of GenAI.

The first section reconstructs how AI research evolved from the end of World War II to the present day, and the second section deals with the parallel evolution of semiotics. In this case, the description emphasizes the transition from a sign-centred to a text-centred semiotics, and from there to sociosemiotics. If section three focuses on the intersections between semiotics and AI research, section four proposes a series of possible interventions of sociosemiotics on GenAI mainly based on categories already tested in the analysis of media contents. The article concludes with a final reflection on the possible constitution of an applied semiotics of GenAI, understood as an emerging research field based on a long tradition of exchanges between semiotics, narratology, cognitive sciences, information theory and cybernetics.

2. AI evolution

AI have undergone a remarkable journey since their inception in the 1950s. This field has evolved through distinct phases, each marked by paradigm shifts, notable researchers, and *both* achievements and frustrations, as well as new challenges. Since they are very well known, I will present just a snapshot of the main phases of AI evolution[3].

2.1. *The foundational years (1950s - 1960s)*

The first phase of AI research was characterized by boundless optimism and the belief that 'thinking machines' could be created. Symbolic AI, commonly known as Good Old-Fashioned AI, was the dominant paradigm. Researchers believed that intelligence could be emulated by manipulating symbols using rule-based systems.

During this phase, AI researchers achieved milestones like developing programs for solving mathematical theorems and playing chess. However, early optimism about achieving human-level AI proved overly ambitious, leading to practical limitations. Enthusiasm waned as the complexity of attaining human-like intelligence became apparent. Symbolic AI faced challenges in representing uncertainty and managing real-world ambiguity, contributing to a period of reduced funding and interest known as the (first) AI Winter.

2.1. *Knowledge-based systems (1970s - 1980s)*

The second phase saw a shift toward knowledge-based systems, also known as expert systems[4]. Symbolic AI continued to dominate, but research focused on capturing and representing human expert knowledge in specific domains using *if-then* rules and formal representations. Expert systems designed for medical diagnosis, demonstrated the potential of AI in decision-making tasks. However, knowledge acquisition proved laborious, leading to a bottleneck in scaling expert systems to larger domains. The rigidity of rule-based systems limited adaptability to new scenarios, prompting researchers to explore alternative approaches.

[3] This section is based on Crevier (1993); Buchanan (2005); Bibel (2014); Mitchell (2019); Haenlein and Kaplan (2019); Muthukrishnan *et al.* (2020); and Adami (2021).

[4] Expert systems caught the attention of early semioticians interested in AI. Meunier considered that these systems "are very close to the concrete practice of semiotic analysis of text" (Meunier, 1989, p. 55).

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2.3. *Between cognitive science and connectionism (1980s - 1990s)*

The third phase witnessed a shift toward cognitive modelling and connectionism based on the contributions of researchers from the fields of AI, psychology, linguistics, neuroscience, and philosophy. In this phase, connectionism, a sub-symbolic AI approach inspired by the structure and function of the brain's neural networks, gained prominence. Cognitive modelling and connectionism used artificial neural networks to process information, learn from data, and excel at complex pattern recognition tasks. However, the broader adoption of these models was limited by challenges like the 'black box problem' (lack of transparency) and the fact that connectionist models often required substantial amounts of data and computational resources. Nevertheless, this phase laid the foundation for the resurgence of neural networks in later years.

2.4. *The knowledge engineering crisis (Late 1980s - Early 2000s)*

The fourth phase was marked by challenges with traditional rule-based expert systems. Knowledge acquisition remained a bottleneck, hindering the scalability of expert systems to broader domains. Brittleness and a lack of adaptability in rule-based systems prompted a decline in funding and interest in AI research, leading to a second AI winter. Once again, the optimism about achieving human-level AI led to high expectations that were not met in practice. As a result, there was a sense of disappointment in the progress of AI research. In this context, AI researchers began to explore alternative approaches to overcome the limitations of rule-based systems, turning their attention to machine learning, neural networks, and other sub symbolic techniques that could learn from data and handle uncertainty. This phase highlighted the importance of developing approaches that could learn from data, which eventually led to the development of machine learning and deep learning techniques that have revolutionized AI in more recent years.

2.5. *Machine learning and Big Data (2000s - Present)*

The last phase of AI evolution has been characterized by a remarkable resurgence driven by advancements in big data treatment, machine learning and deep learning. In this phase, machine learning techniques gained significant traction due to the abundance of data and progress in computational power. Researchers leveraged large datasets to train sophisticated algorithms that could automatically learn patterns, relationships, and representations from the data. Deep learning, a subset of machine learning, emerged as the dominant approach, as deep neural networks with multiple layers performed exceptionally well in tasks such as image recognition, natural language processing, and speech recognition.

