



Other-than-Human Perspectives on *Écosystème(s)*: Towards an ecosemiotic approach to sound and media art

ESTELLE SCHORPP  and MATTHIEU GALLIKER 

Université de Montréal, Faculté de musique, Canada
 Emails: estelle.schorpp@umontreal.ca; matthieu.galliker@umontreal.ca

1. INTRODUCTION

Je pourrais donc dire que la vie n'est pas en moi ou dans le monde, mais qu'elle est entre le monde et moi. (Ferrari and Hansen 2017: 45)¹

Sound and new media arts appear to be both historical and contemporary means to invest in the notion of more-than-human. Although the concept was formulated in the late 1990s (Abram 1996), certain related practices in art works exploring machine or animal agency have existed since the 1960s, especially in new media arts using sound, video, and electronic and computational technologies.

On the one hand, as a reaction to the first cybernetic wave in the 1950s, robotic artwork emerged: *CYSP 1* is the first so-called cybernetic sculpture in the history of art designed by Nicolas Schöffer in 1956. Equipped with an *electronic brain* linked to sensors, the sculpture reacts to variations in sound and light. The polychrome plates used in the sculpture rotate in response to external stimuli, giving the work a living appearance. In 1968, the art critic and curator Jack Burnham drew up the profile of a 'systems aesthetic' as a relational perspective, linking together heterogeneous elements, technological devices and living organisms (Burnham 1968).

In these examples, the focus is on human–machine–environment interactions, rather than on objects as such. Happenings, installation art, video and sound art are all new forms of art based on a systemic and interactive thinking, on both technological and conceptual levels. This systemic perspective expanded in the poststructuralist era, where we saw the development of theoretical currents such as constructivist epistemologies, or the emergence of the notion of situated knowledges (Haraway 1988), which focuses attention on the unstable and dynamic components of human culture, and on the relationship between an observer and what they observe.

¹So I could say that life is not in me or in the world, but between the world and me' (personal translation).

On the other hand, in parallel with this systemic aesthetics in new media arts, the ecological question became increasingly present in the late 1960s, raising questions about our understanding and relationship towards the environment in general, as well as the animal world and 'so-called nature' (Parikka 2016). In the realm of sonic art, soundscape and acoustic ecology practices developed by the World Soundscape Project in the 1970s henceforth shape awareness of sound pollution and human sonic presence, giving the act of listening a new ecological perspective. Moreover, practices derived from bio-acoustics, whose figurehead is Bernie Krause, bring a new understanding of animal communication and agency through field recording.

Today, a large range of media art practices derive from the intersected legacy of systemic and ecological perspectives, exploring a more-than-human point of view on technology and/or nature. The wind-generated sound installation *Anémochories* designed by Estelle Schorpp, the works of the Berlin-based sound artists collective 'hands on sound', the cockroach-controlled robot designed by artist Garnet Hertz, and the work of circuit maker and sound crafter Léa Boudreau are examples of this diversity.

Following these historical legacies, the self-interactive sound installation *Écosystème(s)*, which constitutes the subject of the present article, explores the more-than-human sonic environment from both a systemic and an ecological perspective. Conceived by sound artist Estelle Schorpp in 2019, *Écosystème(s)* imitates sonic signatures and behaviours inspired by the communication techniques of orthopteran insects. The installation uses algorithmic processes to fabricate hybrid sound environments that imitate existing more-than-human sonic relationships, in a dialogue between artificial technologies and more-than-human ecosystems, while setting up a context for attentive human listening.

It is our intention to question the aesthetic, technical and conceptual strategies inherent in *Écosystème(s)* from different perspectives taken from post-humanist

theories, sound studies and ecosemiotics. In doing so, we aim to broaden the theoretical framework for thinking about the potentialities of sound and media arts, and propose the hypothesis that arts which engage with the more-than-human can participate in shaping new ways of attuning with sonic environments.

In order to meet this aim, certain concepts must first be clarified in the next section. The framework of thought thus defined will enable us to approach *Écosystème(s)* in two stages: first through a general description and clarification of the artist's intentions; then via an analysis of the semiotic processes involved in the installation experience. From this ensemble, a reflection on the occupation of sound space will give an account of what we call – borrowing a Foucauldian notion – an ethopoietic presence.

2. THEORETICAL FRAMEWORK

The more-than-human refers to a more global understanding of any phenomenon which considers human experience as one among many. This includes non-human animal experiences, as well as the modalities of existence of organic and inorganic elements with which the more-than-human notion presupposes a relationship of otherness. According to David Abram, 'the shaman or sorcerer is the exemplary voyager in the intermediate realm between the human and the more-than-human worlds, the primary strategist and negotiator in any dealings with the Others' (Abram 1996: 15). Two ideas emerge from this: on the one hand, there is a human community which forms a discrete unit, but which is included in a more-than-human world that transcends it; on the other, a relationship is established between this human community and the rest of the world, represented by 'the Others'. Abram's notion presupposes the inclusion of humans in a larger world that permeates humanity.

