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The Fourth Phase of Electroacoustic Music and the Intimate Transformation of the Sonic Experience

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Abstract

In this paper, I illustrate the history of electronic music in four phases: irruption (i), mediation (ii), embodiment (iii) and intimate transformation (iv). This last one expresses a more effectively and deeply integration of the sonic and operational aspects of electronic music in the musical imagination. I argue that electronic sounds, once detached by the ancestral contingencies, are now attached to contemporary contingencies. These transformations affect the existential temporal structure of the musician. In order to define the specificity of this fourth phase, I propose to consider the relationship that contemporary musicians establish with their devices and sounds through the lens of temporality and existentialism. In order to clarify this specific musical horizon, I consider three pieces (acousmatic, mixed music and live coding) proposing to look at the inclusion of the human constitutive temporal and durational sonic aspects in the non-natural and non-temporal environment.

Phase four

In 1976, Henri Pousseur edited a book, *La musica elettronica*[1]. The chapters written by composers and inventors such as Stockhausen, Chowning, Chadabe, Boulez, Reich and Lietti, represented the whole spectrum of the musical tendencies – and technologies – of the time. However, despite this unusual richness, in the *Preface*, Luciano Berio claimed that electronic music no longer existed. Why?

In the Italian composer's opinion, electronic music ended because it was "everywhere" and "belonged to everyday musical thoughts"[2]:

[1] Henri Pousseur, éd., *La musica elettronica* (Milano: Feltrinelli, 1976).

[2] Luciano Berio, "Prefazione", in *La musica elettronica*, Henri Pousseur (Milano: Feltrinelli, 1976), viii.

> *La musica elettronica 'non esiste' più […]*", he claimed, "*possiamo descriverne le tecniche specifiche, ma non possiamo porla come antitesi ad altri modi e concezioni della fabbrica musicale*[3].

Electronic music became just music. Because of its evolution, it was assimilated in the common musical practice. This assimilation followed an "irruption": as reminded by Pierre Schaeffer in his *Traité*, the arrival of electronic technologies was an *Umwandlung*[4], an "irruption" of means that created sounds that were "detached by ancestral contingencies"[5] and "compelled to deal with sound phenomena unknown to musicians […]"[6].

Therefore, the first electronic pieces were "wrapped in silence", Berio claimed, "bottles thrown in the sea", awaiting to be "collected and transformed". Their collection and transformation characterised, in Berio's opinion, the successive phase of electronic music evolution, indicated by the term "mediation".

This new time of electronic music history was represented by the contamination of electronic sounds with the instrumental idioms, in order to transform the expressivity of the former ones. Berio meant the necessity of investigate, through composing, the "continuity" of electronic, natural and instrumental sounds. In Berio's opinion, arrived on Earth, electronic music has to manage with the meanings of everyday life, the bodies of instruments and humans. It has to evoke physical experiences, to amplify sonic details, movements and environments. Electronic music has to be contaminated by the common musical languages and influenced by the existing jargon. Thus, Berio indicated the next path of electronic music.

As a consequence of this paradigm change, electronic music became performative, a means of the sonic and agential awareness. In this phase of mediation, life, conceived as the sum of its sounds and agencies, enters explicitly in the electronic sounds through morphologies and figures. Thanks to this evolution, pursued by the composers, the listeners and the musicians became more accustomed to electronic sounds as part of the usual acoustical – and musical – environment. Thereafter, what was heard as unknown and novel in the fifties is no longer in the seventies, and even less nowadays.

The perception of electronic sounds, their utilisation, functional applications and senses, evolves in history. As Philip Auslander observed, *liveness* is historical, it changes towards its experiences and is progressively inscribed in the fabric of meaning[7]: it is a mobile concept that evolves in history towards the development of the technological and social environment. Thanks to this evolution, the once unknown sound morphologies are "attached" to some "contemporary contingencies".

