STUDIA SEMIOTYCZNE (SEMIOTIC STUDIES), 38(1), 175–199
ISSN 0137-6608, e-ISSN 2544-073X
DOI: 10.26333/sts.xxxviii1.10

Article

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# SOUND AS MODULATING REALITY: A SEMIOTIC AND PHENOMENOLOGICAL APPROACH TO ELECTROACOUSTIC MUSIC

SUMMARY: This paper explores the semiotic and phenomenological dimensions of sound, positioning it as a modulating reality, rather than a fixed entity. Drawing from Henri Pousseur's theory of *generalized periodicity* and Michel Butor's intermedial poetics, we examine how electroacoustic music challenges conventional frameworks of composition and perception. Integrating Peircean semiotics, existential phenomenology, and cybernetics, we demonstrate how sound functions as a dynamic sign system that reshapes meaning through interaction and transformation. We introduce the concept of *spectral semiotics* as both an analytical and epistemological tool for understanding how sonic meaning emerges through the modulation of spectral qualities—frequency, timbre, and temporal flux—as experienced through focused, embodied listening. Special attention is given to *8 Études Paraboliques*, which exemplifies sound as a recursive, self-organizing system of modulating relationships. We also draw on *Votre Faust: Fantaisie variable genre Opéra*—not for comprehensive analysis, but as an *object of comparison* in the Wittgensteinian sense—to illustrate how intermedial strategies and open forms reinforce the epistemological potential of sound. This perspective aligns with Jean-Luc Nancy's concept of listening as resonance, where sound is not merely received but co-constituted through perception. By foregrounding fluidity, impermanence, and intermediality, we propose that sound—both in music and literature—functions as a modulating reality that actively shapes experience, cognition, and the aesthetic imagination.

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KEYWORDS: sound, spectral semiotics, semiotics, electroacoustic music, cybernetics, generalized periodicity, *8 Études Paraboliques* [Eight Parabolic Studies], Henri Pousseur, Michel Butor.

## 1. Sound as Semiotic and Phenomenological Construct

Sound is ephemeral. Unfolding in time, it vanishes the moment it appears. Yet its impermanence does not lessen its impact; rather, it intensifies its presence. In electroacoustic music, this fleeting nature of sound becomes even more accentuated. Detached from traditional instruments and liberated from fixed notation, sound evolves into an autonomous, mutable entity. It is no longer merely an expressive tool, but a dynamic material that shapes perception, invites interpretation, and modulates reality itself (Pousseur, 1970).

This paper explores how the emergence of electroacoustic music transforms the very ontology of sound, shifting our understanding from object to process, from fixed identity to fluid becoming. We engage with semiotic and phenomenological frameworks to analyze how sound operates in Henri Pousseur's music—not as a representation of something else, but as a *modulating reality*: a force that continuously alters both the listener's experience and the structures through which meaning emerges.

To support this view, we draw on Charles Sanders Peirce's triadic semiotics, which defines meaning as the interplay between a sign (*representamen*), its *object*, and the *interpretant*—the response evoked in the perceiver (Peirce, 1931–1958). This model emphasizes the relational and processual nature of signification. In electroacoustic music, sound often functions across all three dimensions simultaneously, generating meaning not through pre-established codes but through interaction with context, perception, and technological mediation (Tarasti, 1994; 2015, pp. 59–60).

We also incorporate Eero Tarasti's existential semiotics, which introduces the concepts of *Sein* [being] and *Schein* [appearance] to highlight the ontological depth of signification. Tarasti emphasizes that musical meaning arises through tension and transformation—sound is never fully present but is always becoming, suspended between what it is and what it could be (Tarasti, 2015, pp. 3–38). His notions of *pre-signs* and *post-signs* reflect how musical signs traverse temporal horizons, resonating with the phenomenological insights of Edmund Husserl (1990) and the resonant ontology of listening articulated by Jean-Luc Nancy (2007).

Henri Pousseur was a pioneering figure in conceptualizing sound as a modulating entity, deeply embedded in the aesthetic and technological transformations of the twentieth century. His influence on electroacoustic music stems from his insistence that sound should not be treated as a discrete object, but as a continuous material, capable of transformation through technological and compositional

intervention. In *Naissance et développement de la musique électronique*, published in the volume *Fragments théoriques* (1970, pp. 79–189), Pousseur argues that electronic music should not be seen as a separate discipline, but rather as an extension of musical practice—one that enriches and reshapes compositional methods. He emphasizes that electronic sound is inherently fluid and multidimensional, breaking free from the constraints of traditional notation and embracing a process-oriented logic in which the act of sonic transformation holds as much importance as any final structure.

This approach aligns with semiotic theories that highlight the instability of meaning: in this view, the significance of sound is not fixed, but constantly renegotiated through *interaction* and *perception*. Pousseur's thought demonstrates that sound is not merely an aural event, but a modulating force that interacts with its environment and the listener. It embodies a state of continual becoming, challenging traditional models of musical structure and authorship, and reinforcing the idea that music, particularly in its electroacoustic form, is a living, evolving entity.

Contemporary electroacoustic music thus challenges aesthetic frameworks grounded in permanence and repetition. Unlike classical compositions based on stable forms and repeatable scores, electroacoustic works often exist in flux, constructed through digital manipulation, spatial diffusion, algorithmic variability, and real-time processing. This impermanence is not merely a byproduct of technology but a central aesthetic stance, one that resonates with poststructuralist and phenomenological approaches to art and perception. Nancy's concept of listening as exposure—*être exposé*—describes the listener not as a recipient of a fixed object, but as someone opened up, affected, and reconfigured by sound's unfolding presence (Nancy, 2007; see also Tarasti, 1995).

Electroacoustic music reinforces this by often severing the sonic event from a visible source, inducing what Pierre Schaeffer termed *acousmatic listening* (Schaeffer, 1966), and what Michel Chion later developed into the concept of *écoute réduite* (Chion, 1983). Detached from cause, sound becomes a field of pure potential—interpreted not through recognition, but through attentive immersion. Therefore, we propose the metaphor of *sound as skin* (Nancy, 2020; Reybrouck, 2024), to highlight the tactile and immersive dimension of listening. Just as skin functions as both boundary and contact zone, sound in electroacoustic music acts as an interface between perception and reality, shaping and being shaped by the listener's attention and environment. In this way, electroacoustic sound becomes a site of continuous negotiation: between *being* and *appearance*, *signal* and *sign*, *structure* and *sensation*.

This aesthetic of impermanence is also central to the work of contemporary composers who engage with real-time synthesis, interactive technologies, and site-specific installations. These works resist fixity; they are co-constructed through each new interaction between sound, space, and listener. Meaning is not embedded within the work itself but arises as an emergent property produced by the encounter. This aligns with poststructuralist theories of signification (e.g.,

Derrida, 1976), which argue that meaning is constantly in flux, continually deferred and reinterpreted.