However, this otherness is not faithfully represented by the more-than-human. Indeed, the 'more' in its formulation elicits a hierarchical ranking of ontologies. Yet the aim is not to estimate a being according to its degree of lived experience, nor to apply a labelling strategy by replacing 'more' by 'other'. Furthermore, the point is not to address an ethical issue. More-than-human does not target the most important: differences should be considered for what they are, and for the relationships of otherness that they support, rather than to associate a particular value with this or that group. Our position follows philosopher Cary Wolfe's clarification of the meaning and purpose of post-humanism: it is not just about 'a thematics of the decentering of the human in relation to either evolutionary, ecological, or technological coordinates', but also about 'how thinking confronts

that thematics, what thought has to become in the face of those challenges' (Wolfe 2010: xvi). According to this perspective, the question is to put humans in a transversal relationship with others.

For this reason, our aim here is not to adopt a broad framework that includes all elements (more-than-human), but to pay attention to all these differences in a broad framework that articulates their relationships. We are more interested in the relationship between oneself and others, and in the forms of relationships, shared or not, around the same topics – sound in this case – than in the revelation of a global experience that would integrate each individual experience. We therefore prefer to speak here of other-than-human, based on Marianne Elisabeth Lien and Gisli Pálsson's (2021: 3–5) conceptualisation. While human experience is always part of research, as they explain, it is nonetheless in relation to other experiences that knowledge can be developed; they underline the importance of exploring relations between animate and inanimate, which we consider central to a study of modes of existence through sound.

The other-than-human continues to question the categorical divide between nature and culture, following Philippe Descola (2013) and Donna Haraway (2016). Although the former was able to recognise a practical form for this dichotomy in thinking about the world and advancing the sciences, Descola insists it is a culturally specific categorisation that cannot be universally extrapolated. For her part, Haraway proposed the term 'natureculture' in her *Companion Species Manifesto* published in 2003 and re-edited in *Manifestly Haraway* (2016: 93ff.) to refer to cross-species experiences. Yet we cannot escape a certain pitfall in trying to go beyond the traditional nature-culture grid that still seems to underlie this new term. From this perspective, we also refuse to choose between oppositions such as subject/object or natural/artificial. This is why we will formulate and use the notion of human-and-other-than-human to designate, in a general way, any space composed by various animal species (including human), plant species, and the inanimate elements of the physical environment. Since decentering the human point of view is a necessary issue, but at the same time it would be a mistake to think that we can escape completely from our human condition, the full notion thus suggests that humans are not associated with other-than-humans but rather mapped and reflected in the eyes of others. Other-than-human makes the relationship between others and humans explicit, and human-and-other-than-human merely affirms the whole.

Despite these general labels, agency will remain specifically attributed to agents who have, in a general definition, the capacity to act (Schlosser 2019). We will acknowledge animal agency (including humans)

without going into further detail to find out whether organisms from other living kingdoms are endowed with it. However, a clarification will be made about artificial systems such as *Écosystème(s)* which require having ‘the adaptive regulation of the agent’s coupling with the environment and metabolic self-maintenance’ (ibid.) to assume minimal agency. At most, we could speak of quasi-agents in the same way as we will speak below of quasi-semiosis.

The term ‘other-than-human’ implies a critical exploration of anthropocentric categories and assumptions, which can be meaningfully extended to the realms of sound art and music as well. In contrast to the French *musique concrète* of the 1950s, which theorised sound as a ‘reduced’ object (Schaeffer 1966) cut off from its environment – a process that desemantises the causal value of sound to focus solely on its formal appearance (Bonnet 2016: 114–15) – sound can be defined as a social and technological interface between subjects, space and time (Di Scipio 2003). In turn, Brandon LaBelle demonstrates that sound has an intrinsic relational dynamic (LaBelle 2015). Conceiving of sound as a mediator between sensitive, intelligible and/or resonant bodies, in other words taking an interest in the relationships that sounds have with agents and their environment, allows us to consider it as a phenomenon of the ecological experience of listening, shared between humans and other-than-humans. In the case of insect sounds, Makis Solomos speaks of ‘listening to other-than-human’, inviting a ‘becoming-insects’ (Solomos, 2023: 106–8) that encourages listening attention to experience sound in a relational way.

Taking sound as an interface enacts a conceptual shift from an art of sound to an art of listening, as a relational art (Bourriaud 1998) since it underpins sonic relations towards others, space and time. The art of listening is indeed a practice that responds to sound interactions between different individuals, a practice that is sensitive to the meanings of these interactions. From this position, we acknowledge that there are as many ways of listening as there are living beings and machines with a sense of hearing. The art of listening is not so much about developing a sensitivity to sound objects, but rather about relating listening to and with others. From this relational perspective, sound as a medium can help us to understand and maintain human-and-other-than-human sonic collaborations (Ullrich and Trump 2022).

Finally, these listening experiences are articulated in a listening context. In reaction to Raymond Murray Schafer’s (1969: 43–7; Schafer, 1994: 90–1) and Barry Truax’s (1984: 120–2) proposal of schizophonia, according to which the reproduction of a sound separates it from its original context, Jonathan Sterne develops a critique by reporting on the aporias on

which such a conception stumbles (Sterne 2003: 20–1). Schizophonia underpins an essentialisation and hierarchisation of listening: the place of origin is presumed to be better than the place of reproduction; similarly, direct communication, in the presence of others, seems more ‘authentic’ than communication at a distance, separated from the source. As François Bonnet explains, the confusion between ‘the appearance of sound (what is heard by the listener)’ and ‘the appearing sound (which covers the cause, context and *situation* of the sound’s appearance)’ overlooks the important fact that the reproduction of a sound does not exactly re-produce, but ‘re-presents it by producing a sound from its imprint’ (Bonnet 2016: 179–81).