GenAI are a key component of the last phase of AI research. These systems learn to generate data that resemble real-world examples, leading to applications in art, content creation, and data synthesis. In the specific case of writing, models like OpenAI's GPT can generate human-like text and are being applied in natural language processing, chatbots, and creative writing. Despite remarkable progress, there are still some unsolved challenges, such as data privacy, accountability, transparency, and biases.

3. Making sense of AI

This section focuses on the transition from a sign-centred semiotics (or, following the French tradition, *semiology*) to a text-centred one, and from there to narrative-centred approaches and sociosemiotics.

3.1. *From sign to text*

By the end of the 1960s, semiology, understood as an extension of Ferdinand de Saussure's (2011) structuralist proposals for understanding non-linguistic systems (photography, cinema, dance, etc.), began to show its limits. Umberto Eco (1979) ignited the transition to a new interpretive theory based on a set of epistemological movements: from *code* to *encyclopaedia*, from *sign* to

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text, and from *decoding* to *interpretation*. These movements were not just semantic substitutions: going from codes to encyclopaedias means going from a 'flat' notion of sign –understood as a simple substitution of terms, like in a dictionary– to a new idea of sign based on the inferences and dialectics of semiosis. The distance from code to encyclopaedia breaks the message-sending lineal tradition that can be found in traditional linguistic, information or broadcasting theories (Scolari, 2004; 2009). These changes and conceptual shifts collectively marked the transition from semiology to semiotics

Thanks to Eco and other researchers, semiotics abandoned widely popular (yet restrictive) key concepts of communication theories such as message and effects. In the new framework, semiosis ceased to rely on signs alone and embraced sense production and interpretation strategies. This new conception allowed researchers to approach studying much broader and heterogeneous settings that, at first glance, did not even appear to be 'texts' (e.g., urban spaces or digital interfaces).

3.2. *Narrative algorithms*

In a parallel way to the interpretative semiotics of Umberto Eco (1979), the narrative or generative semiotics inspired by Algirdas Greimas (1987a) carried the postulates of formalism to their ultimate consequences. In the 1920s Vladimir Propp had identified the algorithm behind Russian folk tales, that is, the 31 functions that must always be present in this specific narrative genre. If an algorithm is a set of commands that must be followed to perform an operation, the next paragraph by Propp should sound familiar to GenAI practitioners:

> It is possible to artificially create new plots of an unlimited number [...]. If one then distributes functions according to the dramatis personae of the tale's supply or by following one's own taste, these schemes come alive and become tales [...] new tales will always appear merely as combinations or variations of older ones (Propp, 1968, pp. 111-112).

Since the 1960s, Greimas has expanded Propp's model to develop an analytical tool that can be applied to all kinds of situations and processes. Greimas completely assumed that algorithms are central in narrative analysis:

> In narrative semiotics, complex narrative programs, for example, can already undergo an algorithmic formulation. In similar fashion, we have proposed that any ordered sequence of operations permitting passage from the initial stage to the final stage of a closed narrative be considered as a transformational algorithm (Greimas & Courtés, 1982, p. 11).

This formal approach was later expanded to encompass the study of *passions*. According to Greimas, semiotics goes beyond reducing narrative to a mere sequence of actions; instead, it embraces the intertwining of passion and narrative. As actions transform, so do the subjects, and the passions of the subjects materialize within the narrative's programmatic dimension. Faithful to the structural approach, in the late 1980s Greimas worked on the formalization of human passions like anger, jealousy, hope and avarice understood as expanding syntagmatic narratives (Greimas, 1987a; Greimas & Fontanille, 1992). Given its potential contributions to understanding interactions between humans and AI, this semiotics of passions will be revisited in section 4.5.

It is important to note that both Greimas and Propp analyzed narratives without any connection to the emerging fields of AI or computer science at the time. However, despite –or perhaps because of– their limitations, such as their extreme formalism, Propp's functions and Greimas' narrative model offer a valuable set of categories that can be effectively applied to the analysis of Generative AI.

3.3. *Beyond the text*

Why should semiotics care about GenAI? In a first approach, it could be said that: 1) a text (written, iconic, audio-visual, etc.) is always a text, regardless of who or what created it; and 2)

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semiotics has often excluded the empirical or real author from its field of intervention to concentrate on the virtual figures that 'live' and face each other within the text (model author, model reader, enunciator, enunciatee, etc.) (Chandler, 2022). Whether from an interpretive (section 2.1) or generative (section 2.2) perspective, the empirical author of the text does not seem to be a research object for semioticians. As explained by Umberto Eco in different works, the creator of the text appears to be out of the semiotic game:

> My idea of textual interpretation as the discovery of a strategy intended to produce a model reader, conceived as the ideal counterpart of a model author (which appears only as a textual strategy), makes the notion of an empirical author's intention radically useless. We have to respect the text, not the author as person so-and-so (Eco, 1992, p. 66).

> I'll tell you at once that I couldn't really care less about the empirical author of a narrative text (or, indeed, of any text) (Eco, 1994a, p. 11).