By integrating semiotic, phenomenological, and electroacoustic perspectives, we arrive at a new understanding of sound as a dynamic, modulating reality. Pousseur's theories provide a foundation for reconsidering the role of sound in both artistic and cultural contexts. Rather than adhering to static or hierarchical models of musical organization, sound emerges as a relational force—fluid, contextual, and resistant to closure.

As we move further into a digital era in which sound becomes increasingly detached from its physical origins and remediated through complex technologies, these insights become ever more relevant. Electroacoustic music, with its emphasis on transformation and impermanence, not only redefines compositional practice but also reshapes our perception of reality itself. In this way, sound transcends its function as an artistic medium and becomes a method of inquiry—a way to experience and interrogate the fluidity of existence.

To fully account for these dynamics, we propose *spectral semiotics* as a conceptual bridge between phenomenological listening and the spectral analysis of sound structures. In this view, sound is not only a temporal phenomenon, but also a continuously evolving field of spectral relationships—shaped by frequency trajectories, morphing timbres, and dynamic instabilities. Drawing from neurophenomenology (Varela, 1991; 1999) and embodied cognition, this approach emphasizes how meaning emerges from perceptual engagement with spectral detail. Sound becomes not just a sign, but a *spectrum of becoming*—where semiotic interpretation unfolds through dynamic modulation, situated attention, and experiential depth. This perspective is crucial for understanding the architecture of works like Pousseur's *8 Études Paraboliques*, where spectral evolution becomes the primary agent of musical meaning.

## 2. Henri Pousseur's Concept of Sound as a *Homogeneous Potential*

Henri Pousseur was among the first composers and theorists to challenge the discrete, note-based paradigm of Western music by proposing a view of sound as a *homogeneous potential*. This continuous malleable material resists static definition. His theoretical reflections, particularly in the essay *Naissance et développement de la musique électronique* (1970, pp. 79–189), articulate a vision in which electronic music is not a rupture with the past, but a natural extension of musical thought—a deepening of its expressive and structural potential.

For Pousseur, the shift to electronic sound marked a decisive ontological transformation in music: from fixed notational artifacts to evolving sonic processes. In his view, electronic music enables composers to engage directly with the physical properties of sound—frequency, amplitude, spectrum, and spatial distribution—without the mediating constraints of traditional notation. In this context, sound is not segmented into pitches or intervals, but unfolds as a field of potential transformation. This reflects a process-oriented approach in which

composition is not the inscription of fixed values, but the design of interactions within a continuously modulating acoustic continuum.

Pousseur's notion of *homogeneous potential* is closely aligned with Peircean semiotics, in which signs are defined not by isolated meaning but through a network of relational interpretation (Peirce, 1931–1958). Moreover, sound in Pousseur's framework is shaped by its dynamic interaction with other sonic events, listening contexts, and technological mediations. Eero Tarasti's existential semiotics reinforces this interpretation by emphasizing sound's ontological duality: it is both an object of perception and an existential signifier—a becoming that never fully stabilizes into meaning (Tarasti, 2002, p. 142; 2015, pp. 59–60). Meaning, in this model, is not extracted from sound, but emerges through lived engagement with its temporal unfolding.

This perspective necessitates a rethinking of compositional structure. Instead of linear development or harmonic closure, Pousseur embraces *modulation*—understood not merely as a shift in tonal center, but as a general principle of transformation operating across all musical parameters. For Pousseur, modulation encompasses spectral change, spatial movement, rhythmic morphing, and dynamic evolution. It is both a compositional tool and a philosophical stance, replacing hierarchy and permanence with relationality and flux.

Pousseur's electroacoustic works demonstrate this principle in action. His integration of acoustic and electronic sound sources avoids binary distinctions and instead supports fluid interaction. In pieces like *Rimes* (1958) and *Trois Visages de Liège* (1960), he combines live instruments, tape, and indeterminate structures to generate open forms. Chance operations here are not a rejection of authorship but a means of incorporating contingency into musical form. Unlike the theatrical indeterminacy of Berio or Stockhausen, Pousseur's aleatoric methods emphasize the continuity of sonic identity—ensuring that variability becomes a feature of process rather than disruption of structure.

Automation is also central to this compositional ecology. During his work at the Siemens Studio for Electronic Music in Munich (1966–1967), Pousseur developed systems in which algorithmic processes and human decision-making coexisted. He did not treat technology as a replacement for creative agency, but as an extension of it—a set of tools that could enhance the material engagement with sound while preserving interpretative flexibility. This triadic relationship between structure, chance, and automation, models a cybernetic aesthetics of composition that anticipates contemporary algorithmic practices and artificial intelligence.

Integral to this approach is the idea of *micro-macro structuring*: that is, the interrelation between small-scale sonic details (such as spectral inflections or rhythmic textures) and the emergent large-scale form they produce. This aligns with Peirce's semiotics of recursive signification, in which meaning is not deduced from any one level but emerges across scales through interaction and context. In Pousseur's music, harmonic and formal relationships are not pre-imposed but continuously unfold through timbral evolution and processual transformation.

His expanded harmonic language, including the use of microtonality, spectral interpolation, and non-tempered systems, resists codification. These choices reflect not only a technical expansion but an aesthetic commitment to openness. Pitch, rhythm, and form are treated not as containers of meaning but as conditions for sonic becoming. This aligns with Jean-Luc Nancy's conception of sound as an event rather than a substance—a force that exposes the listener to a world of sense without stabilizing into fixed content (Nancy, 2007).

Through this integrated framework, Pousseur redefines music as a relational, adaptive practice. The concept of *homogeneous potential* enables a compositional logic in which sonic material is shaped through transformation rather than inscription, and meaning arises through interaction rather than representation. Modulation, automation, and micro-macro structuring become not secondary techniques but foundational elements of this aesthetic. Sound, in this model, does not signify in isolation—it signifies in motion.

Pousseur's contribution remains essential today as digital technologies further amplify the fluidity and hybridity of musical materials. His insights provide both a philosophical and technical model for navigating a world in which sound is increasingly mobile, immersive, and interactive. As composition moves further into algorithmic, real-time, and spatial domains, Pousseur's theory of sound as a *homogeneous potential* continues to offer a compelling vision: one in which music is understood as a living process, and sound as a continuously modulating reality.

### 3. Generalized Periodicity and the Multidimensional Nature of Sound

A major contribution of Henri Pousseur's theoretical work is his reconceptualization of sound as a vibrational phenomenon, whose oscillatory nature provides a foundational metaphor for both musical structure and the dynamic processes of signification. By understanding sound not as a discrete sequence of pitches but as a continuous interplay of frequencies, amplitudes, and temporal envelopes, Pousseur bridges the physical properties of acoustic phenomena with philosophical, compositional, and semiotic concerns. This vibratory framework enables him to move beyond traditional categories of musical form and embrace modulation and transformation as both sonic techniques and epistemological tools.