For a more accurate view of our relationship with the place where we listen to the sound’s appearance and the appearing sound, whether in production or reproduction, it is therefore important to redefine this process, which involves an aspect that is above all symbolic, but also cultural and ecological (in its contextual inscription). This attention to the listening context, understood as a decisive factor in the listening experience, has already been the subject of in-depth reflection in art history, through the concept of iconotropy (García and Sáenz-López Pérez 2022), which aims to study the displacement of visual works from one specific space to another, and the accompanying change in symbolic regime. In this way, we propose to speak of ‘phonotropy’ as the study of meaningful transformations brought about by the relocation of sound in any space whatsoever, no longer in order to essentialise and hierarchise their origin and reproduction (and consequently their listening), but to situate the relations between a sound and a subject who experiences it, and to account for symbolic reappropriation from one context to another.

As opposed to schizophonia, phonotropy will be more capable of opening up a human-and-other-than-human reading that involves different experiences of reality, without having to inscribe them in relation to an arbitrary conception of listening. For example, Bill Fontana’s hybrid form of installation-sculpture, *Distant Trains*, consisted in relocating sounds taken from a station in service to another that had been destroyed and abandoned after the war (Stokowy 2017). The reproduction of these sounds, understood from a schizophrenic perspective, would be deprived of its original symbolic value and conceived as less than its original production. By contrast, in a phonotropic conception, the symbolic value of these sounds, which configure an imaginary sonorous landmark playing on topochronological memories, would be evaluated in relation to the context in which they are listened to, since meaning is always exposed to transformations. Phonotropy thus underlines the dynamic vision

inherent in Gascia Ouzounian's situated and embodied listening (Ouzounian 2006), according to which sound experience lies at the intersection of sound, space and body. This and all previous notions, which will recur throughout the text, explicitly or not, constitute the critical framework with which *Écosystème(s)* will be approached from now on.

3. ÉCOSYSTÈME(S): ARTISTIC INTENTIONS

Écosystème(s) is a self-interactive sound installation inspired by the communication techniques of orthopteran insects. The term 'self-interactive' is used here to emphasise that the device regulates itself autonomously through a feedback loop system. It takes the form of a wooden desk in which are embedded 17 speakers of different models. Two cardioid microphones are suspended above the speakers and pick up the intensity level of the sound environment. Simultaneously, these data are sent to a computational algorithm that controls the triggering, localisation and duration of about 50 sound samples.²

This work is based on an ecosystemic approach to sound creation. The term 'ecosystemic' was borrowed from composer and researcher Agostino Di Scipio (2020). Such an approach aims at creating aesthetic, technical and conceptual links between ecology and sound art practices (Schorpp 2023). In the context of *Écosystème(s)*, it is expressed through a shared sonic and sensitive experience of a fragile and complex living system. This approach uses algorithmic processes to fabricate an artificial and autonomous sound environment that imitates existing other-than-human sonic ecosystems while setting up a context for attentive human listening.

With *Écosystème(s)*, Schorpp uses both her knowledge of computational technologies and her sensitivity towards our sonic environments, to propose a contemplative sonic experience that brings the audience to reflect on the place they share with other-than-humans in a complex and evolving sonic environment.

3.1. Inspiration

The idea of *Écosystème(s)* was born after reading Yvelines Leroy's *L'univers sonore animal: Rôle et évolution de la communication acoustique* (Leroy 1979). The author details how in order to recognise each other and to isolate signals from the background noise, different species cohabiting in the same environment use various strategies of frequency (specific ranges), spatial (distinct territories) and temporal (different times of the day) exclusion. Leroy's text summons an ecosystemic thought of the

animal sound world while using a musical vocabulary to talk about language innovations. It was thus possible for Schorpp to take advantage of both the concept of self-regulation and the typomorphological suggestions for sound composition.

In shaping an artificial sonic environment imitating an other-than-human sonic communication system, the project follows three organisational principles: the choice of sound materials, the autonomous algorithmic system and the design of the listening device. In this regard, the communication techniques of orthopteran insects have been a source of inspiration from the point of view of both sound materials and algorithmic logic.

3.2. The sonic material

The choice of insects is not insignificant. From an aesthetic point of view, they offer a fertile ground of materials, including noisy and high-pitched sounds arranged in more or less regular rhythmic patterns. Buzzing, rubbing, stridulating, clicking – insects' songs blur the boundaries between the perception of a machine or an animal sound. Because of this ambiguity, insects' songs could be described as 'cyborg' sounds that deconstruct the nature–culture duality (Haraway 2016). Considered strange because they are far from human in their ways of being in the world, they embody the other with whom we cohabit. Moreover, their relative invisibility to the human eye emphasises the perceptive field of the listening: omnipresent and invisible, as sounds, they are acousmatic beings, or rather *acousmètres* (Chion 1982).

For the production of sound materials, the idea was to take advantage of the cyborg dimension of insects' songs by combining samples from field recordings made by Schorpp with electronically produced sounds imitating different parameters of insects' songs such as spectral characteristics, temporal articulations, or rhythmic patterns. In total, about 50 samples were used in the installation, classified in two categories (recorded insects and artificial insects) and subclassified by their frequency range.