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[3] Berio, "Prefazione". "Electronic music no longer exists. We can describe its specific techniques but we cannot place it in antithesis against other modalities and conceptions of the musical factory." (Translated by the author of this paper).

[4] Pierre Schaeffer, *Traité des objets musicaux. Essais interdisciplines.* (Paris: Editions du Seuil, 1966), 405.

[5] Schaeffer, 239.

[6] Herbert Eimert, "What is Electronic Music?", *die Reihe*, vol. 1, 1955.

[7] Philip Auslander, *Liveness. Performance in a mediatized culture* (London New York: Routledge, 2008).

Detached from ancestral contingencies (1966) ⟶ **Attached to contemporary contingencies (2018)**

The concept of *liveness* shows very well this evolution. Indeed, the utilisation of electronic means in contact with living performers exalts the mediatisation of the devices and the sense shifting and roles of the musical agent. This contact increased in intensity in the last two decades, thanks to the miniaturisation of devices and the evolution of interactive techniques in terms of performance and writing as well. As suggested by Emmerson, the electronics started to be reanimated[8]. After 2000, the embodiment of the electronics and the transformation of the human behaviours related with technology defines a real new paradigm. This transformation is characterised by a more effective connection from the point of view of the meaningfulness of the causal relationship between the agent and the sound and a more effective interaction between the conception and the perception of the musical work: mediation is progressively more transparent.

As a consequence the perceived mediation decreases because the meaningful response[9] of the electronic instruments is much more effective: this kind of perfect mediation creates a specific musical environment of expression in which the devices and the sound morphologies occupy the background of awareness, belonging to the inner consciousness[10].

At the time of the post-acousmatic practice[11], musicians play with instrumental-vocal sounds in studio and on scene. Musicians collide with electronic sounds, fostering hybrid musical units that express a deeper contamination of human, non-human, environmental, and non-environmental sounds. They use these devices as a means of expression, part of their usual sound vocabulary. This contemporary situation is a sonic and operational mix that has the musical function of defining relevant symbolic forms[12], adapted to the contemporary sonic and anthropological environment. Electronic music, as a "nexus of

[8] Simon Emmerson, *Living Electronic Music* (Aldershot: Ashgate, 2007), 53.

[9] Simon Emmerson, "Rebalancing the discussion on interactivity", in *Proceedings of the Electroacoustic Music Studies Network Conference* (Electroacoustic Music in the Context of Interactive Approaches and Networks, Lisbon, 2013). Emmerson claims: "I am arguing for a shift of focus here. The perception of an appropriate and meaningful link in this interactive chain pertains to the *nature of the perceived results* not simply to the *nature of the known causes* (which we may never fully know). Where the nature of the result is appropriate and meaningful crude interaction becomes true response – and even more importantly 'appropriate and meaningful' are *musical* judgements". It will be useful to start a critic of the concept of liveness. I think that it describes a transitional part of our recent history but it does not fit with the actual technological and artistic situation.

[10] Cf. Luc Nijs, Micheline Lesaffre, et Marc Leman, "The musical instrument as a natural extension of the musicians" (Fifth Conference on Interdisciplinary Musicology, Paris, 2009).

[11] Monty Adkins, Richard Scott, et Pierre Alexandre Tremblay, "Post-Acousmatic Practice: Re-evaluating Schaeffer's heritage", *Organised Sound*, 2016.

[12] Jean-Jacques Nattiez, *Music and Discourse. Towards a Semiology of Music* (Princeton University Press, 1990), 8.

numerous genres, styles, and subgenres, divided […]"[13], pervades languages, practices, habits, musikings and impacts on the musical experience *tout court*. Mediation, reanimation and embodiment solicit an additional, advanced transition to a more intimate transformation.