The specificity of semiotic analysis lies in the textualization of the world. If it can be read as a text, any object, from a restaurant menu to a funeral, is worthy of semiotic attention. Given this situation, Greimas' famous statement "Outside the text, there is no salvation" (Greimas, 1987b) implied a strong textual-centred research programme. However, in recent years semioticians have explored different strategies to go beyond the limits of the text. Fontanille wrote that Greimas' statement is "a slogan that has had its day" (cit. by Marrone, 2010, p. 8). According to Fontanille,

> the semiotic practice itself has largely gone beyond the textual limits, taking an interest, for about twenty years now, in architecture, urban planning, the design of objects, market strategies, or even the tasting of a cigar or a wine and, more generally, in the construction of a semiotic of situations and also, today, of experience, starting from a problem of contagion, aesthetic adjustment, randomness (Fontanille cit. by Marrone, 2010, p. 9).

The expansion of semiotics beyond text does not imply a flight from semiosic processes, quite the contrary: the description of sense production and interpretation processes continues to be the main business of the discipline. In this context, not only can the texts generated by AI be approached from a semiotic perspective, the textual generation and interpretation processes themselves as well as the discursive construction of AI (the rhetorics of AI) are also in the radars of semioticians (section 4). For Marrone there is not a text on one side and the social context on the other,

> The two things have the same dual nature, and it is only the descriptive project of the alerted scholar that decides each time what is one and what the other, what is pertinent for the analysis (and it is text) and what is not (and it is context) (Marrone, 2010, p. 51).

After this digression on the limitations of textual analysis, we can return to the evolution of semiotic paradigms.

3.4. *Social semiosis*

Sociosemiotics or social semiotics is nourished and inspired by a vast spectrum of disciplines and analytical experiences, from semiotics, sociology, sociolinguistics and communication theory to cultural anthropology, Marxism, pragmatics, pragmaticism, constructionism and the linguistic turn (Cobley & Randviir, 2009). More than a radical change of paradigm, sociosemiotics proposes a confluence between the interpretive (section 2.1) and narrative (section 2.3) traditions and, at the same time, an expansion of its field of intervention (Verón, 1987; Marrone, 2001, 2010; Fernández, 2023). In this framework, the contributions of Eliseo Verón and his concept of social semiosis are particularly stimulating. Already in the early 1970s Verón proposed that employing the term discourse instead of the prevalent text or sign offered certain advantages. He argued that discourse has the benefit of "being more easily associated with the notion of a producer subject than the term text. It is always a situated message, produced by someone and addressed to someone" (Verón, 1974, p. 24). In the late 1970s, while Eco (1979) moved

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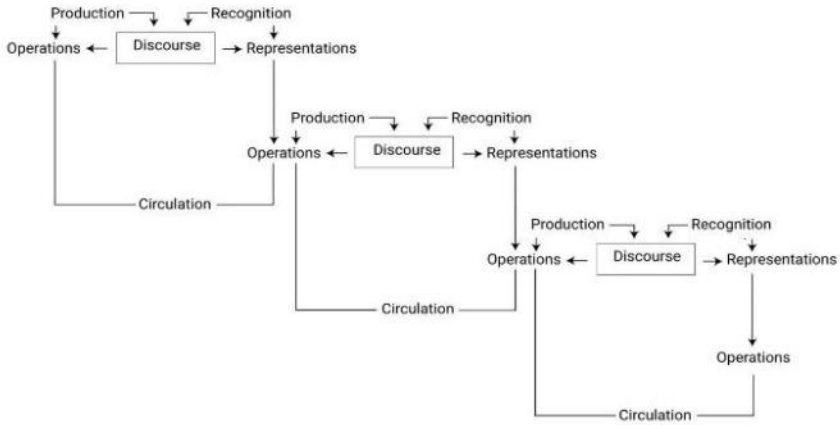
toward a model inspired by representational cognitive sciences, Verón began to go further down the path opened by a theory of social discourses and the related concept of social semiosis (Verón, 1987; Scolari, 2022).

To understand the relationships between the discourses and their conditions of production and recognition, researchers must consider their "rules of generation" ("grammars of production") and their "rules of reading" ("grammar of recognition") (Verón, 1987, p. 129). According to Verón,

> in the infinite network of semiosis, every *grammar of production* can be examined as a result of certain conditions of recognition; and a *grammar of recognition* can only be verified in the form of a certain production process: this is the form of the textual production network in history (Verón, 1987, p. 130).

During the production process, the enunciator –whether a politician, journalist, or even an AI– inevitably interprets existing texts and utilizes them as resources for subsequent production processes. As other texts are always part of the conditions of production of a text, the entire process of production of a text is, in fact, a "phenomenon of recognition." Likewise, a set of meaning effects, expressed as a recognition grammar, can only be manifested "in the form of one or more texts produced" (130). In Verón's view, the interpretation processes express themselves in the creation of new texts (Figure 1).