3.3. System development: autonomy and biophonic writing

Once this set of samples had been selected, all that remained was to organise them in time and space with the objective of avoiding linearity. There was no question of elaborating a soundscape based on a hierarchical order that would determine which sound would come after or before another. On the contrary, the idea was that the soundscape should generate itself by taking up the principles of communication of the orthopteran insects, that is, to make it both

²See <https://estelle-schorpp.com/ECOSYSTEME-S>.

analogically and computationally ‘alive’. Two microphones were therefore added, becoming the receiving organs of the ecosystem with the speakers taking the role of transmitting organs. To complete the system, a computational algorithm analyses and reacts to the incoming sounds in real time. The idea was to engage pseudo-cognitive mechanisms, even if minimal, which make the device both sensitive (thanks to the microphones, the system receives sonic data from the environment) and capable of reacting, with the help of a computational algorithm that analyses the amplitude envelope of the incoming sounds. In other words: 1) the microphones pick up any sound pressure variations (whether the source comes from the sounds broadcasted by the installation itself, or the sounds in the room); 2) a system of variable thresholds analyses the amplitude envelope of the data; 3) depending on the peak level, the system triggers the duration and localisation of a specific sound sample randomly chosen in the different categories named earlier; and 4) these samples are broadcasted via the speakers, then reinjected into the system thanks to the microphones. Here is an arbitrary example: if the system receives a sound of 45 dB SPL, it will trigger sample 33 on speaker 7. Sample 33 will trigger samples 4, 5 and 6 on speakers 1, 4 and 12. But when sample 12 plays, it stops sample 33 and triggers sample 45. As the logic uses a certain amount of randomness, it is impossible to predict precisely the behaviour of the system.

Based on this logic, the system needs to be activated in order to start the feedback loop: it needs any sound pressure variation loud enough to open one threshold, then it keeps regulating itself forever as long as the threshold system receives a certain amount of peak level data from the environment. Indeed, in order for the installation to find a balance (meaning it does not get ‘stuck’ on a sample and does not shut down after a while), the right amount of sound has to enter the system. For this reason, Schorpp adjusts the sensitivity of the system based on the exhibition’s sonic environment. Usually, if the level of the sonic environment exceeds 70 dB SPL, the system will get ‘stuck’ on one specific sample pattern indefinitely, it will not have the sonic space to evolve. This allows people to talk at a reasonable volume around the installation, without disturbing the system.

This feedback structure ultimately gives the device the ability to self-regulate, that is, to be autonomous. According to Di Scipio (2020), two characteristics define the ‘living’ in electroacoustic performance: 1) the human agent and 2) the ‘autonomous dynamic system’. On the one hand, in the case of a closed linear system, the capacity for action and perception is controlled by the human performer, who becomes the only element capable of triggering the self-regulation of the device. The same logic can be applied in the case

of an interactive installation: here the key agent is also human since it is the audience that activates and controls the device (Figure 1). On the other hand, an autonomous dynamic system – the second characteristic of the ‘living’ – is focused on the technical agent, that is, the machine. Thus, the ‘internal medium’ (the machine) is coupled to the ‘external medium’ (the environment), and the human agent, in the background, is no longer indispensable to the functioning of the retroactive system (Figure 2). *Écosystème(s)* is based on this second characteristic of the ‘living’: it is an autonomous dynamic system.

3.4. The installation: on the importance of embedded devices to induce interactive postures

Since it was decided to make the installation interact with acoustic data, it was obvious that the sound environment and the audience would also be taken into account. The essential point was to mark the sound presence of the listener that produced a perceptible impact on the behaviour of the ecosystem, which, once disturbed, tried to find a balance in order to keep developing in time and space. The function of aesthetics is decisive when it comes to predicting the social behaviours it induces. In this sense, the choice of the form and the aesthetics of the device must take into account the type of behaviour that Schorpp wishes to engage with the listener. To this end, the first idea was to conceive an immersive installation of the environmental type: a space in which the listener evolves. Unfortunately, this immersive device curbed the recognition capacity of the system, which could no longer distinguish itself from the environment; the behaviour then became chaotic, which was not the desired effect.

Consequently, the device is integrated into a specific piece of furniture in which the speakers are embedded. Such a device allows the concentration in turn of the acoustic energy and the attention of the listeners. Since the speakers are located below the microphones, the sensitivity level is limited to a distance close enough to obtain a minimum of control over the system’s behaviour. This arrangement also greatly reduces the difficulty of separating the system’s own emissions from those of the environment.

Once the object had taken on the dimensions of a piece of furniture which, by its shape, informs the orientation of listening, it was important to concentrate the listener’s attention in one locus: rather than an itinerary, inviting them to adopt a listening posture with respect to a sound microcosm. At this scale, in addition to solving a technical problem, the device was consistent with the ecological dimension of the project, insofar as listening to a smaller and more fragile world intuitively arouses a desire for discretion. On the one

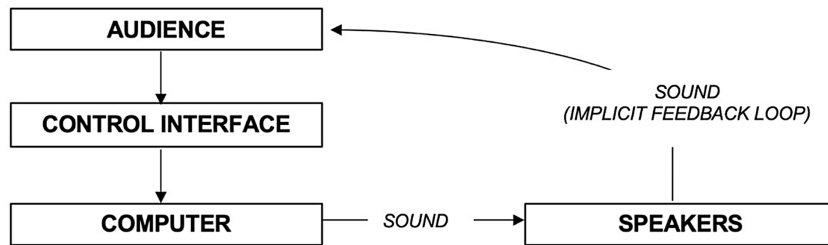


Figure 1. Diagram of a linear sound system.