Expanding on his concept of sound as a homogeneous potential, Pousseur introduces the idea of generalized periodicity in his essay *Pour une périodicité généralisée*, also published in *Fragments théoriques* (1970, pp. 242–290). This notion challenges the serialist rejection of repetition and symmetry, proposing instead a more nuanced model in which asymmetry and periodicity interact dialectically. Pousseur's approach does not revert to tonal regularity but reconfigures periodicity as a relational principle—an evolving pattern of recurrence that remains open to transformation across multiple dimensions of sound.

Critiquing the totalizing logic of early serialism, Pousseur observes that the attempt to eliminate periodicity in the name of progress often produced aesthetic sterility. Serialism's rigid asymmetry, while expanding compositional possibilities, also diminished the perceptual anchors that enable listener engagement. For Pousseur, periodicity is not a constraint but a perceptual affordance—a flexible structure that supports orientation, memory, and variation. His vision replaces structural rigidity with *fluid recurrence*—where patterns emerge, dissolve, and reconfigure in response to context.

This model aligns closely with Peircean semiotics, particularly the concept of *infinite semiosis*, in which the meaning of a sign is never fixed but constantly reinterpreted through a chain of interpretants (Peirce, 1955; see, also, Bankov, 2004). Just as signs evolve within a relational network, Pousseur's generalized periodicity treats sonic structures as provisional, recursive forms. The sonic signifier is not absolute, but open-ended—shaped through modulation, contrast, and resonance. As Tarasti (2015, p. 60) notes, sound functions both as an object of perception and an existential signifier that changes meaning as its context shifts—precisely the model of relational semiotic flux that Pousseur's theory supports.

Generalized periodicity thus emerges not as a technique but as a *multidimensional principle*—one that unites time, space, spectrum, and form into a continuous field of interaction. In this perspective, music is no longer composed along a single linear axis, but across multiple coexisting dimensions, each with its own periodic characteristics. Pousseur maps the following wave properties onto musical parameters:

- *Wavelength* corresponds to the duration or recurrence rate of musical patterns.
- *Amplitude* reflects dynamic intensity or expressive force.
- *Phase* refers to the temporal displacement or relational positioning of sonic layers.
- *A waveform* expresses the internal timbral morphology of sound, its evolving character over time.

By conceptualizing musical form through these interrelated wave-like parameters, Pousseur develops a spatialized, processual understanding of composition, in which events are layered and diffused rather than sequenced hierarchically. This resonates with Umberto Eco's idea of the *open work* (Eco, 1989), wherein the meaning of an artwork is not imposed by structure but emerges through interaction between the work and its interpreters. Pousseur's music, like Eco's literary model, invites multiple trajectories of engagement, allowing sonic forms to function as provisional, perceptually activated constellations.

This multidimensional framework also reflects the Fourier-based conception of sound, which understands all complex acoustic events as the sum of simultaneous oscillations at various frequencies. For Pousseur, this becomes both a scientific and aesthetic model: each musical event is nested within micro and macro-periodicities that form an evolving harmonic landscape. These interac-

tions are not imposed from above but arise through the interaction of discrete sonic gestures—modulated in time, shaped in space, and perceived through embodied listening.

Here, Jean-Luc Nancy's philosophy of listening as exposure and resonance provides further insight. According to Nancy, sound is not an object, but a force of opening: "To be listening is to be straining toward a possible meaning, and not to be caught in a fixed reception of it" (Nancy, 2007, p. 11). Pousseur's periodic structures function precisely this way—they do not convey a stable message but modulate attention, opening zones of perceptual and cognitive resonance. His music does not illustrate concepts; it *enacts* the process of meaning as becoming.

Pousseur's emphasis on *phase relationships* among sonic layers reinforces this dynamic. When multiple waveforms interact—whether acoustically, electronically, or perceptually—they generate interference patterns that evolve continuously. This becomes a metaphor for musical experience itself: meaning arises not from fixed relationships but from *interference* and *resonance*, where perception shapes and is shaped by sound's multidimensional unfolding. Such fluid structuring echoes Nancy's (2007, pp. 31–32) idea of resonance as the condition of meaning: a surplus, a spacing, a reverberation rather than a statement.

In his compositions, this model is realized through complex superpositions of sonic layers with independent temporal, spectral, and spatial properties. The result is music that resists closure, defers resolution, and foregrounds *transformation as structural logic*. Works such as *Scambi* and *Votre Faust: Fantaisie variable genre Opéra* exemplify this open, recursive approach. Rather than prescribing a single path, they configure networks of relationships, inviting listener agency and interpretive variation. In this model, the listener becomes not a decoder but a co-creator or co-composer of musical meaning.

Pousseur's theory also provides a critical alternative to both tonal determinism and abstract formalism. By reintegrating *harmonic reference* within generalized periodicity, he avoids nostalgia while reclaiming music's *communicative dimension*. For Pousseur, harmony is not an inherited convention but a *relational force*—a dynamic of tension, release, and transformation operating within an evolving field. This view aligns with Tarasti's existential semiotics, in which musical meaning is always in negotiation between *Sein* [being] and *Schein* [appearance], between internal necessity and external appearance (Tarasti, 2002, p. 142).

Ultimately, Pousseur's theory reframes music not as a closed formal language, but as an open system of perceptual and semiotic processes. Generalized periodicity becomes a structural metaphor for reality: composed of oscillations, shaped by resonance, and continually renewed through interaction. His concept resonates with both scientific and philosophical models of complexity, drawing on acoustics, cybernetics, and phenomenology to articulate a theory in which sound is not just a carrier of meaning, but its dynamic condition of possibility.

## 4. Pousseur's *8 Études Paraboliques*: A Cybernetic Model of Modulating Reality

The integration of *cybernetics* into music composition represents a radical shift from traditional, subject-centered aesthetics to models of self-regulating systems, where sound is not merely a composed object but an evolving entity shaped by feedback, modulation, and adaptation. Rooted in Norbert Wiener's foundational work (Wiener, 1948), cybernetics explores systems of communication and control in both living organisms and machines, emphasizing circular causality, homeostasis, and self-organization. This framework offers an understanding of music as a complex, open system where outcomes are contingent, historically embedded, and structurally nonlinear—marking a pivotal departure from classical notions of authorship and musical structure.

In this context, music composition aligns with the principles of non-trivial machines, as theorized by Heinz von Foerster (2003), in which outputs are not deterministic but contingent on internal states and external stimuli. By applying these principles, Pousseur's work exemplifies how sound can function within adaptive frameworks, where meaning and structure are continuously reshaped through recursive interactions between human agency and technological mediation. This approach dissolves the boundaries between composer, performer, and listener, transforming composition into a dynamic process rather than a fixed artifact (Chagas, 2014, pp. 65–102) and introduces an adaptive feedback-driven model in which sound is not merely the result of compositional design, but an emergent property shaped by modulation and transformation.

Henri Pousseur's *8 Études Paraboliques* (1972) exemplifies a radical reconceptualization of electroacoustic composition as a cybernetic field. Rather than generating fixed sound objects, these studies embody a self-regulating sonic environment governed by interdependent oscillations and recursive feedback. Sound in this model is not transmitted from composer to listener in a linear fashion, but continuously shaped through modulation, perception, and intervention.