Figure 1. Verón's model of social semiosis.



Source: Verón, 1987.

The sequence production/recognition may lead readers to think that this is a linear process. Nothing could be further from Verón's vision, as he always thought in terms of networks, "from both the synchronous and diachronic point of view, social semiosis is an infinite significant network. In all its levels, it has an embedded structure" (p. 129). The interplay between production and recognition grammars settles the foundation of social discourses, giving rise to a vast grid known as the boundless network of *social semiosis*.

4. Crossroads

Now it is possible to reconstruct how semiotics, like cognitive sciences (Forbus, 2009), coevolved in a certain way and intersected with the theoretical developments in AI. For reasons of space, the reconstruction must be limited to certain key crossroads between the two fields (Figure 2). If post-war cybernetics was the grandmother of contemporary AI, it is worth remembering that a first crossing point took place when in the 1950s Roman Jakobson (1987) adopted Shannon and Weaver's (1949) model of information transmission for his functions of language. By adapting

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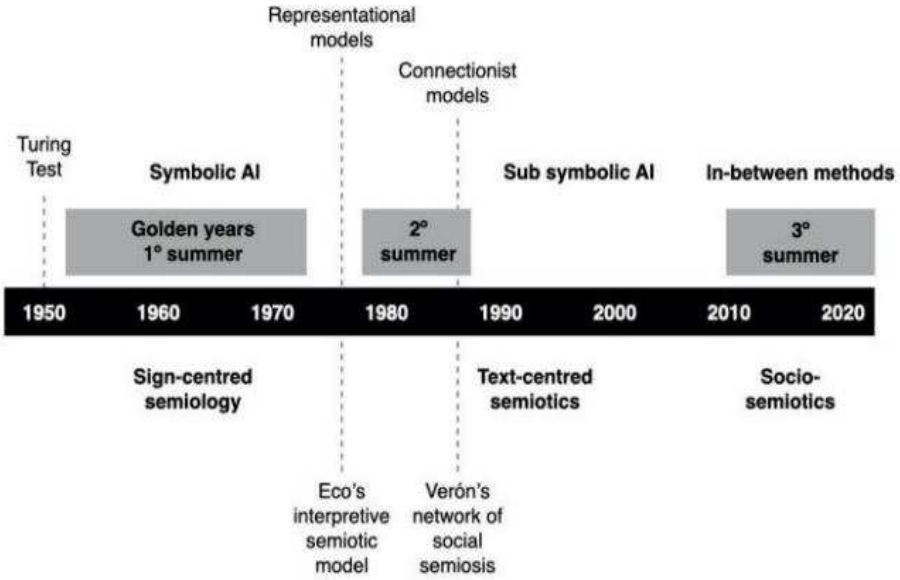
Shannon and Weaver's technical model to incorporate linguistic and social dimensions, Jakobson developed a more comprehensive framework for analysing human communication. His model emphasized that language serves multiple functions beyond mere information transmission, thereby enabling more nuanced analyses of communication in fields such as linguistics, literary theory, media studies, and semiotics. This interest in the Theory of Information led Jakobson to introduce the concept of *code* in linguistics. Eco's early works on the theory of codes and sign production were part of this first sign-centred approach (section 2.1).

As seen in section 1.2, the second phase of AI research opted for creating expert systems based on symbolic processing and the exploration of mental models as a possible paradigm for building intelligent machines (Mitchell, 2019). If Eco (1979) was one of the theorists who led the way from a semiology of the sign to a semiotics of the text, he was also responsible for introducing the representational models of cognitive sciences into semiotics. Eco's interpretive theory would be unthinkable without the contributions of symbolic AI researchers like Minsky (1974) and Schank and Abelson (1977). Eco's "sceneggiature" –understood as a set of pre-established, culturally shared knowledges or conventions that guide individuals' actions– descends directly from Minksy's "frames" and Schank and Abelson's "scripts." Eco took advantage of these theoretical contributions to go beyond the sign-centred semiology of the 1960s and build an interpretive theory based on the cooperation between text and reader.

Figure 2. The parallel evolution of semiotics and AI models.



Source: Own elaboration.

The interest of semioticians in AI did not stop growing. In 1989 *Semiotica* dedicated a special issue to the exchanges between semiotics and AI. In the presentation Pierre Quellet (1989) wrote that "AI is the new Pandora's box from which we can pull out all sorts of knowledge and beliefs, in the form of hard or soft facts, for discussion in almost every field. Semiotics is no exception" (1). In Quellet's view, semiotics could then make two types of contributions to the "AI turn" that was at the heart of computer sciences and neurosciences:

- Theoretical contributions: Exploring the syntax, semantics, and pragmatics of the artificial and natural 'language of thought' in machines or brains. This entails examining signs in symbolic representation systems, their interconnections, their ability to convey meaning by referencing the external world or internal representations (intentions, beliefs, knowledge), and their utilization by agents (human or mechanical) to accomplish goals or tasks (Quellet, 1989, p. 2).