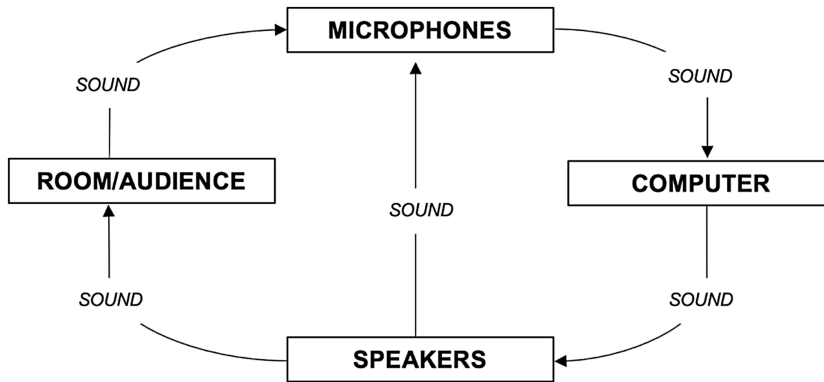


Figure 2. Diagram of a retroactive sound system.

hand, the installation interacts with its sound environment and thus with the sound presence of the public. Indeed, if the ambient noise is too high, the system will no longer perceive its own emissions, which will be masked, and it will no longer be able to self-regulate. On the other hand, as explained earlier, the audience is not an essential agent for the system to function properly. The system reacts to its presence, but does not need it to self-regulate. This is why *Écosystème(s)* is described as self-interactive: the human agent has a role to play in its reactivity, but is not essential to its functioning.

In this case, the audience holds a minority position, a silent role. The simple audible feedback of the interaction with the microphone is enough to enrich the experience without necessarily being noticed. It is towards this almost unnoticed or unremarkable interaction, that is, towards an interactive aesthetic of the unspectacular, that the artistic objectives of *Écosystème(s)* tend. The interaction as such is considered in its relationship with silence. Reacting to sound intensity, the system's behaviour is disturbed when the ambient sound signature exceeds its own signal. Unable to regulate itself, the ecosystem then stops evolving and goes into a loop. Thus the *sine qua non* condition for listening to *Écosystème(s)* is a (relative) silent attention, more than an active interaction. It is in such conditions, where the sound environment is equitably shared and the communication of the insects is not masked by

human noise, that *Écosystème(s)* manages to self-regulate and that musical motifs emerge.

By this means, *Écosystème(s)* proposes a contemplative experience of a reactive yet autonomous sonic system based on other-than-human communication techniques, leading to a reflection on the place the human agent occupies in a shared sonic environment.

4. ÉCOSYSTÈME(S) IN LIGHT OF THE SEMIOSIC PROCESSES

4.1. Mediascape levels in *Écosystème(s)*

As initially described, *Écosystème(s)* is a self-interactive installation that implies a specific spatial context, configured in an other-than-human mode. From this global perspective, the room in which the installation is displayed represents a local 'mediascape'. According to the definition of Arjun Appadurai, 'Mediascapes refer both to the distribution of the electronic capabilities to produce and disseminate information ... and to the image of the world created by these media' (Appadurai 1996: 35). As he explains, this conception of the mediated world configures a complex network of representations that blurs 'the lines between the realistic and the fictional landscapes' and constructs 'imagined worlds that are chimerical, aesthetic, even fantastic objects, particularly if assessed by the criteria of some other perspective, some other imagined world' (ibid.)

In the case of *Écosystème(s)*, the space is divided into several levels due to different mediated sounds: the first is the installation itself, forming a microcosm of insect and machine sounds, while the second corresponds to the rest of the room. The sounds of *Écosystème(s)* illustrate what Jussi Parikka calls ‘insect media’ (Parikka 2010), both from a life science perspective, through Jakob von Uexküll’s ethological concept of *Umwelt* (Uexküll 1956), and from a cybernetics perspective. Through the specific application of acoustic principles (Leroy 1979), the installation experiences its own *Umwelt*, by virtue of its materiality and its conditions of emission and reception. However, it is also a vector of mediation insofar as it shares insect sounds in space. In so doing, it transforms the value of these sounds, making them its own, and reveals a new circuit of exchange in the transmission of signals both within *Écosystème(s)* and with the surrounding space. The reproduction of a recorded sound allows the original model of the sound to be heard, but this reproduction is also a representation in the circuit of exchanges: it affirms the new production of this sound and its different interpretation from the original model (Bonnet 2016: 114–15, 179–81). Despite its formal appearance, *Écosystème(s)* thus suggests a new situation, a phonotropy in which the sounds produced, referring to familiar meanings from the original context, must be perceived and interpreted differently depending on the new listening context. In this sense, sounds mediate between the different contexts of production and reception.

The hybrid profile of the mediascape shaped by the presence of *Écosystème(s)* proposes an ecological understanding that differs from its original model. This context makes it necessary to approach the mediascape in two steps: first within the installation as a microcosm, then in its periphery represented by the rest of the room. By using ecossemiotics to examine how these two levels work together to form a relational space through friction, a better understanding of the local mediascape will account for the other-than-human dimension of *Écosystème(s)*.

