Some semiotic dimensions of generative AI:
Structure, generativity, and relational epistemology

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ABSTRACT

The common use of 'generation' may suggest an epistemic link between Chomskyan generativity, the Greimasian *parcours génèratif*, and modern systems of Generative AI. This article, however, reconstructs the relationships between contrasting epistemologies – specifically, the structural semiotic approach *vs*. Chomskyan generative syntax – to distinguish and semiotically analyse AI-driven textual generation. While the Chomsky-Greimas relationship has been extensively studied and debated, its relevance to the epistemological presuppositions of *General Purpose Chatbots* (e.g., ChatGPT, Gemini) remains underexplored. Generative AI's operation thus provides an empirically observable basis for semiotic analysis *and* reflection on language, relaunching the semiotic project to address challenges arising from the widespread use of these linguistic technologies. This study also reaffirms the profound semiotic-anthropological relevance of Greimasian generativism concerning sense as it is structured in the lived world, as well as the importance of not separating semantics from pragmatics, as indicated by Umberto Eco's interpretative framework of semiotics.

Introduction

The rise of generative artificial intelligence (GenAI) has shed new light on the concept of *generation* in linguistic and philosophical discourse. The current, common usage of the term generation in systems like *ChatGPT, Gemini, Claude,* and *Deepseek* might suggest that there can be traced a cohesive epistemic link spanning Noam Chomsky's formal generativity (1957), Algirdas Julien Greimas' *parcours génératif* (Greimas and Courtes 1979; Greimas 1983), and modern computational models that reproduce linguistic performance. However, this presumed continuity masks fundamental theoretical incompatibilities.

This paper proposes a path through theoretical and technical models of language to clarify the differences between homonymous concepts and to deepen understanding of semiotic processes related to AI. GenAI systems model language's semantic space by mapping relationships between discrete units, called *embeddings*; this mapping creates a vectorial and topological model of the semantic space across different languages. It will be argued that this function is rooted in a particular reception of structural epistemology within the North American community of linguistic studies, thereby enabling the emergence of the distributional hypothesis in linguistics, which in turn influenced the development of Natural Language Processing (NLP). An investigation of the conditions of possibility of these AI systems will frame how their use reaffirms key epistemological principles of semiotics, from relationalism to a critique of Chomskyan syntax. The core challenge posed by these modern systems lies in their underlying technical *dispositifs* [1] – in a Deleuzian (1989) and Latourian (2012) sense. Large Language Models eschew reliance on explicit, innate rules, instead relying on a mathematical model of the semantic space which emerges from vast quantities of linguistic data. To this architecture, which grants linguistic competence, a *generative* component must be added.

Through this research paper, multiple dimensions of meaning will be analysed. First, a theoretical inquiry on the difference between linguistic theories will be pursued: the first section (§1) of the paper will discuss the premises of different approaches to language. In the second section (§2), we will draw a connection between these linguistic theories and the development of NLP and GenAI. This will help to understand how GenAI *works* – both in the architecture of the *Large Language Model* and the assemblage of the *Transformer* – and how its manifestation of linguistic abilities differs from human language phenomena. Even if the Natural Language Processing theories that shaped

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[1] Even if the term *dispositif* is commonly translated with *device*, the meaning adopted here is the one outlined by Gilles Deleuze in his theory of how knowledge and power are constantly *assembled*, co-implicated and distributed via heterogeneous networks of different modes of existence; the same term – with little explicit reference to Deleuze, but many analogies – is adopted by Bruno Latour to indicate the series of relations deployed in the use of an artifact. In the latest development of his *Actor-Network Theory*, the *Inquiry on the Modes of Existence*, the *device* or *network* is studied under the principle of irreductionism; the system of relations cannot be reduced to its components, nor to the single workings of the nodes, but has to be conceived as a whole.

LLMs have been originally formulated to explain human language, it is better to avoid the temptation to generalise different kinds of mediation under the same theoretical concepts. The aim of this research is not to formulate one theory that can encompass all of the possible dynamics and strategies of meaning production; instead, moving from a semiotic point of view, different perspectives will be compared in order to establish *which* approaches can better describe, rather than explain, different strategies of emergence of meaning. Once this is accomplished, the discussion will be able to move toward a semiotic analysis of technical mediations of meaning (§3), integrating GenAI *chatbots* as semio-technical artifacts that *act* and therefore *produce signs*.

1. Theories of language and generativity

1.1. Relational epistemology and the problem of reference

Semiotics, as a scientific project, is inscribed in a structuralist tradition: it stems from a European reception of Saussure's *Course in General Linguistics* (1916)[2] and has been contaminated by a pragmatist view of meaning (cf. Eco 1975, 1984, 2007). In this section, the reception of two fundamental *pairs of* (or, rather, *oppositions between*) semiotic notions will be addressed: the arbitrary relationship between *signifier* and *signified* (and its Hjelmslevian translation into *planes*) and the paradigmatic dimension of *Langue* as it has been opposed to the syntagmatic one of *Parole*.

The scope of this research does not allow for a deep dive into the foundational role of Saussure in structuralist epistemology; therefore, only a few starting points of his reflection will be recalled. First of all, the idea that language is a structural system composed solely of differences: the *Cours* (Saussure 1916) inspired the anti-essentialist relationalism of semiotics, which implies that the *value* of an element neither has an ontological foundation nor can be deduced from its properties, but instead derives from the network of relations that surrounds it. Hence, value is *relational*. It was the relational take on the structuration of language systems that enabled language to be defined in a non-referential and autonomous manner with respect to the extra-linguistic space: in this framework, the *linguistic value* emerges from the opposition of forms, which are defined at a systemic level. However, in Saussurian terms, this is related to a specific abstraction of language: the *system* of language (*la langue*), which remains fundamentally *virtual*. In itself, *la langue* is an operative construct, a structural hypothesis which can be reconstructed *a posteriori*, following a work of classification and analysis of *parole* acts. It is indeed independent from reference, but it still holds a relationship with *the social use of the word*, or the *parole* act.