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- Empirical contributions: Exploration of the human or mechanical 'mind' through specific formal models of semiotic behaviours, developed in various semiotic fields, from narratology to visual semiology, like discourse production, comprehension, story recognition, categorization, and practical reasoning (Quellet, 1989, p. 2).

It is highly suggestive to verify that, while AI research was moving towards connectionist models based on neural networks (third phase), semioticians such as Verón were exploring a reticular conception of semiosis ("social semiosis is an infinite significant network"). Could this be a sign of the times or the beginning of a new collaboration between semiotics and AI research in a post-symbolic context?

5. The semiotic functioning of GenAI

GenAI systems, leveraging Generative Adversarial Networks (GANs) and Large Language Models (LLM), employ advanced machine learning techniques to learn patterns from extensive datasets. These systems process significant volumes of labeled or unlabeled data during training. GANs have a generator network that creates data samples and a discriminator network that evaluates their authenticity. Through iterative refinement, the generator improves its ability to produce realistic data, while the discriminator enhances its capacity to distinguish real from fake, thus refining the generative AI model. Human-AI interaction commences with specific instructions or prompts guiding the system's response. The quality and clarity of these prompts profoundly influence the model's performance and response accuracy (Dall'Acqua & Bellentani, 2023). Crafting and refining high-quality, clear instructions for specific tasks or desired outcomes constitute prompt engineering.

How can sociosemiotics contribute to the understanding of GenAI? What follows is a first description of promising areas where sociosemiotics could improve the analysis of GenAI. If many of the generative processes carried out by AI are considered to be blackbox processes, then semiotics, a discipline created to dismantle the idea that sign systems, sense production and interpretation processes are transparent and neutral, has a lot to contribute.

5.1. *GenAI's production grammar*

For Verón (1987), the social semiosis is an "infinite significant network" that has "a structure of interlocks [...] to the extent that other texts are always part of the conditions of production of a text or of a given textual set." If every process of producing a text is, in fact, a phenomenon of recognition, conversely "a set of effects of sense, expressed as grammar of recognition, can only be manifested in the form of one or several produced texts" (p. 129). Ferraro (2023) proposed considering a grammar "not so much as rules but as a set of resources" (p. 75). Following a Greimasian perspective, he considered that creative operations are organized through hierarchical levels. The most superficial rules can only be understood as expansions of more general and fundamental principles found at a lower level. Seen from the opposite direction, all artists play with a limited set of basic principles (e.g., contrast, background/figure, colour, etc. in painting) that, as they move them to higher and more general levels, give rise to an almost infinite variety of styles and trends. Ferraro detected a parallel between this creative process and the functioning of deep learning (p. 76).

Let's reflect on the following idea: machine learning works in a very similar (although not equal) way to Verón's social semiosis, but at hyperaccelerated speeds. Machine learning systems (for example, to detect tumours in medical images) are based on a series of internal iterative recognition processes (the machine refines the identification of 'suspicious' signs each time). After many repetitions with each training example,

> the system eventually (we hope) settles on a set of weights and a threshold that result in correct answers for all the training examples [...]. Learning in neural networks simply consists in gradually modifying the weights on connections so that each output's error gets as close to 0 as possible on all training examples (Mitchell, 2019, pp. 20-31).

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These internal processes could be considered the grammar of production of the AI's outcome. Obviously, these computational automatized recognition processes cannot be compared to analogic human interpretation (see section 4.2). When interpreting, humans "identify significant correlations, while the machine looks for more or less reasonable, more or less understandable correlations, and that's it. They are only statistical correlations and nothing more" (Ferraro, 2023, p. 80). Regarding the concept of grammar, for Ferraro AI can only apply rules, but they "cannot follow human beings in the ways in which they disregard the rules, change them, create entire new rules systems." In other words, humans do things that "seem to straddle deviance and creativity, but which in fact are widespread and completely normal behaviours for human beings" (p. 74).

5.2. *GenAI's recognition grammars*

According to Eco (1994b), there are semantic (semiosic) and critical (semiotic) interpretations. If the semantic interpretation is the outcome of the process by which a reader, facing a text, "fills it up with a given meaning," the critical interpretation is a metalinguistic activity that aims at "describing and explaining for which formal reasons a given text produces a given response" (p. 54). In this sense, "every text is susceptible to being both semantically and critically interpreted, but only a few texts consciously foresee both kinds of response" (p. 55). It could be hypothesized that the internal 'interpretations' made by AI do not even reach the level of Eco's semantic (semiosic) interpretations. The internal iterative recognition processes are closer to that pre-semiotic activity that Eco linked to Peirce's categories:

> We are familiar with the indexical signs, this or that in verbal language, a pointing finger, an arrow in the language of images; but there is a phenomenon we must understand as pre-semiotic, or proto-semiotic (in the sense that it constitutes the signal that gets the semiosic process under way), which we will call primary indexicality or attentionality (Peirce spoke of attention as the capacity to direct the mind toward an object, and to pay attention to one element while ignoring another). (Eco, 1999, p. 14).