4.2. Semiosis within and around *Écosystème(s)*

Despite the close historical links between communication studies, cybernetics and machines, information circuits approached from a semiotic point of view are not considered in the same way as the linear logic in communication whereby a message is transmitted by a producer to the attention of a specific receiver. On the basis of Jean Molino’s semiological tripartition (Molino 1990) and in connection with Charles Sanders Peirce’s semiotic theory, Jean-Jacques Nattiez (1990: 16–17) reminds us that the aesthetic point of view (the receiver) seeks to reconstruct the material or ‘immanent’ trace

(message) coming from a poietic level (the producer). According to this semiotic point of view, the initially proposed schema of the *Écosystème(s)* communication circuit can be reinterpreted in a new way, as shown in Figure 3.

Henceforth, the sounds produced by the speakers (or by the audience) are received by the microphones in such a way that the computer processes the information and reconstructs its meaning, reduced to the main components of the sound waves perceived by the system. As no reception, strictly speaking, takes place, because the microphones operate and automatically receive the sounds they transmit to the computer, their placement nevertheless seems aesthetically relevant: as much pragmatic as intentional, they have been placed so as to perceive in a privileged way the sounds produced by the speakers. However, this specific orientation does not indicate minimal or even quasi-agency, since it has been decided and placed by the artist. Schorpp chose to install the microphones in this way, but once the information circuit is considered through the installation’s reception activity, semiosis accounts for a process of reconstruction of the sound sign perceived by the microphones.

In this configuration, the *Écosystème(s)* information circuit represents a special case, insofar as the poietic and aesthetic levels are part of the same system. This theoretically closed circle (at this stage of the analysis) can be put into perspective on the basis of Peirce’s semiotics (Peirce 1960–6). According to the theory, meaning emerges from semiosis, the process of sign production. As in all of Peirce’s ternary thinking, these signs are made up of three components: 1) the *representamen*, conceived as the immediately perceptible face of a sign; 2) the *object*, that is, what the sign represents; and 3) the *interpretant*, which is merely a function, the association between the representamen and the object. Semiosis occurs in such a way as to result in an interpretant that triggers the mechanism for elaborating successive signs resulting from the first sign. The process can thus be recursively prolonged *ad infinitum*.

In *Écosystème(s)*, semiosis takes place at the moment of sound reception. For example, a sample is started and the sound is received by microphones as a representamen, corresponding to the purely physical quality of the sound. The acoustic components, in particular the frequency and amplitude, of this representamen are recognised as those associated with an object; for example, sample 33 (according to a human interpretation, an ‘insect chirp’), or more precisely a type or a category of sound encoded in the algorithmic program. Like the interpretant, this program makes it possible to associate the representamen and the object by virtue of knowledge embedded in the system. The resulting sign prompts the system to

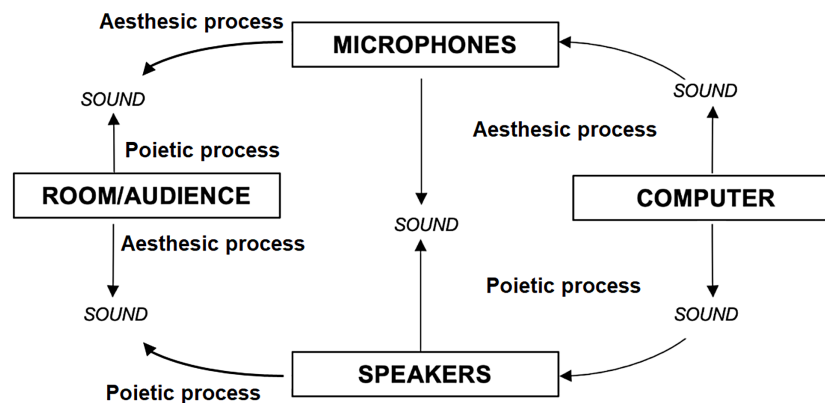


Figure 3. Diagram of the semiotic processes.

form a new association between the last meaning, which has become the representamen of the new sign, and the new associated object. To return to the sample or the insect chirp, after several repetitions of the process, a sign like another sample or insect chirps can be formed in response to previous signs, according to the rules established by the acoustic principles of animal communication.

Although Kalevi Kull considers a machine to be ‘a scaffolding without semiosis’ (Kull 2015: 231), we adopt Peter Brödner’s more nuanced point of view, according to which it is possible to speak, to use Winfried Nöth’s term (Nöth 2003: 83–6), of quasi-semiosis (Brödner 2019: 209–10). Nöth explains that ‘computers do not only operate with symbols, but also with indexical and iconic signs (more precisely quasi-signs)’ (Nöth 2003: 82). Brödner adds that a machine presents a reduced semiosis – he even speaks of ‘degenerated sign processes’ – due to its lack of openness to the world; in his words, it is ‘without a window to the world, that is, lacking the reference to an object of experience (its denotation)’ (Brödner 2019: 209; emphasis added). From a semiotic point of view, this consideration makes it possible not to reject the process of sign analysis associated with a machine, and favours an understanding of differences between agents and non-agents, or quasi-agents, in terms of degree rather than of nature.

Finally, the semiosis, in addition to referring to the materiality of the subject’s experience of reality, also implies an ecological dimension, in that the experience is inscribed in a context, here microcosmic. Ecossemiotics, described as the study of ‘the role of environmental perception and conceptual categorisation in the design, construction and transformation of environmental structures’ (Maran and Kull 2014: 41), can articulate the self-interactive dimension of *Écosystème(s)* and its semiotic process. Despite the distinctions sometimes made between culture-oriented ecossemiotics and biossemiotics associated with nature

(Tian and Wang 2022), our theoretical position aims to go beyond such separations and assumes an ecossemiotics conceived for a human-and-other-than-human context as the study of sign processes between an organism and the environment in which it is embedded. Timo Maran points out that ecological and biological perspectives focus ‘their attentiveness on the connections between the physical realm and meaning processes’ (Maran 2015: 141), thus touching on a porous boundary between different abstract categorisations of the experience of reality.