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[2] As it is well known, Saussure's *Cours* was published by his students Charles Bally and Albert Sechehaye, with the collaboration of Albert Riedlinger, in two editions: one in 1916 and the second one in 1922.

Following Saussure and the Prague Circle, many theorists advanced the idea of analyzing language as the *immanent object* of a structural science: in this view, the possibility for language to be an autonomous system of relations did not mean that *experience* or *the lived world* (the *transcendent*[3]) could not influence language, but that *it is not in elements outside the activity of language*, such as *speaking*, that explanatory elements for the functioning of language itself should be looked for. One of the key promoters of the *immanent* hypothesis in the study of language was Luis Hjelmslev (1961), who was then able to articulate another Saussurian dyad – the *signifier* and *signified* – through the notions of *expression* and *content planes*. As is well known, the two are correlated via *forms* which, as already stated, are differential and relational.

A lot can be said about the history of linguistic thought and its consequences on different philosophical stances. For instance, many interpreted the strong Hjelmslevian structuralism as a *complete detachment* of sense from the structure of the world, making the relation between experience and language as arbitrary as the relationship between signifier and signified (cf. Bondì 2012). Of course, this is a simplification of semiotic epistemology, which presents a much more nuanced integration of a structural hypothesis about language and the semiotic phenomena of *motivation* (cf. Eco 1975). However, it is true that this interpretation is confirmed by some of the most classical semiotic arguments: for instance, in Barthes (1964), we find the famous theoretical project of *tuer le referent*; it was always Barthes who argued that it is *language,* with its structuring strength, that speaks to *us*. However, many of these theoretical challenges remain valuable to the scientific project of semiotics. Before dwelling into the *pragmatic* account on meaning – and how it shaped the semiotic adventure allowing it to overcome some of these aporias – it is important to remind that it was the structuralist hypothesis – the one that recognised the arbitrary connection between *expression* and *content* – which allowed for a study of the interdependencies of forms as they are related among them in the system in which they are found. The fact that these two planes are *organised* through forms (the *constants* of the *langue*) that only exist in virtue of their relations means that *it is impossible for an enunciative act not to bring with it the entire set of relations 'embedded' in that language*. Even if we wanted to criticise the rigid non-referentiality of structural epistemology, some of its evidence still holds theoretical and analytical value. For instance, it is evident, as Hjelmslev famously pointed out, that different languages cut the two planes in different ways; not just the plane of expression, but also the one of content: this is sufficient proof that the arbitrary hypothesis cannot be denied. Starting from this possibility, Hjelmslev's theory of *forms* can be developed, and more research is possible: how does the semantic plane structure itself? What dynamics organise the matter of content?

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[3] For an interpretation of the role of the transcendent dimension of meaning, cfr. Paolucci 2010.

The Hjelsmlevian hypothesis sees the *continuum of what can be expressed* (the *matter* of content, loosely connected to the idea of *experience*) and *the continuum* of *how it can be expressed* (the *matter* of expression) as two planes in which *forms* are individuated through systemic relations, and the correlation as simultaneous for both planes. It is true, however, that in our experience we only encounter *substances*, or *already* articulated sounds and *already formed* words: these, however, are not the object of the *immanent* science of language – at least not in Hjelmslev's terms.

1.2. Before Chomsky: back to distributional semantics

How does structuralism relate to our inquiry into generativity? Before defining generativity and how it might or might not relate to both linguistic theory and modern-day AI models, it is better to lay down the theoretical framing of a linguistic hypothesis that connects both with structuralism, the works of Noam Chomsky, and modern-day LLMs. It comprises the distributional hypothesis of semantics, as proposed by Zellig Harris (1951). One of Harris's most famous arguments was that the *meaning* of an expression should reside in its *neighbourhood*. This hypothesis has an indirect Saussurean lineage: Harris was strongly influenced by Leonard Bloomfield (1933), a reader of Saussure who is widely regarded as the father of the North American structuralist linguistic school.

Leonard Bloomfield wrote a review of Ferdinand De Saussure's *Cours* in 1924: as Venier notes (2019: 289-20), the review does not attest an *adherence* of Bloomfield to the theoretical apparatus of Saussure, but it testifies what Bloomfield recognised relevant in Saussures' work: the construction of a new scientific object, the *systematic* aspect in the study of language, and the radical refusal of psychological explanations for the scientific grounding of the study of language.[4] In this review, some of the theoretical directions of his seminal work, *Language* (1933), are evident; however, many points of divergence with Saussure are also noticeable. According to Lenci's interpretation (cf. 2008), for Bloomfield, paradigmatic classes emerged from textual distribution, but his analyses focused only on syntactic types to reconstruct models specific to particular linguistic groups. Harris (1951) instead accepted that the analysis of meaning was possible, but it could not be the starting point for scientific work. Harris promoted a profound anti-psychologism for which it could not be the signified that explained the behaviour of speakers, but the similarity in the distribution of signifiers that explained the meaning. Therefore, a scientifically grounded analysis had to start from a solid empirical base, i.e., the distributional method, which, we should remember, Hjelmslev was a great critic of, arguing that it added nothing to classic structural analysis. Another protagonist of distributional semantics was Firth (1951), who, instead, pursued a *contextual* theory of meaning: his theory moved towards a pragmatic understanding of

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[4] On the different relationships among structural linguistic theories, also cf. Lepschy 1966.

context, moving away from Harris' idea of *neighbour words*, and comprehended more cultural factors and presence in context. Meaning was not a matter of neighbourhood (intra-textual) but of keeping company in concrete occurrences (collocations, inter-textual and extra-textual relations).