Primary indexicality occurs when, "amid the thick stuff of the sensations that bombard us, we suddenly select something that we set against that general background" and decide we want to speak about it" (p. 14). This form of indexicality also occurs when we capture someone's attention, not necessarily to communicate verbally, but merely to show them something that will eventually become a sign or an example. When neural networks process verbal texts, images, or sounds, they are not 'interpretating' (the semantic dimension is absent) but rather just identifying similitudes, differences, and patterns. In this context, the internal iterative recognition processes could be defined as a form of pre- or proto-semiosic activity.

5.3. *The art of prompting*

All human interaction with GenAI begins with a prompt, a command of what the user wants (to perform a translation, create an image, generate a text, etc.). The prompt establishes a semiotic exchange between the user and the AI that, when the human masters prompt engineering techniques, does not stop at a single question-answer interaction but becomes an increasingly deeper and more specific conversation. Experts recommend users to think about how they take the system responses and use them to inform the next question or statement. In Eco's terms this is the strategy of the author (in this case, the user) and the construction of a model reader (the GenAI) (Eco, 1979). In other words, by dominating the art of prompting, users are constructing the reader of their commands.

One of the most suggestive possibilities offered by GenAI is the possibility of modelling the enunciator of the discourse. The "act as…" prompt is a powerful semiotic tool that allows users to guide the AI's author strategy (Eco, 1979). For example, the user can ask a GenAI to "act as Marshall McLuhan" and describe his vision of the media (a typical noun + action syntaxis). However, users may also ask a GenAI to answer a complex question in simple terms (e.g., "Now

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you are a nine-year-old child. Please explain to me Eco's conception of interpretation"). The same logics work in the generation of images (e.g., "Paint a portrait of Donald Trump in the style of Pablo Picasso"). From a semiotic perspective, in this case the user takes on the role of the author and defines the model reader of the AI textual production.

5.4. *Prompting and intersemiotic translations*

Researchers interested in these crossovers between semiotics, cognitive science and AI research could explore applying the concept of *intersemiotic translation* to the analysis of prompts intended to create images. As Eco explained:

> [...] culture continuously translates signs into other signs, and definitions into other definitions, words into icons, icons into ostensive signs, ostensive signs into new definitions, new definitions into propositional functions, propositional functions into exemplifying sentences, and so on; in this way it proposes to its members an uninterrupted chain of cultural units composing other cultural units, and thus translating and explaining them. (Eco, 1979, p. 71).

Jakobson (1959) identified three types of translation: intralingual translation (to translate signs into other signs within the same language), interlingual translation (to translate signs into another language), and intersemiotic translation (to translate from one semiotic system into another, for example from verbal into nonverbal). The popularization of GenAI such as Dall-E, Midjourney or Stable Diffusion is transforming the generation of images. In this framework, a semiotician may ask: How do GenAI translate into images the verbal inputs that come to them through the prompts? Can these processes be an intersemiotic translation? Or are we dealing with a different translation phenomenon?

5.5. *Semiotics of passion*

The semiotics of passions presented in section 2.2 can help to outline new avenues of research on how humans relate to AI. Perron and Fabbri (1992) described the semiotics of passions in the following way:

> *Hope* is first of all a desire. Desire, in turn, is the minimum state of a subject. Hope is then defined as a desire with something added, namely, the future. Thus, the concept of time had to be included. Moreover, an object of desire can also be introduced, then a subject desiring the object in question. Furthermore, the modality of uncertainty must be interjected, for if the subject is in a state of certainty, there is no room for hope. Hence, the modality of uncertainty plus time plus desire produces something that can be called *hope*. More complex passions also can be affixed to desire, for example, *revenge*. But then how can revenge be described? It is a more elaborate system than hope insofar as it presupposes offense and thus appears as a desire to repair the said offense (Perron & Fabbri, 1992, xi).

Could this highly formalized approach help to generate human-like passional attitudes in GenAI and other conversational systems? If the answer is yes: Could passions be 'algorithmized' so that AI could process them? And going beyond this: Are passions culture specific? Do they change their syntagmatic sequence over time? The answers, obviously, go far beyond the limits of the present article, but semioticians could also join this fascinating conversation.