Now, the reanimation and embodiment of electronic music realise the process understood by Berio: the assimilation of the electronic in music in the general musical practice. I think that this historical directionality arrives, nowadays, at a point of an even higher integration, that exceed the embodied interaction and enters directly in the intimate imagination. It is a mind-set, an implicit *Weltanschauung*. This contemporary paradigm is characterised by the intimate inclusion of the electronic sound forms in the musical thinking. This paradigm brings the transformation of the intimate conception of music as sound morphologies and even as environmental awareness. We passed, through the embodiment of electronics, to its inclusion in the disembodied imagined practice. As Berio sensed, the electronics becomes part of our "fabric of meanings" that has the transformational power of metamorphosing the conception of the musical ideas.

Thus, in my opinion, four paradigms characterise the history of electronic music:

1. The experimentation and development of the electric devices: *irruption (1897–1966)*;
2. The contact with the traditional instrumentations and techniques: *mediation-liveness (1966–1992)*;
3. The embodiment of the electronic sounds: *reanimation and embodiment (1992–2010)*;
4. The experience of the electronic sounds is no longer dependent to ancestral contingencies but is rooted in contemporary contingencies: *intimate transformation (2010-)*.

This history is the one of an interiorisation of sonic and social constraints related to music making. This fourth paradigm is characterised by the performative utilisation of writing and the dilution of the barrier between conception and perception. This evolution of the notion of writing shows a deep transformation of the intimate relationship of the composer with its music.

The Most Intimate Part of the Sonic Experience

Therefore, if this historiographical hypothesis is acceptable, it is crucial to justify and qualify its characters. I will try to sketch a hypothesis grounding my arguments in philosophy.

The employment of electronic means enters in the human consciousness and behaviours. Thus, the transformation of the musical experience due to their utilisation is rooted in a substantial recalibration of the human intentionality in relationship with these electronic devices and their sonic – or, more broadly, perceptive and sensitive – outputs. This mind-set's metamorphosis is defined by a process of

[13] Joanna Demers, *Listening through the Noise: The Aesthetics of Experimental Electronic Music* (Oxford: Oxford University Press, 2010), 5.

disembodiment and of successive re-embodiment[14]. As a dialectical movement, it solicits the emergence of a hybrid sonic output and its consequent agential references.

Because of this evolution, the former hybrid situation has lost its "hybridity" and become "usual". This hybrid is the actual nature, the "contemporary contingency". It solicits a musical form anchored in the intentionality of augmented individuals, experienced as produced by the contact with complex machines.

I argue that this evolution brings a substantial modification in the human being's existential temporality. The intimate transformation provoked by the digital means is existential and concerns the relationship with the specific temporality of the electronic sound morphologies. This temporal experience is solicited by non-natural sounds, that populate the contemporary environment redefining the sonic horizon of the sonic awareness[15].

Now, the sounds we are listening to every day are reduced in time, usually around three seconds[16]. These sounds represent the horizon of durations of everyday sonic experience. They represent the reference of musical outputs and the ambitus of musical speculations. That means that everyday sounds are isomorphic with the profile of the existence: they have a beginning and an end. Thus, musicians control the sounds and understand their actions playing objects that have their same temporal shape. Electronic music practice creates forms that are similar with the everyday sound objects, imposing envelopes. Indeed, electronic sounds are rarely used in their crude potential. Our interaction with the machines limits their sound durations in order to create a signal that is understandable by a human. This action mimics instrumental and vocal phrasing. The electronic sound objects do not rise from the actions and gestures of the musician, but from the limitation and constriction of an enormous power – that can disrupt, by its massive durations and amplitudes, the human existence. Then, the pleasure of electronic music is the pleasure of control.

As a consequence, electronic morphologies are intimately other, radically alternative to a human being's existential and unavoidable finitude. Electronic sounds are signs of life forms deeply alternative with the human one. They don't have an intrinsic sound morphology[17]. These sonic forms are potentially infinite, out of our control. Thus, the fundamental cognitive processes of expectation and anticipation[18], are affected because of the durations and dimensions of the electronics sound morphologies, not related to any proprioceptive acoustic experience. However, through the embodiment, the proprioceptive

[14] It seems to me that Marc Leman expresses a similar concern. In: Marc Leman, *Embodied Music Cognition and Mediation Technology* (Cambridge: MIT Press, 2007).