1.3. Chomskyan and Greimasian Generativity

The distributional hypothesis was later abandoned – at least, in major linguistic debates – in favor of another linguistic theory, promoted by one of Harris's students: Noam Chomsky. Chomskyan *Generative Grammar* (1957) forms a research tradition focused on explaining the cognitive basis of language. It operates under a strong *universalist* and *nativist* theory that claims humans are born with an innate language faculty, encapsulated in the Language Acquisition Device (LAD) and the concept of Universal Grammar (UG). The generativist model suggests innate rules of language that could explain the emergence of this universal grammar, capable of accounting for the syntax of all languages. This capacity represents an unconscious *competence* that allows a speaker to produce syntactically *correct* sentences in any language they speak.

Chomsky's Cartesian linguistics was not interested in the problem of semantics, focusing only on syntax. His take was precisely that semantics was irrelevant to the coherent construction of sentences, which depended instead on the notion of *rule.* This idea of *rule* was *constitutive* of language, a *human* and *inner universal* linguistic mechanism, rather than a socially constructed norm in practice, as theorized by Coseriu (1952).

Later, Chomskyan generativity – which became central to mid-century linguistic debates – inspired the Greimasian notion of generativity, as noted by Fabbri (2000). The latter, however, is constructed against a completely different theoretical backdrop. Algirdas Julien Greimas was the most prominent figure in the Parisian school of semiotics: to him we owe the development of a different concept of generativity centred on the *construction* of sense. His theoretical basis stems from structural semiotics: in particular, he was a reader and interpreter of Hjelmslev, applying his fundamental categories to specific portions of language or *texts*. In fact, Greimas' theory does not focus on *parole* as the syntagmatic element that allows the reconstruction of the system; rather, it finds in the *text*, as a *concrete semiotic manifestation*, its fundamental object of analysis. From the text, fundamental structures of meaning can be abstracted and analysed, moving from *empirical manifestations* toward deeper levels of meaning; these structures are the ones capable of *generating* meaning in the trajectory of emergence, proceeding in the opposite direction from the analysis.

The *parcours génératif* (generative trajectory) describes the hierarchical process by which meaning unfolds, moving from the most abstract conceptual relationships to concrete, observable discourse. This trajectory begins at the fundamental level with the Semiotic Square, which systematically structures binary oppositions. It then progresses

through the narrative – profound – and syntactic – superficial – components, towards the discursive level. Greimas' generativity is fundamentally a model of narrative syntax, providing a metalanguage that describes the scheme of empty positions that will be invested with semantic content.

In this sense, it follows a completely different dynamic than Chomskyan generativity: unlike Chomsky's concern with grammatical sentences, Greimas seeks to explain how sense is structured. This notion of sense does not account for a 'fixed' and quantifiable codification of meaning, but rather for the articulation of narrative structures as they acquire sense in the *lived world*. These structures are reconstructed using texts as a collection of elements (*corpora*) that enable the individuation of deep semantic and actantial relationships, such as the roles of actants, modalities – semionarrative – and actors – on the discursive level.

In the *Dictionnaire* (1979), Greimas and Courtes note that *discursive semantics* is a rather understudied field of research. Following the *parcours génératif*, the enunciative dynamics move from abstract and profound levels to enunciative strategies that enable the *discursivisation* of figures and themes. The idea that underlies Greimasian generativity is that, given *universal articulations of sense* that work on deep semantic oppositions, semantic values are invested along the passages of the different levels that compose the trajectory.

Moreover, Greimasian generativity applies to all kinds of texts, including figurative ones: the model describes the generation of sense through abstract categories, regardless of whether the final output is linguistic or figurative. What is universal here is the generative structure of the Greimasian project: it is not the *syntax*, but the *scheme* of abstract relations that can be invested by different figures and values. This is why the model can describe different articulations of a text's meaning, depending on how the recurring scheme is applied during analysis. It could be argued that Greimasian generativity is a theory of how *semantic values* move from a *repository of semantic forms* towards our concrete, empirical utterances, regardless of the language in which we produce them.

2. Language: from theoretical to technical models

The primary focus of this section is the relationship between different theories of language and the development of Natural Language Processing (NLP) and GenAI systems. Whereas a precise reconstruction of the historical conditions of the emergence of this specific type of Artificial Intelligence systems[5] cannot be provided here, it is fundamental to distinguish between different ideas about language and their subsequent descriptive models. This type of inquiry will allow a deeper understanding of how GenAI works and how semiotics can produce a meaningful criticism of its functions (§3).

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[5] For a semiotic reconstruction, see Monti 2025a and 2025b.

2.1. **Criticism of formalisms and the notion of rule**

Chomskyan formalism, which relied on the UG hypothesis, was successful in the early stages of AI development because it proposed that human linguistic *competence* could be represented by a set of formal rules that a computer could program. Along with mathematical information theory and Cybernetics (cf. Monti 2025b), it inspired the development of early NLP models that aimed to imitate human language structures without the need for corpora: the idea of an innate grammar challenged the importance of empirical data – at the time the domain of behaviorism – which posed an obstacle to programming functional AI (cf. Manning 2022).

This possibility of individuating formal structures that go beyond and shape linguistic utterances has fueled a highly debated philosophical issue. In his work on how forms emerge in lived experience, Jean Petitot emphasizes one inherent limitation of formalist views of language.