5.6. *Rhetorics of AI: A map of discourses*

Emerging technologies never come alone: they always bring a set of discourses that explains, mythologizes, defends, or criticizes them. AI are no exception. For decades science fiction writers, corporations, researchers, policymakers, and mass media have proposed "mythicizing visions" of AI (Ferraro, 2023, p. 67). How can this discursive mass that increases day by day be organized? One possibility is to reorganize and position the discourses according to two axes: strong/weak AI and utopian/dystopian discourses. Strong AI are intended to embody general cognitive abilities akin to human intelligence, exhibiting consciousness and self-awareness

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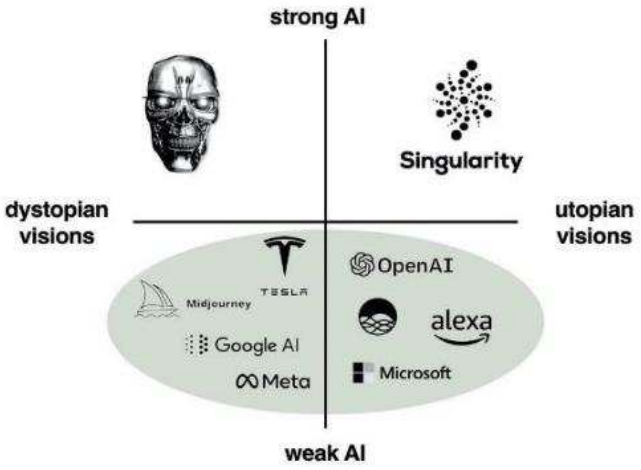
while understanding, learning, and applying knowledge across various domains. In contrast, weak AI (narrow AI) are designed for specific tasks, excelling in them but lacking overall intelligence and consciousness. Utopian visions foresee a harmonious society with positive advancements and happiness due to AI, while dystopian visions depict a grim society marked by suffering caused by AI misuse. The Cartesian graph below illustrates the positioning of these discourses (Figure 3).

Figure 3. The Rhetorics of AI: a taxonomy of discourses.



Source: Own elaboration.

Situated at the top left are science fiction dystopian discourses on AI, such as those inspired by Skynet from *Terminator*, HAL 9000 from *2001: A Space Odyssey*, or the superintelligence behind *The Matrix*. These fuel real fears surrounding strong AI and contribute to the techno-apocalyptic imaginary prevalent today.

Utopian discourses, often situated in the upper right, view the emergence of superintelligences positively, sometimes with religious undertones. They focus on *singularity*, envisioning a future where AI and technological progress radically transform human civilization. Kurzweil's (2005, 2024) vision involves exponential AI growth, merging human and machine intelligence, and widespread AI proliferation surpassing human capabilities. In this context, Ray Kurzweil and Peter H. Diamandis founded Singularity University in 2009, a global learning and innovation community focused on leveraging exponential technologies like AI to address the world's most significant challenges. Despite these initiatives, the concept of superintelligence remains speculative, eliciting both excitement and scepticism within scientific and technological circles.

At the bottom of the graphic, we find the discourses surrounding weak AI, encompassing both utopian and dystopian visions related to GenAI and other specialized systems. In this area positive corporate narratives about AI-driven cars confront journalistic reports of fatal accidents during testing. Likewise, discussions about ChatGPT's creative capabilities are contrasted with critical views of students using it to do their homework. In these conversations, the fear of a strong AI taking control and enslaving humanity remains ever-present, connecting to the upper left quadrant. Semioticians and discourse analysts face significant tasks ahead. Semiotics also provides diverse analytical tools to examine AI-generated narratives, their modes of expression, and important aspects like intertextuality.

Before concluding this section, it's important to note that the sociosemiotic interventions discussed in the realm of GenAI are just one among many potential analytical approaches. Additionally, the philosophical contributions of semioticians like Charles S. Peirce have been pivotal for AI development. Early AI systems relied on deductive symbolic processing, which,

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after centuries of reflection, is deemed suitable for confirming existing knowledge but not for generating new insights. GenAI, in contrast, operates within an inductive framework, adept at identifying patterns and offering recommendations, but they suffer from brittleness issues. Addressing these limitations poses a substantial challenge. Semioticians (e.g., Walsh Matthews & Danesi, 2019) and AI researchers (e.g., Larson, 2019; Mitchell, 2019) believe that the answer lies in Charles S. Peirce's *abduction*. In other words, the limitations of AI systems have a semiotic root and are due to the difficulty of reproducing the operations of the most complex abductive machine: the human brain[5].

6. Conclusions: Towards an applied semiotics of GenAI

AI are a challenging study object for semioticians. However, the relationship between AI and semiotics is not unidirectional: semiotics, like any other discipline, also grows and strengthens when confronted with new objects of study. The developments and perspectives related to AI "can in turn offer very important food for thought to semiotics, and for me this aspect is perhaps the most relevant" (Ferraro, 2023, p. 66).