Among the main issues of ecossemiotics presented by Maran and Kull, several are relevant for the computer sound device (Maran and Kull 2014: 44–6):

- Changing signs can change the existing order of things. Living organisms change their environment on the basis of their own images of that environment.
- Semiosis regulates ecosystems. Meaning-making both stabilises and destabilises them.
- The environment as a spatial-temporal manifestation of an ecosystem functions as an interface for semiotic and communicative relations.

In the microcosm, the environment, understood as an interface, corresponds to the system of *Écosystème(s)* made up of speakers, microphones and a computer. Sound signal processing more or less imitates the sound interactions of insects, generating a sound environment similar to that which might be found in an ecological niche. The decisive difference in this installation lies in the number of agents participating in the constitution of this ecosystem. Unlike a multitude of insects, here there is only one machine. A single system applies itself to producing a quasi-semiosis. However, as discussed later, a form of relational interaction will take place in any friction that may arise between *Écosystème(s)* and the audience.

Located in the same mediascape but at a different level, the public is conditioned by *Écosystème(s)*.

The presence of the latter, suggesting a reconstitution of a living ecosystem, invites silent listening, since a noisy activity could significantly disturb the system. This situation imposes what we call phonotropy. This proposed term in place of schizophonia emphasises the relationship between the listener and the context of the listening environment. It respects both the ecosemiotic thesis of the dynamic character of the sign and the close relationship between signs and the environment.

The semiosis incurred by contact with *Écosystème(s)* illustrates gradual awareness of the attitude to adopt. The first impression consists of recognising a sound (representamen of any sample), which is immediately associated with the installation (object) due to the principle of causality (interpretant). These sounds, moreover, are subject to precision, as they refer to insects and machines by virtue of knowledge acquired in another context already experienced. From these first signs, others emerge: the interaction of different sounds suggests an organisation, which is revealed by the attention focused on the installation. *Écosystème(s)* thus imposes a phonotropic experience: the installation creates a new symbolic regime that mediates the mental representation already experienced elsewhere (e.g., a forest), and provokes a confrontation between the other-than-human presence of the sounds and the human place in this space. It is precisely a case of phonotropy, as we have defined it.

As an inductive aesthetics (Nattiez 1990: 141–2), this explanation of the audience's semiotic process should be triangulated with empirical data on the experience of participants. At present, however, the hypothesis of semiosis leading to the understanding of a sound ecosystem is envisaged insofar as by moving from the installation to occupation of the space, the audience comes, through a process of successive semiosis, to a broader meaning, symbolised by a representation of a living ecosystem by analogy. This whole setting in relation to *Écosystème(s)* confronts the audience with an environment of insects mediated by machines, an other-than-human ensemble that renews listening modalities and shifts the focus of human vision without sidelining or reducing it.

4.3. Frictions of semioses, territories, and experiences

The two levels of mediascape considered have been approached independently. Information circulates, is evaluated and interpreted or analysed differently, and for different purposes. On the one hand, the *Écosystème(s)* microcosm is based on a global unit that organises the heterogeneous sound signals that constitute the signs of a quasi-semiosis, while on the other hand, the audience experiences the installation's presence in the space through a specific phonotropy,

so as to imagine an ecosystem that is certainly different, but related to an environmental model.

Nevertheless, frictions erupt at the boundaries of these levels. The mediascape could be read as an assemblage (*agencement*) in the sense given by Gilles Deleuze and Félix Guattari: 'We will call an *assemblage* every constellation of singularities and traits deduced from the flow – selected, organised, stratified – to converge (consistency) artificially and naturally' (Deleuze and Guattari 1987: 406). *Écosystème(s)*, its sounds, and its public are all singularities that lie within this agency. However, as the preceding analysis has shown, an articulation is formed between the two levels: *Écosystème(s)* territorialises – to use another of Deleuze and Guattari's terms – the space, transforming everything outside its microcosm into a periphery, which the public deterritorialises and reterritorialises – echoing Maran and Kull's 'meaning-making both stabilises and destabilises' (Maran & Kull, 2014: 44) – as it comes and goes, through its presence in relation to the installation.

Exchanges take place at the boundaries of these sonorous territories, as much when the public listens to the sounds of *Écosystème(s)*, as when they try to disrupt the system by making excessively loud noises. The overall structure of the mediascape is organised by complex relationships between the audience and the installation. Through different semiotic processes, the ways in which sounds are interpreted and given meaning appear distinct from one level to the other. According to different territorialisation processes, space appropriations occur in conditions of interdependence insofar as when a human or another entity makes some noise, they can disrupt the installation, and when the installation suggests enough familiarity and attention to the external audience, through the semiotic processes of sign production, so the human audience maintains a silent, attentive attitude.³ It involves different processes of experience, whether at the level of sound production or perception.