> Les grammaires consistent en des mécanismes générateurs attribuant une interprétation sémantique à des séquences phonétiques, leur théorie dépend d'une sémantique générale encore inexistante. D'où la centralité de la syntaxe conçue comme le système des *contraintes formelles* conditionnant la possibilité de l'interprétation sémantique. (Petitot 1985: 147)

Petitot includes both structuralist and Chomskyan formalism in these ideas but criticizes them for lacking the interpretative component of semantics. Criticism of Chomskyan formal generativism did not come only from within the linguistic sciences but also from the philosophy of AI. Notably, Chomsky was among the polemical targets of the criticisms that thinkers such as Dreyfus (1972) later addressed regarding the limits of AI in managing the complexity of human language. While Chomsky's theories suggested that language could be formally modelled, Dreyfus pointed out that human use of language involves more than syntactic processing; rather, it includes other dimensions such as pragmatics, adaptation to context, nuances of meaning, implicit knowledge, and other non-representable conditions. Another critic of the project of Strong AI – who also believed that *semantics could not be reduced to syntax* – was John Searle (1980),[6] who was skeptical of the idea of *constitutive norms* of language.

The relationship between formalism and various ways of understanding a rule – either as *constitutive,* as in the computational and generative (Chomskyan) paradigm, or as *normative,* as in the social regulation of behavior through exposure to recurring

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[6] Even if Searle (1980) does not explicitly name Chomsky as the target of his essay, he directly challenges the computational theory of mind that forms the bedrock of Chomsky's approach to cognitive science and language, making it a major, indirect point of dispute.

patterns – thus leads to another philosophical and linguistic antecedent of how GenAI functions: a specific interpretation of Wittgenstein's philosophy within the context of distributional semantics and the so-called use theory of meaning.

2.2. Back to distributionalism, moving towards empiricism through social pragmatics

A second generation of distributionalists (cf. Lenci 2008) later interpreted the *use theory* of meaning in strictly textual terms. Famously, Wittgenstein asserted that the meaning of a word resided in its *use*: "For a large class of cases-though not for all – in which we employ the word 'meaning' it can be defined thus: the meaning of a word is its use in the language" (Wittgenstein 1953: §43). Although Wittgenstein intended this use to be *anchored* in concrete, non-textualizable *forms of life*, second-wave distributionalists interpreted it in terms of the co-textual distribution of words. In the current academic setting, Wittgenstein also figures prominently in the didactical framework of *Natural Language Processing* (Jurafski and Martin 2024): a textbook designed for computational linguistics students at Stanford University that reconstructs the theoretical inquiry over the reproduction of language starting from Wittgensteinian theory through distributionalism, the rise of modern NLP, and culminating in the development of contemporary large linguistic models.

It might even be argued that the success of modern computational models, based on a distributional, relational epistemology, constitutes a strong empirical argument in the long-standing debate between Chomskyan rationalist nativism and Harris' structural relationalism. However, this interpretation addresses only one aspect of the technical assemblage that constitutes GenAI, such as the workings of language. In reviewing the debate between connectionist and symbolic AI, Cardon, Contiet, and Mazières (2018) highlighted how Wittgenstein's theory also influenced Dreyfus' critique of symbolic AI, thus opening the way for various connectionist-type criticisms; the primary one being the critique of Cartesian dualism, which argued that in the symbolic hypothesis, dualism was based on the separation of mind and body, leading the philosophical debate on AI's theoretical foundations toward a logicist formalism.

Between Chomskyan rationalism, the formalism underlying the birth of symbolic artificial intelligence or GOFAI (Bachimont 1996; Cardon, Contet, and Mazières 2018; Rastier 2011), and that of Wittgenstein's *Tractatus Logico-Philosophicus* (1921), there is a significant common term, namely the formalism of the Vienna Circle. This laid the foundations for the possibility of formalising natural language, allowing, on the one hand, its total control and calculability, and, on the other, its constitution as a rigid logical theory capable of linking the meaning of propositions to their truth conditions. The Vienna Circle's formalism does not just provide a theory of language but constitutes a hypothesis concerning the possibility of description of the world in terms of logical atomism, where

semantics and *meaning* are resolved in terms of *truth conditions* that must respect a world perfectly representable through structured descriptions. Dreyfus, strongly condemning this theory, defined this account as the ontological hypothesis (Dreyfus 1992: 211-2).

It is truly remarkable to see that the same progression occurs from the Fregean project of the *Tractatus* (1921) to the social pragmatics of the *Investigations* (1953) as well as from the failure of natural language processing based on symbolic calculation to the interpretation of the use theory of meaning that informs modern NLP.

Whereas the first ones see the linguistic behaviour as a process that can be *deducted* by a closed set of rules, connectionist machines proceed by an *inductive* method of pattern recognition that is based on the consistency of regularities in huge amount of data:

> Lorsque les concepteurs des machines symboliques cherchaient à insérer dans le calculateur *et* le monde, *et* l'horizon, la réussite actuelle des machines connexionnistes tient au fait que, de façon presque opposée, ceux qui les fabriquent vident le calculateur pour que le monde se donne à lui-même son propre horizon. (Cardon, Contiet and Mazières 2018: 181)

On this point, computational linguists (Jurafski and Martin 2024) acknowledge the failure of the pure language system project and the role of Wittgensteinian theory in orienting research not only in NLP but also in linguistics. The development of LLMs, which has led to satisfactory results in terms of linguistic production, comes instead from the combination of different approaches to language which are rooted in its social dynamics: the combination of what we have here identified as a 'structuralist' theory (distributional semantics), a social pragmatic theory (the use theory of meaning), both combined to another tradition in AI, namely connectionism, which stems from an *empiricist* tradition.

Connectionism openly opposes symbolic AI. Of course, the calculation of data within the connectionist paradigm can also be considered formalist, but it rests on a completely different epistemological basis: one that does not allow for hierarchies of levels in the production of meaning; nor for them to be rooted in logical, computational structures; instead, connectionism identifies formal relations as they are recognised *from regularities occurring in the linguistic experience*.