Composed at the WDR Electronic Music Studio in Cologne, the *Études* were produced without tape splicing or montage—unusual for the time. Instead, Pousseur relied on voltage-controlled oscillators and modular synthesis patches that permitted continuous control over parameters such as frequency, amplitude, phase, and spectral shape (Pousseur, 2002, p. 105).[1] The result is a sonic contin-

[1] Voltage control, a key innovation in analog synthesis during the 1960s, revolutionized electronic music by enabling greater flexibility in sound generation and manipulation. Based on the application of small electrical currents to electronic components, voltage control allows for both audio and control signal processing. While the audio signal is converted into audible sound, the control signal—an inaudible electric flow—modulates various parameters, such as pitch, amplitude, and timbre. This modular design, first commercially popularized by the Moog synthesizer, enabled composers to create complex and evolving soundscapes by dynamically interconnecting different synthesis modules. The principles of voltage control persist in contemporary digital and software-based synthesiz-

uum in which textures evolve organically, rather than by discrete gesture or formal juxtaposition. His decision to avoid edits ensures that the music unfolds as a real-time process, aligning with his broader aim of positioning sound as a living, modulating presence (Chagas, 2014, pp. 115–116).

This compositional strategy is best understood through the lens of *generalized periodicity*, which, as discussed in *Fragments théoriques* (*Pour une périodicité généralisée*; Pousseur, 1970, pp. 242–290), redefines periodicity not as a fixed recurrence but as a dynamic, multidimensional logic. Drawing on Fourier analysis, Pousseur treats every sonic structure as a sum of micro-oscillatory components that interact to form macrostructural fields. These fields are neither static nor predictable but behave as self-regulating modulations—intensifying, diffusing, and reappearing with variation, like waves across time and spectrum.

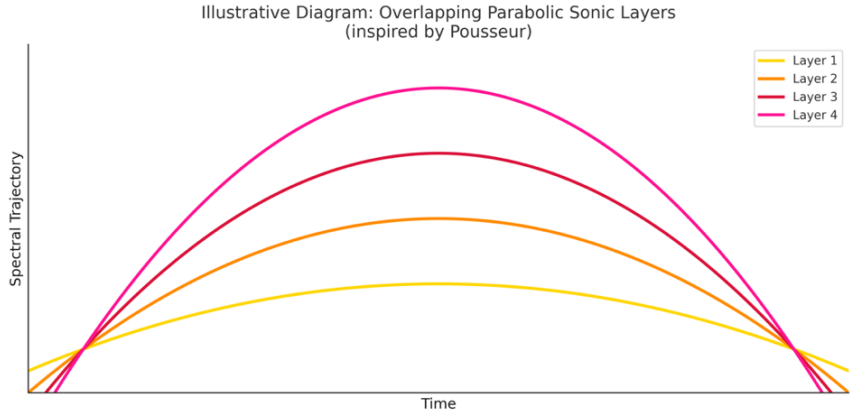
Such behavior parallels Foerster's concept of non-trivial machines: systems whose outputs are influenced not only by inputs but by their own internal states and histories (Foerster, 2003). Each sonic event in the *Études* alters the framework for what follows, producing a recursive structure that adapts both to itself and to the interpretive context of the listener. The composition becomes an autopoietic environment—self-organizing and historically contingent (Foerster, 2003, pp. 213–218).

This structure is particularly evident in *Étude I* (*Les Ailes D'Icare*), where an initial low-frequency pulse gradually unfolds into an elaborate frequency spectrum. Modulation occurs across multiple domains—pitch glissandi, amplitude envelopes, and wave morphologies—all contributing to an evolving texture. As seen in the spectrogram simulation below, the frequency curve follows a parabolic arc, illustrating Pousseur's tendency to shape musical form not through theme and variation but through spectral trajectory (Figure 1).

ers, remaining one of the most widespread methods of sound synthesis and control (Chagas, 2014, pp. 115–116).

**Figure 1**

*Spectrogram simulation of a parabolic frequency gesture inspired by Henri Pousseur's* Étude I *from* 8 Études Paraboliques




*Note*. Source: authors' own elaboration.

This visual representation illustrates a symmetrical spectral rise and fall, simulating Pousseur's use of continuous modulation and generalized periodicity. Rather than rigid cycles, form is shaped through evolving oscillatory intensities.

Pousseur's compositional notes (2002) confirm this aesthetic, describing the *Études* as continuous sound fabrics, woven from recurring sonic characters, rather than variations on a defined material.[2] Each piece is constructed from modulated waveforms—grains of sound that rise, morph, and dissolve according to internal logic. These transformations, governed by frequency modulation (FM), phase shifting, and amplitude sculpting, are often layered in dynamic polyphonic structures.

This poietic approach is especially vivid in *Étude V*, *Mnémosyne disparue*, which draws upon the metaphor of submerged memory. Here, spectral fragments rise and fall through recursive echoes, filtered textures, and elongated glissandi. The result is a musical surface that seems to forget and remember itself—a sonic dramatization of temporal dislocation and perceptual flux. Interpreted semiotically, this structure reflects a Peircean model of signification: the sonic event (*rep-*

[2] The quote means that the étude was not built through planned variations but rather developed organically, like an intricate fabric whose recurring musical figures emerged naturally without conscious control or imposed boundaries:

> As I wrote above, this étude involves no intentional variation and is developed rather from a "tapestry-like" texture, with a "woven" or "knitted" character, marked by the perpetual recurrence of diverse figures; I have not sought to give a representation of these, still less to set their limits. (Pousseur, 2002, p. 196; translated from French to English by the authors of the current paper)

*resentamen*) acquires meaning not in isolation but through a dynamic interplay with both its sonic context (*object*) and listener perception (*interpretant*) (Peirce, 1955; Tarasti, 2015, pp. 59–60).

This recursive logic resonates with Jean-Luc Nancy's ontology of listening. According to Nancy, sound "is meaning in the act of its arrival" (Nancy, 2007, p. 11). The *Études* enact this principle: they do not deliver pre-encoded messages but unfold as emergent forms, exposing the listener to a continuously modulating field of potential.[3] In this way, sound becomes a surface of encounter—a liminal skin—where perceptual and semantic boundaries blur (Nancy, 2020; Reybrouck, 2024).