[15] François Delalande notice that. Cf. François Delalande, *Analyser la musique, pourquoi, comment ?* (Paris: INA, 2013), 69.

[16] Rolf Inge Godøy, "Images of Sonic Objects", *Organised Sound* 15, nº 1 (2010): 57.

[17] Trevor Wishart, *On Sonic Art*, a new and revised edition edited by Simon Emmerson (Amsterdam: Harwood Academic Publisher, 1996), 177.

[18] Rebecca S. Schaefer, "Mental Representations in Musical Processing and their Role in Action-Perception Loops", *Empirical Musicology*, 2014, 165.

experience changes of value and evolves with the musical practice. The confrontation with an embodiment of the electronic sounds' durations characterises a specific musical imagination.

To explain this fact, I recall a well-known Heideggerian hypothesis. In *Being and Time*, the German philosopher claimed that humans existential experience could be considered as characterised by three levels: the emotional situation (i), its comprehension (ii) and its interpretation (iii)[19]. I argue that the process of comprehension and interpretation of the above-mentioned existential hermeneutical circle is impacted by the embodiment of non-human and non-reducible durations. The electronic musical practice enters in the hermeneutical existential circle through a "transmutation in the form"[20] that transforms the sonic experience in musical works. Thus, if the acoustic experience is characterised by the embodiment of electronic devices, then the transmutation of the form through the production of relevant musical artefacts, provokes an intimate shifting of the hermeneutical cycle in which music is involved.

Therefore, if music is part of the existential hermeneutic cycle, sounds that exceed the human experience and represent an automated human condition are means of comprehension and interpretation. This includes, in its possibilities, the infinite duration and power of electronic devices and encompasses, in its existential horizon, symbols which are related to non-human sound types.

Thus, if music is the "logical expression of feelings"[21], as well as a symbol of emotions' articulations, representations and formulations, then, its transformation must be related to this radical modification of the musical vocabulary. Moreover, if the tripartition of emotional situation, comprehension and interpretation constitutes an hermeneutical circle and if the existential experience is mainly interpretative, thereafter, in this circle, the technological means and their sonic outputs necessarily change the very fundamental emotional situation by means of the creation of specific, relevant and concrete sonic forms.

As a consequence, the utilisation of electronic sounds places the composer in front of his or her existential limits. In front of electronic sounds, composers experience the condition of "anxiety", that is well defined by Martin Heidegger as the situation in which our being is in front of the "possibility of the impossibility": death.

In a diametrically opposed sense, electronic technologies furnish the experience of another possibility of the impossibility, that is the possibility of the impossible infinite duration of music allowed by electronic sound. This shows, as a reflex, the human limited power and existence.

[19] Martin Heidegger, *Sein und Zeit* (Tuebingen: Max Niemeyer Verlag, 1927).

[20] Hans-Georg Gadamer, *Verità e metodo* (Milano: Bompiani, 1983), 140.

[21] Susanne Langer, *Philosophy in a New Key. A Study in the Symbolism of Reason, Rite, and Art* (New York: The New American Library, 1948), 176.

To deal with the "*possibility of the impossibility*"

A clarification of this hypothesis can be found in the compositional activity, that acts as part of the hermeneutical circle through the fixation of real sound events. I think that the act of musical writing could be conceived as the comprehension of a musical emotional situation. The act of writing is at the same time an hermeneutical and a creational act that integrates the possibility of the impossibility of a never ending sound: composers limit durations and amplitudes of the electronic sound generators; they experiment, through their imagination, the existence of this impossible possibility, choosing to anthropomorphise it, constraining that possibility at a mesoscopic sound dimension.