2.3. **The development of Natural Language Processing techniques**

The development of NLP slightly precedes that of artificial intelligence, and according to Manning (2022), it is not possible to draw a clear separation between the two fields: the institutionalisation of NLP precedes Minsky's famous denomination by a few years. As previously stated, NLP has a dual foundation in structural epistemology and in the North American reception of Wittgensteinian social pragmatics; the mechanism underlying modern Large Language Models will now be described.

The operational mechanism of modern Large Language Models (LLMs) relies on the distributional semantic hypotheses. These systems map the contextual relations between words into a high-dimensional vector space (embeddings), thereby creating a mathematical model of semantic similarity derived exclusively from *usage patterns*; this is where the *use theory of meaning comes in*. Of course, this passage from the *langue* as a virtual, structural field to a mathematical model can be seen as a type of reductionism – namely, the one that goes from the *territory* to the *map*.

According to Manning's reconstruction of the NLP field (2022), what enabled distributional semantics machines to work was that, in 2013, developers began using *deep learning* systems and *artificial neural networks* to train Transformers. Deep Learning is a type of machine learning that uses networks composed of multiple layers of interconnected nodes (*neurons*). The term 'deep' indicates that these models contain three or more such layers, enabling them to handle the sheer volume and complexity of data required for sophisticated tasks such as natural language processing. This transition enabled the representation of words and sentences in a vector space with what are called 'real dimensions,' improving the performance of these machines in terms of semantic coherence and syntax (Manning 2022).

From 2013 to 2018, deep learning techniques enabled the development of more powerful models that can handle broader contexts and generalize more effectively across similar words or phrases. However, the basic approach remained supervised learning: the data used to train natural language processors had to be *labelled* by human annotators. In 2018, a significant change occurred with the introduction of large-scale self-supervised learning. In this approach, systems can recognize patterns in large amounts of data, enabling them to *autonomously* produce well-formed linguistic expressions.

In linguistic terms, the realisation of a device that can speak *naturally* – that is, without making grammatical, semantic, or lexical mistakes – could be defined as the realisation of a device that presents a *technically mediated competence*[7] about language: a *potential ability* to perform linguistic acts *made possible* by the technical assemblage. This competence is based on the computation of enormous quantities of textual data: the system trains itself by creating prediction tasks from the same texts, such as completing missing sentences. The system 'learns'[8] from correcting its own errors, using

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[7] *Competence* is not a neutral word in respect to the array of linguistic theories that we developed: it is the word used by Chomsky to describe the innate, universal ability of speakers; it is a phase of the Canon Narrative Scheme developed by Greimas, preceding the one of *Performance*. It might describe a theoretical knowledge about language that precedes – and acts as a precondition – of linguistic utterances. However, the competence-performance dyad cannot be aligned with the notion of *Langue* as opposed to *Parole*. In this text, we chose to speak of the technical working of LLMs as a *technically mediated competence* because it allows us to describe the *manifestation* of a *coherent linguistic behaviour* without the risk of attributing 'knowledge' or human-like features to *Chatbots*. For a study on the agency of Chatbots, see Paolucci (2025).

[8] The learning metaphor has become technical jargon to describe the training of Artificial Intelligence Systems; however, the author here recognises the risk of anthropomorphisation that lies in the use of such terminology.

the same training corpus as verification, and accumulates a vast *competence* made of procedural-type rules that can be applied for tasks like answering questions or classifying texts.

This competence allows for the *generation* of texts that are not *copied and pasted* from the linguistic structure in its database. The main difference between a pre-trained transformer and a search engine is that the former does not properly 'search' its database for answers, but instead uses a trained mechanism to generate text.

The possibility of self-learning in neural networks has reopened debate over the legitimacy of metaphors such as learning, understanding, and knowledge, which has taken the form of a debate over the natural-language *understanding* of NLP systems, particularly between Manning (2022) and Bender and Koller (2020). Bender is also one of the authors responsible for one of the most pervasive metaphors regarding LLMs circulating in culture: the *stochastic parrot* (Bender et al 2022). Manning, without explicitly mentioning it, reports an updated version of Searle's Chinese room problem, reconstructing a debate between distributional semantics on one side, which would be capable of holding together different dimensions of meaning via *statistical modelling*, and a linguistic theory that rigidly divides syntax, semantics, and pragmatics on the other. Bender and Koller, on the other hand, argue that if we want to conceptualise meaning according to the *use theory of meaning*, as in a social pragmatic theory, then we should explain it in terms of communicative intentions. However, they do not intend here a phenomenological notion of intentionality, rather a psychologistic and mentalistic one, thus denaturing Wittgenstein's position while trying to defend it.

2.4. What kind of generation is involved in Generative AI?

It has been explained how these technical *dispositifs* model the semantic space of language using embeddings to map relationships between discrete units, *thereby* creating a vectorial and topological model of the semantic space of different languages. How do they *generate* answers to users' prompts then?

It is now possible to define the *concept* of generation in *generative* AI. LM generation is purely a statistical prediction mechanism. Although, like other examples of generativism, they allow us to produce an *infinite set of possible answers* from a finite set of rules, these rules are not *constitutive* but *procedural*. The model works by calculating the likelihood of the next word given the preceding sequence, based on the patterns absorbed from billions of words of text. It uses high-dimensional embeddings as vectorial mappings to model relationships between linguistic units in a semantic space: this is an associative, sub-symbolic process, but it does not apply explicit, human-readable grammatical rules. The possible grammars – or formal rules – that can be observed in the behaviour of the Chatbot are an *effect* of these statistical patterns, not the cause of the generation.