Although the *Études* were originally untitled, Pousseur later gave each a metaphorical name to reflect their poetic and structural character. In his essay *Die Zeit der Parabeln* (2002), he proposed the following designations. The numbers in parentheses indicate the approximate duration of each *étude* in minutes and seconds:

- *Étude I: Ailes d'Icare* (Icarus's Wings)—evoking mythic elevation and spectral descent (31:22);
- *Étude II: Liebesduett* (Love Duet)—portraying interwoven sonic dialogue (28:17);
- *Étude III: Viva Cuba*—infused with rhythmic vitality and cultural color (23:34);
- *Étude IV: Voyage aux Éléments* (Journey to the Elements)—evoking natural forces through timbral shifts (38:23);
- *Étude V: Mnémosyne disparue* (Mnemosyne Disappeared)—a meditation on loss and memory (28:08);
- *Étude VI: Hymne à Zeus ornithologue* (Hymn to Zeus the Ornithologist)—filled with bird-like gestures and mythic allusions (21:08);
- *Étude VII: Aerial View of Haiphong, Massachusetts*—a surreal, multi-perspective soundscape (36:19);
- *Étude VIII: An Heinrich, Ping-Pong*—driven by back-and-forth rhythmic interplay (21:22).

[3] This multi-stable, modulating field of spectral interactions invites a mode of listening that is inherently polyphonic—not in the traditional harmonic sense, but in the phenomenological simultaneity of coexisting auditory trajectories. As demonstrated in the analysis of Josquin des Prés' motets, the intertwining of spectral and temporal structures establishes a perceptual dynamic already nascent in early polyphony, where informational density operates as a mode of temporal articulation and aesthetic openness. For a historical perspective on the perceptual and structural interplay between spectral and temporal dimensions in polyphonic music (Chagas, 2003).

These poetic titles serve as a symbolic interface between concept and form. They enrich the electroacoustic experience by guiding the listener toward metaphorical associations, while reinforcing the fluid, cybernetic dramaturgy that shapes each *étude*. Henri Pousseur's *8 Études Paraboliques* [Eight Parabolic Studies], available as stereo reductions of the original four-channel electronic compositions via the YouTube playlist *Eight Parabolic Studies* (Pousseur, 1972), exemplify his exploration of generalized periodicity, electroacoustic modulation, and recursive compositional structures.

Ultimately, Pousseur's composition model leads to a reconception of musical form itself. Rather than relying on prescriptive structures or algorithmic finality, Pousseur's *Études* operate as an ecological system of interdependent modulations. Each listening encounter becomes an act of co-creation, where structure emerges through participation, feedback, and historical contingency. Pousseur's lasting innovation lies in his synthesis of technical, philosophical, and poetic logics. His analog modular methods anticipated contemporary practices in live coding, spatial audio, and algorithmic improvisation. Yet beyond technique, his work articulates a sonic epistemology—a cybernetic metaphor for being: adaptive, emergent, and open to transformation.

At its core, Pousseur's work integrates the principle of generalized periodicity, which extends beyond fixed musical structures into wave-based interactions. Drawing from *Fourier analysis*, Pousseur treats sound as an assemblage of multiple oscillatory movements, where microstructural frequencies interact to form macrostructural periodicities. This method aligns with analog synthesis and digital signal processing, where sound is not conceived as discrete events but as a continuous flux of modulations and interferences. Pousseur's serial and parallel connections of oscillators enabled the creation of complex and unpredictable rhythmic and harmonic relationships, forming an interactive sound architecture that resists finality or static meaning (Chagas, 2014, p. 115).

Foerster's non-trivial machine model offers a direct analogy for this approach: while trivial machines maintain predictable input-output functions, Pousseur's *Études* operate as a historically contingent system, where each sonic event transforms subsequent iterations through ongoing feedback (Foerster, 2003). This recursive structure not only shapes sound production but also extends into the listening process, where each audition modifies the interpretive frame of the listener, reinforcing Pousseur's concept of music as a living, evolving system (Chagas, 2014, pp. 113–114).

Pousseur's *8 Études Paraboliques* function as evolving cybernetic systems, where modulation, periodicity, and interaction form a self-organizing musical ecology. These works are best understood through theoretical models developed by Jean-Luc Nancy, Heinz von Foerster, and Umberto Eco, which illuminate the ways sound operates as a recursive, resonant, and open process. Rather than transmitting encoded messages, the *études* enact a sonic dynamic in which listening and form are co-constitutive. In this light, modulation becomes not merely

a technical method but a paradigm for perception itself—a continuous unfolding of transformation and emergence.[4]

### 4.1. Spectral Semiotics and the Modulating Ear: Spectral Analysis of *Étude Parabolique I*

Henri Pousseur's *Étude I: Ailes d'Icare* serves as a compelling case study for the application of spectral semiotics—a framework that foregrounds temporality, embodiment, and the phenomenology of listening as central vectors of musical meaning. Within this perspective, the "modulating ear" emerges not merely as a receptive organ, but as an active participant in the construction of sonic temporality and spectral meaning. In the context of *Étude I*, listening becomes an enactive, polyphonic, and time-constituting activity, in which spectrum and structure coalesce into a semiotic field of temporal becoming.

The *étude*'s central parabolic form—a slow spectral ascent culminating in saturation, followed by a dissolution into noise—embodies a temporal archetype deeply resonant with "spectrum consciousness" (Chagas, 2010). This spectral gesture operates on multiple levels of temporality. According to Husserlian phenomenology, these include the perceived object-events (morphing textures and timbres), the immanent temporal features of these events (such as frequency expansions and modulated trajectories), and the constitutive flow of absolute time that holds the listener in a state of attentive unfolding. The gradual unfurling of the parabola can thus be interpreted as a temporal object with a clearly articulated durational arc and internal unity—a sonic analogue of the mythic arc of Icarus's flight.

From a neurophenomenological viewpoint (Varela, 1999), the *étude*'s macrostructure activates three nested scales of temporal engagement. The ultra-slow frequency modulations operating over cycles exceeding 100 seconds correspond to Varela's "descriptive-narrative" time scale (≈ 10 s), allowing listeners to perceive the global arc of spectral expansion and retraction. Simultaneously, micro-level fluctuations—rapid phase interferences and evolving textures—engage the "elementary event" scale (≈ 0,1 s), producing a dynamic field of textural multiplicity that continuously modulates auditory focus. Between these poles, the study's middle saturation zone becomes a site of integrative simultaneity, evoking polyphonic multi-stability: a condition in which auditory perception juggles

[4] On the basis of the *8 Études Paraboliques*, Pousseur created a series of so-called *Paraboles-Mixes*—works in which individual *études* or elements from them are recombined with additional musical material, live performance, and visual elements. A significant number of these *Paraboles-Mixes* were performed during Pousseur's lifetime, often under his direct initiative or in collaboration with other musicians. An emblematic example is the *Parabole-Mix* that served as the foundation for the chamber music theater piece *Leçons d'Enfer* (1991), a work dedicated to the memory of Arthur Rimbaud and premiered on the 100th anniversary of the poet's death.

multiple frequency components, interference patterns, and modulatory vectors, producing a sense of emergent complexity from within the texture itself.