Umberto Eco (1986) distinguished between general semiotics and specific (or applied) semiotic*s*. General semiotics positions itself close to the capital questions of any philosophy of language. For Eco, general semiotics studies and describes "languages through languages. By studying the human signifying activity, it influences its course. A general semiotics transforms, for the very fact of its theoretical claim, its own object" (Eco, 1986, p. 12). However, a specific semiotics is "the 'grammar' of a particular sign system" and proposes studying it "from a syntactic, a semantic, or a pragmatic point of view" (p. 5). Specific semiotics studies phenomena that are usually stable even if their systems are in continuous transformation. The semiotics of cinema, advertising, theatre, or gastronomy are good examples of applied semiotics. According to Eco, a specific semiotics can also "have effects in terms of social engineering." For example, the description of the internal logic of road signals "can suggest to some public agency how to improve the practice of road signaling" (p. 6). Following the same logic, semiotic intervention could improve the functioning of AI.

Within this framework, where should a hypothetical semiotics of AI be positioned? For Meunier (1989), research in AI is often "regarded as pertaining to the fields of engineering or informatics. Intelligent robots, expert systems, automatic translators, so it is said, belong to the world of computer technology. But is this really the case?" (p. 43). According to this author, a deeper analysis would easily show that "AI is much more an undertaking that pertains to formal and abstract discipline than to concrete and material technologies." AI is related intimately "to abstract disciplines and, more specifically, to semiotics; it is an applied semiotic venture" (p. 43). In a recent text, Leone (2023) argued that AI actually "falls perfectly within the strings of a discipline that since its foundation has been concerned with signification, with meaning, emulation, simulacra, and with innovation and creativity" (p. 17). AI are an exciting research object that cannot be ignored by semiotics, and vice versa: AI researchers should consider the possible contributions of semiotics.

> AI shocks because it does not limit itself to creating new meaning, but changes the rules of human sense, just as in the past language as a product of biological evolution and then writing as its extension in cultural evolution did [...]. Language created shared thought, writing generated collective memory and AI is perhaps giving rise to a common elaboration of thought which, exactly as happens for memory with writing, becomes autonomous from bodies (Leone, 2023, pp. 10-11).

[5] Amid the tension between biological intelligence (biosemiosis) and AI (robosemiosis), Walsh Matthews' (2019) reflections are particularly relevant. She argues that robosemiosis, the semiotic process of robots, is inherently limited compared to biosemiosis due to robots' lack of context, creativity, and adaptability, underscoring the uniqueness of human semiosis.

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Considering the contemporary explosion of AI, the semiotic intervention could be more specialized. It would be preferable to propose an applied semiotics of GenAI, leaving the door open to another applied semiotics that is not necessarily generative. In any case, an applied semiotics of AI (or GenAI) could be integrated with other approaches to enrich the analysis of these technologies within a multidisciplinary framework.

Like cognitive sciences, semiotics has followed a path parallel to that of AI research. In the last 70 years there have been many points of convergence and disagreements. In any case, it is almost impossible to understand the evolution of semiotics without considering the improvements in AI research and vice versa: theoretical and philosophical conversations about AI have always included contributions from semiotics, both in the symbolic and sub symbolic (connectionist) phases. From the perspective of Verón's social semiosis, AI based on machine learning and deep learning are accelerated machines for the production/recognition of textual matter. If the production grammar always includes recognition processes, then these processes take on a recursive character that allows the machine to advance inductively until reaching an outcome. Obviously, the user can reactivate the production/recognition process via a new prompt to improve the results.

In the last 40 years, with the AI 'summers' and 'winters,' many semioticians have confirmed the pertinence of the semiotic intervention in AI. Beyond the sociosemiotic path presented in the article, other traditions like cybersemiotics or computer semiotics have also made contributions towards understanding AI. Now GenAI are the brand-new actors of Verón's "infinite network of semiosis," and sociosemiotics proposes a set of concepts and analytical categories that are very useful for understanding the processes of textual creation and interpretation. The promising areas discussed in section 4 –GenAI's production and recognition grammars, reader construction and intersemiotic translation applied to prompting, semiotics of passions, and the rhetoric of AI discourses– can be seen as an initial and exploratory roadmap with the potential to enrich AI research.

This roadmap, though limited and provisional, is just a starting point and will undoubtedly be expanded and refined through future semiotic interventions. There are still many challenges for semiotics, and they are all welcome. As Ferraro (2018) put it,

> We project ourselves towards the future not because we focus our attention on new objects and fashionable directions, but because we strengthen and renew our basic references. In short, we could say that we do not want to move house, but to substantially renovate the house we live in, making it decidedly more functional and adapted to the times (Ferraro, 2018, p. 19).

GenAI evolves so quickly that many methodological tools and theoretical constructions (not only in the field of semiotics) will be impacted by this and will probably need to be redesigned. Expanding Ferraro's metaphor of a house it could be said that AI are renovating not only semiotics, but many epistemological houses and neighborhoods.

ChatGPT-4o was utilized to enhance the quality of the English text.

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