GenAI has adopted the term *generative* to contrast with another feature: *copying* or *reporting* external linguistic information. Transformers *produce* linguistic outputs from an *open-ended* process that, starting from the same prompt, might produce two different answers. This process is called *generative* because it does not rely on a *copy-and-paste* mechanism from external sources, but it produces novel, *original* outputs. Most recent models combine this process with the mechanisms of a *search* engine to gather factual information from external websites; this information is subsequently synthesized through the *technically mediated linguistic competence of the LLM-Transformer complex.*

The success of GenAI-powered chatbots in generating coherent, complex utterances is achieved exclusively through distributional learning on massive amounts of data. This demonstrates that the required complexity, previously attributed to innate rules, may instead be statistically latent and derivable from sufficient textual exposure, supporting the distributional hypothesis that meaning is induced from structures associated with usage patterns.

3. A semiotic description of generative AI models

What can contemporary semiotics do then, to analyse the workings of these semiotic machines? A first step in a semiotics of GenAI is to define it in relation to linguistic theories.

GenAI systems can be described as *technical dispositifs* that use statistical prediction models to produce semantically and syntactically coherent texts. The debate over whether these machines *think* or the adequacy of categories such as *conscience* and *subjectivity* will not be addressed here. Instead, what will be pursued is an inquiry into the possibility of these models to test different theories of meaning and of sense unfolding.

The principles of distributional semantics and pragmatics, made automatic by the computational power and training methods of neural networks, have jointly made it possible to actualize the relational and virtual system of language in a vector space where differences are structured, and *enunciative praxis* (Fontanille and Zillberberg 1998) is mathematically stratified. However, this does not happen automatically, just by running a computer program on a huge repository of data. This process requires several treatments of linguistic data, such as *normalizing* texts so they can be processed by the machine, and human-driven *fine-tuning* of the chatbot's responses to ensure that the machine produces texts that do not infringe ethical thresholds; training is a process rooted in interaction. This heterogeneous set of directions and intentions calls for theoretical models that account for *mediations* among different modes of existence; a *dispositif* is a network of *transformations* (cf. Deleuze 1989; Latour 2012).

3.1. **Technical mediation of meaning: the semantic architecture of LLMs as a semiotic challenge**

As Eco (2007) and Rastier (2008) variously argue, the division between semantics (understood as truth-conditional semantics) and pragmatics (or the study of language as a practice in context) is almost arbitrary. For Eco, one cannot have an *exhaustive* semantics without resorting to inference processes that link the interpretation of linguistic exchanges to pragmatic operations. According to Rastier, the difference between the two fields is a rivalry constructed by two sides of a debate – philosophy of language and the *sciences du language* devised semantics and pragmatics to deal with meaning by mutually delegating to the other field a set of problems that neither could autonomously solve. Another position on this is expressed by Paolucci (2021b), who states that semantics and pragmatics are not separable, but that, unlike the traditional account of pragmatics, it is not contexts that regulate the possibilities of meaning of a term. Rather, it is words that activate possible contexts, carrying with them the regularity of their uses that can, over time, act on the linguistic norm (cf. Coseriu 1952), modifying it through the stratification of enunciation praxis.

What does Eco mean when he speaks of *exhaustive* semantics? Eco is probably referring to a semantics that allows us to describe how meaning works across *all contexts of its emergence*. This is why semiotics, as a field, includes theoretical inquiries into perception and real-world practices as the frame for the emergence of meaning: from a pragmatic perspective, verbal language alone cannot exhaust the dimensions of meaning-making. Interpretive Semiotics[9] (cf. Paolucci 2007), the current of semiotics that stems from Eco's theory (Eco 1975, 1984), addresses the aporias of structuralism by integrating real-world knowledge into the semantic model of the *encyclopaedia*, a model of semantic memory that regards intertextuality as a condition of possibility for semiosis.

To some extent, the semantics of LLMs realizes the idea of topological semantics: a meaning described purely in linguistic terms, relational and differential, structured topologically in a semantic space. In a structuralist fashion, the system (paradigm) is constructed through abstractions from a series of mechanical operations on processes (syntagms or utterances). This way, the 'radical' vision of the structuralist idea of meaning is realized: it is enough to know the relations between terms to describe meaning within an autonomous and closed linguistic system, without having to refer to a system external to it, whether it be that of the speakers' beliefs or

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[9] Another characteristic of Interpretive Semiotics is its reliance on the pragmatist theory of signs of Charles S. Peirce; however, pragmatism – or pragmaticism – should not be confused with pragmatics as the study of the relationship between language and its context. Famously, it was Umberto Eco that constructed a framework able to *keep together* structuralism, pragmatics and a pragmaticistic theory of signs.

psychological intentions. Through the semantic model of the encyclopaedia, we can conceptualise and describe this complex semantic topology: the encyclopaedia is not a register of terms and properties, but of *relations* between them (cf. Eco 1975, 1984; Paolucci 2010).

In this regard, a recent study by Grand et al. (2022) seeks to derive a theory of lexical knowledge from the topology of meaning, applying the method of semantic projection to LLMs and reconstructing how human lexical knowledge can be extracted from aggregations of embeddings. This method, based on Quillian's semantic memory,[10] projects word vectors onto lines representing different semantic characteristics, such as /size/ or /danger/. This projection is analogous to placing words on a mental scale to compare them based on specific characteristics. The authors explicitly note that one cannot move from a simple linguistic *description* to a *judgment* without recourse to *experiential knowledge*. Although traditional models succeed in identifying generally correlated words, they seem to struggle to capture the nuanced and context-specific ways in which humans perceive the relationships between words: for example, the case of dolphins and alligators shows that while the two animals may be similar in size, they are very different in terms of perceived danger.