The idea of "spectral burnout",[5] as described in the piece's analysis, represents a critical phenomenological turning point. At this apex, the study does not climax in a traditional sense but collapses in on itself: coherence gives way to disintegration, and sonic identity dissolves into bands of filtered noise. In Husserlian terms, this is a moment where retention begins to fail—the decay of overtones and irregular pulses mirrors the "sinking back into emptiness" of temporal objects described by Husserl himself in *Zur Phänomenologie des inneren Zeitbewußtseins* (1966). In spectral semiotics, this translates into a semiotic attenuation: a breakdown of clear sonic signs into ambiguity, indeterminacy, and noise—a process of semiotic entropy.

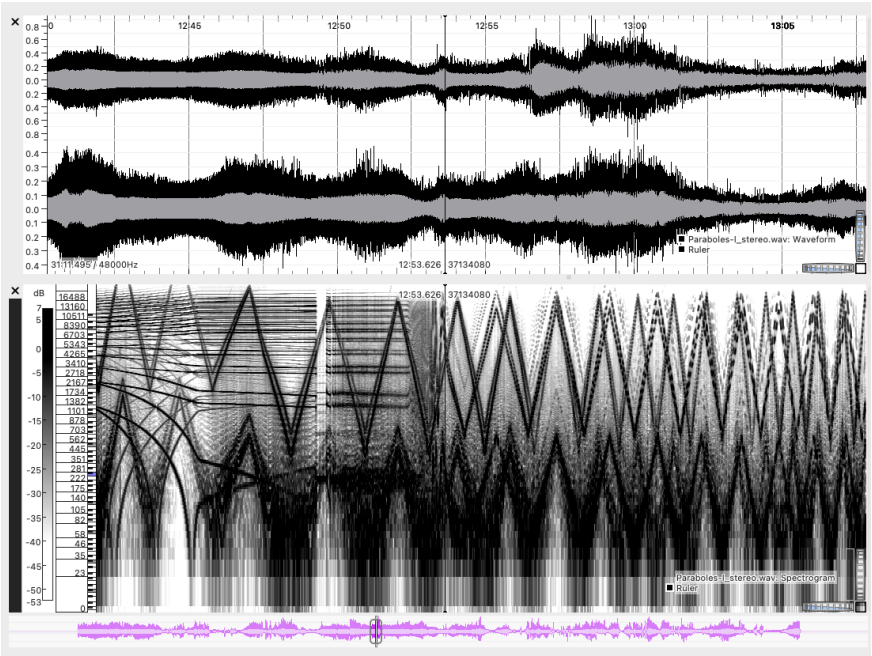
Importantly, *Étude I* also reconfigures the notion of climax. Rather than constructing meaning through dramatic peaks and resolution, it orchestrates a slow unveiling of spectral multiplicity, culminating not in fulfillment but in fragmentation. This resonates with the assertion that in digital sound art, temporality becomes "enacted" through bodily and cognitive engagement rather than formal closure (Chagas, 2010). The study, realized in continuous real-time interaction without montage, demands a mode of listening that is at once immersive and reflexive, attuned to fluctuation, decay, and the porous thresholds of perceptual stability.

Through its structural parabola, its modulation-based architecture, and its refusal of traditional teleology, *Étude I: Ailes d'Icare* exemplifies the core of spectral semiotics: a compositional thinking where spectrum, time, and signification merge in a dynamic interplay of form and dissolution. It sonic terms, this is "sound as enacted experience" (Chagas, 2010). The *étude* thus becomes not only an object of analysis, but a medium through which the modulating ear learns to perceive spectral time—not as static form, but as lived duration, a sonic echo of Icarus's flight through light and void (Figure 2).

[5] "Spectral burnout" refers to the moment in the sonic trajectory where excessive spectral density and modulation complexity lead to perceptual saturation. At this point, the listener's ability to distinguish individual frequency components collapses, producing a state of auditory entropy and semiotic indeterminacy.

**Figure 2**

*Spectrogram of Henri Pousseur's* Étude I: Ailes d'Icare*, excerpt from 12:41.866 to 13:07.839*

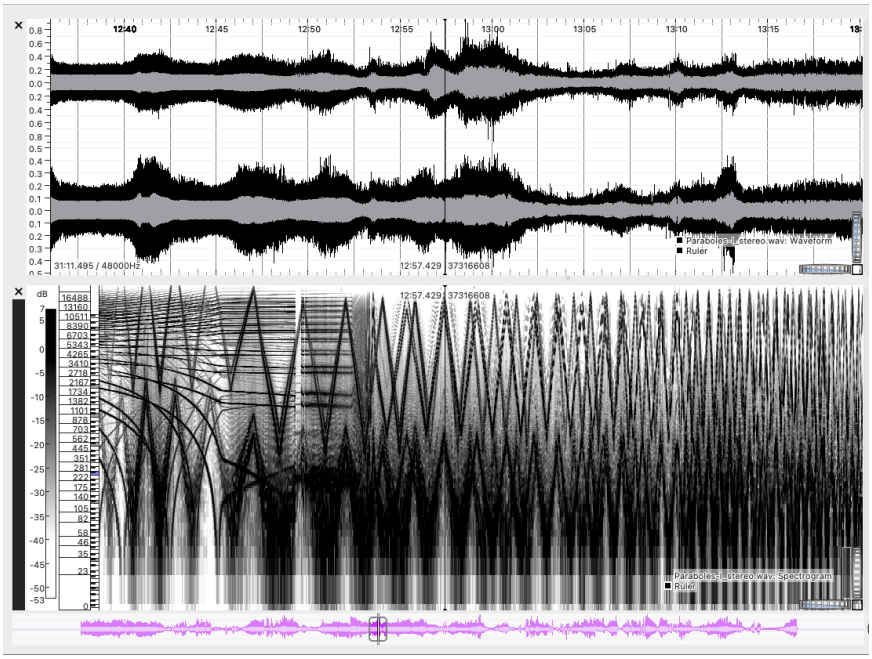



*Note*. Source: authors' own elaboration.

This segment illustrates the beginning of the *étude*'s central parabolic arc, where spectral density increases dramatically toward a state of saturation. The visual field displays multiple ascending harmonic trajectories, bifurcating modulations, and overlapping frequency bands—particularly between 600 Hz and 8 kHz—indicating layered frequency modulation and morphing timbres (Figure 3). The V-shaped harmonic patterns suggest periodic modulation cycles that progressively destabilize, leading to spectral thickening and rhythmic irregularity. This saturation zone corresponds to a perceptual threshold in which the ear must navigate polyphonic simultaneity and modulating instability. Interpreted semiotically, the spectrogram reflects the iconic shape of Icarus's flight, the indexical trace of gestural control, and the symbolic dissolution of sonic form into noise and entropy.

**Figure 3**

*Spectrogram of Henri Pousseur* Étude I: Ailes d'Icare*, excerpt from 12:57.429 to 13:20.170*




*Note*. Source: authors' own elaboration.

This segment captures the sonic apex of the *étude*'s parabolic form, where the accumulation of frequency modulations reaches a state of near-chaotic intensity. The spectrogram reveals a dense field of V-shaped harmonic trajectories, now tightly packed and overlapping across the spectrum from approximately 300 Hz to 12 kHz. These sharply articulated modulations, increasing in both rate and complexity, form a near-continuous vertical texture.