In these terms, *Écosystème(s)* embodies a particular presence through its other-than-human dimension. The critical significance of this presence can be raised by two ideas that will open up the discussion. In a short essay by philosopher Érik Bordeleau on Michel Foucault's thought, the quest for anonymity corresponds to desubjectifying our modes of existence through the anonymity of language, typically with an indefinite subject such as 'someone' (Bordeleau 2012: 86, 93). This anonymity, which leads us to abandon our individualistic conceptions centred on our human

³Appropriation is understood in the sense given by Étienne Souriau and taken up by the philosopher Vinciane Despret (2022: 103–4). In addition to meaning active possession of the subject appropriating a space, this subject also becomes specific to the space, adapting to and adopting the conditions of the space.

existences, can be the vector of a symbolic call to pay more attention to those who have no voice. In the case of *Écosystème(s)*, the absence of the artist during the installation's self-interactive activity gives precedence to the installation, which is capable of self-regulation thanks to the feedback loop systems. By desubjectifying our traditional mode, which consists in associating the artist with a work, *Écosystème(s)* reveals the cyborg voices of insect-machines by constituting an other-than-human mode of existence with the presence of its technological sound device.⁴

To explain the presence of *Écosystème(s)* as an individuality through the artist's anonymity, we should recall Foucault's notion of ethopoietics, which Bordeleau takes up again. He defines the term as follows:

'Ethics' is to be understood here in the strongest and most literal sense, i.e. as relating to *ethos*, to the way in which an individual inhabits and produces an existential territory. To underline the dynamics of this process ... I will call it 'ethopoietics'. Ethopoietics is, as its etymology indicates, the production of *ethos*, the bringing into consistency, the incorporation (in ancient Greek, *poiesis* means to make, to create, to produce). (Bordeleau, 2012: 66; personal translation)

The *ethos* created here, as we have said, involves a desubjectification of the artist, and therefore a subjectification of the machine.⁵ This produces a mode of existence or, more precisely, a mode of listening that generates a territory within the mediascape. The ethic presence of *Écosystème(s)* induces a reflexive phonotropic position to a human audience that comes to silence to better listen to the sounds. It is clear that humans can try to disrupt this ethopoietic presence of installation, but the semiotic process leads humans to a silent mode of listening, as they gradually realise that the noise significantly interrupts the installation.

The conceptual outcomes linked to technical conditions and aesthetic hybridity lead to a critique of our conscious attention. By highlighting the insect-machine sounds and their sequences based on acoustical ethological principles, the installation exploits a form of imitation that creates differences, and it is this imitative motor that underpins the relationality of this human-and-other-than-human complex, leaving each agent and non-agent to conjugate in their own way the form of resemblance that emerges. Bringing us into direct contact with this audible presence, the mediated *ethos* reflects an other-

than-human vision that we generally lack in our automatic everyday human listening. *Écosystème(s)* has the capacity to generate an existential territory that underlines its ethopoietic presence. Putting human listening in a relationship of otherness into perspective, *Écosystème(s)* thwarts expectations of listening and mode of existence to inhabit a human-and-other-than-human space that tunes individualities around a co-presence.

5. CONCLUSION

Analysis of the self-interactive sound installation *Écosystème(s)* made it possible to identify different artistic strategies as well as conceptual perspectives with which the work negotiates with the other-than-human in the realm of sound and media art. Unlike a more-than-human perspective, which would have provided a global vision of the mediascape, the other-than-human perspective enables us to approach the relationships of each singularity while preserving their constituent differences. Decentering the human in order to reinscribe it in an ontological conception of otherness offers a nuanced look at the occupation of a space and how to experience it as both situated and embodied.

The subject of the piece being the communication techniques of orthopteran insects, it immediately shifts the focus on non-human agencies and introduces a listening relationship with others. On a sonic level, the artist intentionally uses sound samples from field recordings as well as synthesis that imitates the timbres and rhythmic patterns of different insect songs, taking advantage of their cyborg nature, in order to blur our capacity to precisely identify the sound source, whether produced by an insect or a machine. This ambiguous sonic hybridity emphasises the nature-culture pairing and its theoretical legacy in the realm of post-humanism studies.

In addition, *Écosystème(s)* functions with an algorithmic computational system of feedback loops based on different communication techniques described by Leroy. This enables the installation to listen to itself and to the sonic environment in order to self-regulate as an ecosystem would. In addition to this self-interactivity that makes the work specific, the artist conceived a device whose scale and shape implies both a particular listening and a relational posture. In fact, it invites the audience to adopt quiet and attentive listening with respect to a fragile sound microcosm, leading intuitively to a desire for discretion. Moreover, it places the audience in a peripheral place. Its presence will subtly interfere with the system's own emissions, but it is not necessary for the installation to self-regulate. In other words, *Écosystème(s)* is a sound installation that does not need the presence or

⁴The notion of 'mode of existence' is understood in the Foucauldian sense of 'process of subjectivation' insofar as a subject and their experience are articulated to establish the individuation of a person.

⁵This subjectification does not mean that the machine is the subject of a life, but that it follows a mode of existence defined by its presence in the world and the experience it performs through a semiotic process.

participation of human agents to function and evolve in time. From this point of view, *Écosystème(s)* operates what we called a friction of territories; in other words, a fine-tuned articulation of the levels that make up the mediascape, through semiosis. All these perspectives make the *Écosystème(s)* sound installation part of a post-humanist thinking, as it shifts the focus of the human experience, but at the same time takes up the challenge of relating to others.

Acknowledgements

We would like to thank Guillaume Boutard, Jimmie LeBlanc and Caroline Traube for their invaluable advice.

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