This could show that, to achieve an exhaustive semantics, one cannot exclude the type of knowledge that comes from experience and shared narratives from semantic modelling, which is one of the main theoretical features of the encyclopaedic model. While going through these types of study, it is difficult not to notice a resemblance to Eco's theory of interpretation based on the selection of semantic potentialities opened by words: the human way of using, learning, and interpreting language is a form of interaction with a repertoire of verbal utterances stored in the encyclopaedia. This model is internally structured through the use and sedimentation of linguistic forms. What we, as humans, do when we enunciate or interpret is select (by *potentialising* or *actualising* paths) the choices recorded in the encyclopaedia, based on our own personal slicing of it, which draws on our experience of the world. Patrizia Violi (1997) argues that

> knowing the set of semantic relations that are established between a term and all others does not at all amount to knowing its meaning [...] for this to be possible, the sign must be interpreted, that is, a relationship between the sign and something else functioning as an interpretant must already be established for the subject. (Violi 1997: 35, my translation)

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[10] Which is the same theory adopted by Eco (1975) to provide his first version of the encyclopaedia model, as opposed to *dictionary*-like semantics. However, a point of incompatibility with current strands of cognitive semiotics (cf. Paolucci 2021a) is that this type of study relies on the idea that humans have an *internal* capacity to code semantic knowledge, which can be precisely localized in the brain.

However, even if the topological space of the embeddings can be described – or even explained – via the encyclopaedic model, the former cannot be considered a realization of the latter. A representation of the encyclopaedia – which, according to Violi (2017), is extended to the limits of non-representability to include everything that is knowable – is impossible, given that it is a *regulatory* model for explaining different dynamics of attribution of meaning. Moreover, it is not only a semantic model, but a semiotic one, concerning the connection between the planes of expression and content. As for LLMs, it can certainly be spoken of as an *actualization* – via the technical means of a *dispositif* – of the topological semantic field that confirms the structural functioning of verbal language, and it is from this consideration that further research can begin.

3.2. Verbal language as a modelling system

The fact that verbal language alone cannot exhaust all the dimensions of meaning-making does not mean that it is not possible to study languages as *immanent* organisations of forms. Instead, the path taken here to link linguistic theories (§1) to the architecture of LLMs (§2) should precisely confirm that a structuralist theory of language is not only possible but is also useful in *reproducing* language. However, it seems that the price to pay for an effective technical reproduction of language generation is that other possibilities opened by language might become more difficult to attend: for instance, the possibility of referring to states of affairs – what Eco calls the s*emiotisation of the referent* (Eco 1997), or forms of reasoning that are based on conceptual abstractions. For a GenAI system to *mimic* reference and reasoning, it must construct a plane of expressions of signs mediated by its linguistic competence, namely, the space of embeddings.

To better explain this dynamic, it is important to recall Lotman's idea of verbal language as the *primary modelling system* (Lotman and Uspenskij 1973). This feature is intended by the authors of the Tartu-Moscow semiotic school as a description of the *possibility of verbal language to translate all other semiotic systems into it*, and therefore as assessing verbal language as the semiotic system with the strongest *structuration* power in the semiosphere.

As is well known, this idea has been criticised by Sebeok (1988), who asserted that the systems of verbal signs could not be considered primary because, both phylogenetically and ontogenetically, verbal language is secondary and therefore dependent on other zoosemiotic systems of signs. On this matter, Sebeok is right: other systems of signs do indeed participate in our experience, scaffolding our cognition (cf. Paolucci 2021a) and allowing us to construct meaningful semiotic niches in which we, as human beings, can act. Also, in the case of GenAI, one could argue that verbal language is secondary to the technical *assemblage* that enables the transformer to operate, or to the data that texts are transduced into for the system to function.

However, the biosemiotic critique of the concept does not challenge two key aspects of the Lotmanian idea: the *potential* for *intersemiotic translation* enabled by verbal language and its semiocultural role in our lived and shared experience. The arguments presented by Sebeok and biosemiotics can be valid when aiming to de-anthropomorphize our view of meaning-making practices or when it is necessary to focus on semiotic aspects that cannot be reduced to the mechanisms of verbal language; however, they do not capture the social importance of verbal language.

The claim that language can be described as a biosemiotic faculty emerging from evolutionary dynamics does not encompass all semiotic dimensions and dynamics of language. Let us take, for instance, the notion of *ratio facilis* systems (Eco 1975), which are described as systems operating with a type-token dynamic *encoded within* the system itself. This notion allows to conceptualise verbal language as something that functions independently of the substance of expression upon which it is realized; although it is true that different substances of expression will allow different possibilities of meaning – effects of temporality, or nuances of connotation derived by different *textualization practices* (De Angelis 2010) – verbal language is the only semiotic system that can be completely disembodied and still function properly (cf. Paolucci 2021a).

This reinforces the idea of verbal language as a primary modelling system – in the sense that it can *translate* every other semiotic system – and explains why LLMs can *perform actions* they would not otherwise be able to, such as *mimicking* the cognitive activity of *reasoning* through language. Normally, cognitive systems cannot be described without reference to the *ecology of relations* in which they emerge as *agents*: these relations encompass embodied mechanisms and situated environmental interactions. However, *through language* and the ability to *generate semantically coherent utterances*, GenAI can mimic complex semiotic behaviours, such as logical reflection or conceptual elaboration.

This is not only due to their powerful capabilities in statistical modelling and pattern recognition, but also to *the way language works*. Since verbal language is a *primary modelling system*, it can translate all other semiotic systems, and *it has*, *culturally*, already *done so*; at least *with sufficient quantity* for an artificial neural network to reproduce its structures and use them as a basis for future utterances.

3.3. Technical mediation of linguistic competence: hallucinations and the problem of reference in Generative AI

It has been noted how the structuralist hypothesis – both in semiotics and in distributional semantics – allows for the conceptualisation of language as an immanent object of study. This depends on the fact that language is structured through a series of interdependencies: this relational constitution of language allows it to function without a referential correspondent, because all linguistic elements can be described in terms of other linguistic elements.