At this point, the modulation cycles intensify into a rapid pulsation, producing an almost rhythmic grid of spectral impacts. The sonic image becomes vertiginous: coherence yields to textural saturation, and the listener is immersed in a dynamic flux of competing partials and spectral bands. This culminates in a semiotic overload: the moment when the ear's ability to parse individual modulations collapses under the weight of simultaneity. In spectral semiotic terms, this is a threshold event—a critical mass of spectral data that forces the ear to shift from differentiated listening to embodied immersion. Philosophically, this apex enacts the fall of Icarus: what ascended as structure now burns into excess. The music does not resolve, but implodes into saturation signaling not closure but

exposure—a sonic space in which form disintegrates, and listening itself is pushed to its limits.

This point of emergence is crucial within the framework of spectral semiotics. In Husserlian terms, it marks a transition from retention-dominated temporality (where sound objects are still coherent and traceable in memory) to a protentional overload, in which excessive simultaneous signals blur expectation. The listener's intentional arc becomes strained under the weight of concurrent spectral stimuli, producing a state that verges on the *sublime* in its complexity and lack of formal containment. Sonically, this corresponds to what might be termed *spectral vertigo*: a moment where the modulating ear must relinquish analytic clarity and surrender to affective immersion. The modulations are no longer individually traceable; instead, they create a field of vibrating instability. The sound-object loses its discrete identity and merges into a spectral continuum—explained in a broader sense as a "flux of enacted temporality", a non-linear, embodied flow of time rooted in Varela's conception of enaction and the *specious present*, enacted through modulation, perception, and bodily engagement, and central to the aesthetic of digital and electroacoustic sound in spectral composition (Chagas, 2010, 107–127; see also Varela, 1999).

The pre-saturation phase is not merely a technical or structural transition—it enacts a philosophical one. The spectral body of the music, no longer stable or amenable to analysis through discrete frequency or temporal segmentation, enters what Jean-Luc Nancy describes as *l'écoute*: not merely hearing, but a mode of resonant exposure and relational sense-making—a listening into resonance, into the retreat or withdrawal of sound as it exceeds structural form (Nancy, 2007, p. 18). In this moment, the parabolic arc ceases to signify ascent or descent; it becomes a semiotic gesture marking the limits of sonic intelligibility—a threshold where coherent perception is destabilized and reconstituted. This marks the true onset of the *étude*'s climactic saturation: not a culmination achieved through accumulation alone, but a point at which saturation becomes meaningful, as a sonic metaphor for disintegration, overexposure, and the fragile boundary of embodied experience.

## 5. Intermediality and Open Structures: *Votre Faust* by Henri Pousseur and Michel Butor as Modulating Reality

At the core of the idea of sound as a modulator of reality is the recognition that sound is not a static entity but an evolving, relational phenomenon shaped by perception, context, and technological mediation. Henri Pousseur and Michel Butor's *Votre Faust: Fantaisie variable genre Opéra*—(1960–1968, revised in 1981) embodies this notion by rejecting a fixed narrative structure in favor of an open, dynamic form, where musical and literary elements engage in a continuous process of transformation. Their collaboration directly applies semiotic, phenomenological, and intermedial frameworks, illustrating how sound does not merely reflect reality but actively modulates it.

This section should not be considered an attempt at a comprehensive analysis of *Votre Faust*—an emblematic and complex work in Pousseur's output that would require an extensive, dedicated study. Rather, we treat it as an *object of comparison*, in the Wittgensteinian sense of a conceptual model that illuminates a broader set of theoretical concerns (Chagas, 2015, p. 126). This framing allows us to use *Votre Faust* as a referential and illustrative example, rather than the primary analytical focus.

Pousseur's polystylistic approach—integrating quotation, pastiche, and serial structures—complements Butor's literary techniques of fragmentation, intertextuality, and shifting perspectives (Coste, 2015, pp. 347–470). Their combined strategies reflect the semiotic and phenomenological principles explored in this paper, where meaning is not imposed but negotiated through engagement and interpretation. Through intermedial strategies, *Votre Faust* becomes a model of sound as a modulating reality, where auditory and textual forms merge into a continuously evolving artistic event. This interplay reinforces the notion that sound and meaning are never fixed, but rather, are consistently shaped by perception, interpretation, and interaction.

The concept of *opera aperta*, central to *Votre Faust*, aligns with Pousseur's *generalized periodicity* and electroacoustic experimentation. By structuring the work so that it unfolds in multiple ways, depending on audience participation, Pousseur and Butor enact a model where meaning emerges rather than being predetermined. This mirrors Peircean semiotics, where signs do not have fixed interpretations but evolve through a triadic process involving the *representamen*, *interpretant*, and *object*. The fluid structure of *Votre Faust* reinforces the notion that meaning is an open-ended, participatory process, paralleling how sound operates within electroacoustic and cybernetic frameworks.

Beyond its innovative form, the dialogue between Butor and Pousseur reflects a shared commitment to understanding music and literature as events rather than static objects. In this context, sound is not only a musical phenomenon but also a literary one, where composition and text function interdependently within a modulating structure. This perspective aligns with the argument that sound should not be viewed merely as an expressive medium but as an epistemological model for understanding reality itself (Butor, 1982, pp. 448–463).

Just as electroacoustic music treats sound as an ongoing process of modulation and transformation, Butor's literary strategies invite readers to navigate meaning through shifting textual landscapes. Their collaboration exemplifies how semiotic and phenomenological thought can be integrated into artistic practice. Butor's experiments with language parallel Pousseur's serialism and electronic manipulation, challenging traditional disciplinary boundaries and inviting participatory interpretation. This intermedial synthesis reinforces the broader theoretical claim of sound as a modulating reality—that sound, text, and meaning exist within a continuous state of becoming, shaped by perception, engagement, and interaction.

Furthermore, Butor's textual strategies foster a fluid and immersive reading experience that mirrors Pousseur's compositional approach, encouraging an open-ended listening. By incorporating layered structures and shifting temporalities, their collaboration destabilizes fixed interpretations, demanding a more engaged and dynamic reception from both audiences and scholars. This perspective reinforces the argument that meaning in art and music is constructed through active participation rather than passive consumption.

One of the key claims in *sound as modulating reality* is that sound should not be understood merely as a representation but as an active force that shapes reality. *Votre Faust* exemplifies this principle by blurring the distinctions between text and music, narrative and performance, and past and present. The opera's reliance on citation and polystylism mirrors electroacoustic music's use of sampled and synthesized sounds, fortifying the idea that composition is not about fixing meaning but about generating an evolving field of possibilities.

Moreover, Pousseur's *generalized periodicity* is embedded within the structure of *Votre Faust*, where motifs, themes, and textual fragments emerge nonlinearly, forming a network of associative and recursive connections. This approach aligns with the notion that sound operates as a dynamic system of relationships rather than as a fixed entity. In this sense, Butor and Pousseur's collaborative project serves as a concrete realization of the theoretical frameworks explored in this paper, demonstrating how artistic practice embodies semiotic and phenomenological concepts. Their work also highlights how intertextuality in literature and music creates a web of references and reinterpretations, resulting in multiple layers of meaning. The interaction between musical motifs and textual themes in *Votre Faust* provides a distinct mode of engagement, where the audience's perception actively reshapes the unfolding narrative. This corresponds with the broader claim that sound is an ephemeral yet foundational force in shaping human experience and artistic expression.

Considering the Butor-Pousseur collaboration, we can expand the discussion of electroacoustic music to encompass broader intermedial and post-structuralist issues. Their approach to open structures, participatory meaning, and intertextual soundscapes reinforces the central argument of this paper: that sound, like reality itself, is a modulating phenomenon shaped by interaction, transformation, and perception. This connection further deepens the exploration of sound as both a material and conceptual entity, bridging the divide between literary and musical experimentation. In this context, Butor and Pousseur's work functions as both a historical precedent and a continuing source of inspiration for contemporary artistic and theoretical inquiries into the nature of sound, meaning, and reality.

Furthermore, their legacy challenges traditional artistic categorization, demonstrating that the intersection of music and literature is not merely a stylistic experiment but a significant reconfiguration of meaning-making across media. By positioning *Votre Faust* within the framework of modulation, we can see that artistic forms are never entirely fixed but exist in a constant dialogue with their contexts, interpretations, and audience interactions. This perspective but-

tresses the idea that sound, in both its musical and literary forms, is an open and evolving structure that resists finality and promotes ongoing reinterpretation.

## 6. Conclusion: Toward a Semiotics of Modulating Reality

This paper has explored the idea of sound as a modulating reality through the lenses of semiotics, phenomenology, cybernetics, and intermediality. Rather than treating sound as a stable object or medium of representation, we have argued that sound should be understood as a relational, dynamic, and transformative phenomenon—one that shapes and is shaped by perception, interpretation, and technological mediation. Drawing on Henri Pousseur's theory of generalized periodicity, Jean-Luc Nancy's ontology of listening, and Charles Sanders Peirce's semiotic model, we have examined how sonic meaning emerges not through fixed structures but through recursive processes, evolving contexts, and embodied engagement.

Through the analysis of *8 Études Paraboliques*, we have shown how electroacoustic composition embodies this principle by foregrounding modulation, feedback, and spectral transformation as essential structural and expressive elements. The *études* function not as fixed musical forms, but as self-regulating systems that continually reshape themselves and the listener's interpretative perspective. They illustrate how sound can operate both as a material process and as a symbolic structure, unfolding in time while also pointing beyond itself. This duality encourages us to understand sound not merely as content but as a model for perceptual, semiotic, and epistemological processes.

One of the key contributions of this study is the introduction of *spectral semiotics*—an approach that situates the evolving spectral properties of sound (frequency, timbre, morphogenesis) within a semiotic framework grounded in embodied cognition and neurophenomenology. Spectral semiotics serves as both an *analytical tool*, allowing us to trace how meaning arises through the modulation of sonic materials, and as an *epistemological paradigm*, suggesting that reality itself can be understood as a field of modulating relations. In this view, the act of listening becomes a dynamic site of meaning-making, where the body and sound co-constitute one another through fluctuating states of resonance, attention, and transformation.

By considering *Votre Faust: Fantaisie variable genre Opéra* as a comparative object in Wittgenstein's sense (Chagas, 2015), we have highlighted how the interplay of text, music, and open form, reflects a shared commitment to modulation as an artistic and philosophical principle. The work of Pousseur and Butor exemplifies how intermedial composition can embody semiotic and phenomenological thought, challenging disciplinary boundaries and fostering participatory meaning.

Ultimately, when understood as a modulating reality, sound invites us to reconceive the boundaries between perception and composition, materiality and meaning, structure and improvisation. It calls for a new semiotics grounded in

transformation rather than stasis, in openness rather than closure. As both an artistic practice and a conceptual framework, sound reveals itself not as a static signifier, but as an evolving presence—one that resonates with the very instability, multiplicity, and contingency that define our contemporary condition.

## 7. *Coda—d'après Pousseur et Butor*: Music as Reality

Music is not merely a reflection of life; it is life unfolding, resonating, and dissolving into time. Music is not a distant echo of reality, but reality itself—in motion and transformation. It does not stand apart from the world like a framed painting on a wall, nor does it attempt to capture existence in stillness. Instead, it breathes, pulses, and expands—an art without borders, a fluid expression of what it means to perceive, to listen, and to be.

### A Sounding World

Reality is not a fixed landscape; it is a murmuring river, shifting and reconfiguring itself with each passing moment. In the same sense, music does not belong to the realm of permanence. It vanishes as it arrives, leaving only the imprint of its passing—a vibration in space, an echo in the mind. We do not hold music; we inhabit it. We do not possess it; we move through it, and it moves through us.

Music does not merely mirror reality; it enacts it. The rustling of leaves, the breath between words, and the distant hum of the city at dusk—all shape the contours of the world before we name it, before we comprehend it through language. Unlike the visual, which fixes and frames, the audible remains open, fleeting, and elusive. Music embraces this impermanence; it refuses to be pinned down and resists the constraints of static form.

### The Language Beyond Words

If words seek to enclose meaning, to define and delimit, music does the opposite—it unbinds and expands. Music challenges the dominance of the word, suggesting that sound, in its very formlessness, speaks a deeper truth. Language attempts to make the world comprehensible; music reminds us that reality is never fully grasped—only felt and encountered in its shimmering, shifting presence.

Like unspoken poetry, like thought before it crystalizes into speech, music reveals the undercurrent of existence—the unutterable, the unsayable. It is a language without syntax, a meaning without definition. It reaches where words fail, where reason hesitates. It is both fleeting and infinite, vanishing even as it creates new worlds.

## The Transformation of Life

To hear music is to feel time bending, stretching, and dissolving. Music does not merely represent life—it transforms it. It alters the way we inhabit space, sense movement, and understand silence. A single note can fracture the ordinary, and a melody can suspend the weight of time. We do not listen passively; we are shaped by what we hear.

And so, music is not only an art—it is an act of becoming. It does not settle, it does not conclude. It leaves us unfinished, constantly returning, perpetually searching. In this way, it is the most faithful reflection of life itself: transient, luminous, unknowable.

## A World Made of Sounds

Listening is an awakening. To open oneself to music is to step into the current of reality—not as an observer but as a participant, woven into the fabric of vibration and resonance. Butor's vision invites us to listen beyond the surface, to understand that sound does not exist apart from us but within us and that the world itself is composed of waves, trembling air, and voices calling and dissolving into the wind.

Music, then, is not something to be grasped nor a structure to be preserved. It is the unfolding of presence, the fleeting touch of eternity against the skin of time. Listening is witnessing the world as it is: in flux, in motion, in song…

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