Clearly, one has to hypothesize an intersubjective transcendent plan in order to make language work, because otherwise *communicative acts* would not be possible. However, this condition does not extend to minimal, intratextual *semantic coherence*. When Eco (2007) affirms that an exhaustive semantics should include pragmatics and inferential models, he is not wrong; however, a system that only works via linguistic relations works *sufficiently well* to have a *working semantics*.

This idea allows for an interpretation of *hallucinations*, or perceived performance failures, in LLMs. It is argued here that the phenomenon of hallucination, where LLMs generate factually incorrect or illogical information while maintaining impeccable grammatical and contextual coherence, is not a manifestation of a semantic crisis, nor an argument for a Chomskyan Universal Grammar. It demonstrates that meaning can operate independently of reference or logical principles (Eco 1984). LLMs decode meaning from statistical patterns and contextual likelihood, rather than from correspondence to truth conditions. While they can perform complex tasks and *mimic* reasoning capabilities, their output derives from *intertextual relationships established in their datasets* and lacks the mechanisms necessary for systematic external validation. There isn't a representation of a state of affairs, not even when they produce a successful act of reference. This, however, is not a crisis or a malfunction, but *an ordinary feature of verbal language*, which does not need a referent to work in a syntaxically correct and semantically coherent way.[11]

Conclusions

Some conclusions can now be drawn. First, it is important to note that the term *generative* in *Generative AI* cannot be shown to relate to Chomskyan or Greimasian generativity, as the three occurrences denote different processes. However, thanks to a reconstruction of the theoretical relations among fields that work *with* and *on* language, it has been possible to identify certain structural characteristics of verbal language that enable GenAI systems to function. Specifically, the characteristics that allow different languages to undergo distributional semantic analysis are the ones that enable LLMs to function. However, to understand and describe the *concrete act of sign production* that is manifested by GenAI-powered Chatbots, it is necessary to appeal to the notion of *competence* as a *potential ability* to perform linguistic acts.

This competence in GenAI chatbots is technically mediated: if LLMs can be seen as *dispositifs* that mediate a topological semantic space in which embeddings *encode* meaning, the Transformer can be interpreted as the engine that enables a coherent, naturally-like production of texts (be it an interaction with a user, the production of

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[11] It is true that this demonstrates that we cannot produce acts of reference only through language – but, for a semiotician, this should not come as a surprise.

a report, a long text, or the review of a series of results from an online query). Rather than *reasoning*, GenAI-powered chatbots *manipulate linguistic data* by computing embedding values, transforming a virtual dimension of meaning into concrete linguistic expressions that make sense. This *competence* is inscribed in material *dispositifs*, technical assemblages made of heterogeneous elements (the engineers' knowledge, material elements, data, human curation…). Real-world meaning-making practices are anchored in social contexts and forms of life and extend beyond linguistic representation, even though language constitutes a semiotic system capable of translating other semiotic systems into a system of forms.

Many more dimensions of meaning remain unanalysed: three will be listed here, as an indication for further research in the field. The first requires an analysis of the dynamics of GenAI systems, understood as technically reproducing a *stochastic modelling of Norms*, in the sense attributed to this concept by Coseriu (1952). As opposed to the Chomskyan concept of constitutive rule, the true level of intervention in which semiotics can work is that of conceptualizing the dimension of *norm* as a dimension of mediation between the *scheme* of the *langue* and the *empirical manifestation* of the *parole*, in both ways, considering *Use* as this mediating dimension. The notion of *norm* reveals the *Langue-Parole* opposition not as privative but as a co-implication between a structured system and its elements, thereby highlighting the profound sociality of sense even in seemingly individual or *non-human* manifestations. Since LLMs are designed to work in interaction with humans, they must adapt to the normal functioning of language: this means that LLMs as well have to adapt to *how language is actually used by speakers*, and not construct an idealistic scheme of language detached from the real use of it. In this direction, the ability to learn through pattern recognition allows the system to analyse the data we produce when we interact with it – even if users don't notice this process. Moreover, for semiotic research on norms, particular interest lies in empirical studies such as that conducted by Yakura *et al.* (2024) that measure the incidence of GenAI lexicon in non-GenAI contexts: exposure to AI-produced texts might affect our word choices in everyday communication. Beyond technophobic preoccupations with how AI might harm our ability to think, this rapid cultural echo of GenAI language choices could be a noteworthy phenomenon to study through the lens of cultural semiotics.

The second concerns the applicability of the Greimasian generative trajectory of sense to GenAI products. The most plausible hypothesis is that the Greimasian model enables analysis of texts produced by GenAI systems, not because these models can reproduce it, but because it is a model that describes the unfolding of sense in the anthropological dimension of *lived sense*. This means that whenever we appreciate a portion of the world that *makes sense to us*, we can apply the Greimasian model to enhance its intelligibility. However, as we pointed out earlier, it would be wrong to apply the notion of Greimasian generativity to the process of text generation.

Finally, a research direction could involve the mediation of the technical *dispositif* and how its technical folds (cf. Latour 2012) can mask its network of mediations. GenAI chatbots combine this *dispositif* with an extremely user-friendly interface in which the artificial agent is only seemingly transparent: the fact that it can be activated and functions according to prompts constructed in our natural language creates an effect of *trust* and *reliability*. Through the semiotic analysis of the *dispositif*, this transparency of use appears as an opacification of its mechanism, masking a series of technical components. Thanks to its design, we do not perceive a semiotic mediation, even when all of its dimensions – from the theoretical background, through the technical folds, to its *effects* of meaning – can be described in a semiotic fashion.

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