It is crucial to understand the compositional act as the realisation of real sound objects that encapsulate the possible impossibility. I evoke the "event theory of sound" [22] as it clarifies the relationship between the act of writing and the consequential sound event, that results from the composer imaginative activity. In this theory, sounds are conceived as events near their sources[23]. Thus, sounds are conceived as secondary qualities of the sound bodies more than a quality of the medium. Thus, composers deal with sound bodies and then their physicality and concrete limits. Compositional activity deals with real sounding bodies', more than pure sound morphologies: composers integrate real sources and deal with real meanings, connected to the cultures, practices and performers that are supposed to realise the musical work. To compose means to elaborate the melting of real sonic properties and chose the coexistence, in our contemporary contingencies, of human, non-human and non-natural sounds and agents. To compose is then the projection – imagination – of concrete sound events in the future. To write a score means to construct a future sound configuration that is concretised starting from the hypothesis of construction proposed in the score[24]. This means that a sound imagined in a time ~~[t]~~ is written to be performed in a differed future time [t]. The composer chose, in a time ~~[t]~~, the construction of a temporal flow in a time [t]: he or she constructs an experience.

This act is impacted by the utilisation of machines capable of infinite power. Composers anticipate real future events that instantiate the sound produced by devices independent from the motor energy of the human being. This compositional activity must consider the unlimited potential of electronic technologies in order to humanise the sounds of the devices: the projection of electronic sounds, that is based on the decision of their duration – cf. envelops – confronts the unlimited duration of electronic sounds with the limited existential conditions of the composer, public and concert hall. Composer is forced to confront him or herself with the control of a material that is stronger and longer than him or her. Thus, he or she must harmonise electronic means to specific limited durations that are imposed to the electronic sounds in order to give expressivity to it. In this manner, composers create hybrid – but real – symbolic forms[25] which get listeners closer to the experience of an automated humanity. These forms place the human as surrounded by a non-natural horizon. These musical forms transmute the

[22] I refer to the well-known "event theory of sound" proposed by Casati and Dokic: a sound is an event placed near its source. Cf. Roberto Casati et Jérôme Dokic, *La philosophie du son* (Paris: Jacqueline Chambon, 1998).

[23] Casey O'Callagham, "Constructing a theory of sound", *Oxford Studies in Metaphysics*, 2009.

[24] A composer furnishes the materials for a performance, suggests Christopher Small. Cf. Christopher Small, *Musicking. The Meaning of Performing and Listening* (Middletown, Connecticut: Wesleyan University Press, 1998).

[25] Jean-Jacques Nattiez, *Music and Discourse. Towards a Semiology of Music* (Princeton University Press, 1990), 8.

contemporary sonic and technological contingencies. Thus, composers are actors, aware or not, of an anthropological, and post-anthropological shifting[26].

In conclusion, this process of compromise characterises the construction and interpretation of an existential and compositional horizon based on the transformation of the manner in which, as humans, we project ourselves in time through durations in music by using electronic sounds and means. Music, as an auto-representational activity, if it's true that compositional practice is, at least in part, projective, requires the control of the possibility of the impossibility of an overcome of human beings by his or her means.

In the wake of these considerations, I will try to show how electronic sounds morphologies are integrated in the composers' imagination. Looking at three concrete cases, I will focus on their musical morphologies and conduct a free investigation in order to indicate the non-natural horizon in which they represent human sonic aspects.

Acousmatic Mixed Live

Half Life by Curtis Roads is a piece composed in 1999. This piece

> […] portrays a virtual world in which sounds are born and die in an instant or emerge in slow motion. As emerging sounds unfold, they remain stable or mutate before expiring. Interactions between different sounds suggest causalities, as if one sound spawned, triggered, crashed into, bonded with, or dissolved into another sound. Thus the introduction of every new sound contributes to the unfolding of a musical narrative[27].

The electronic sounds of this piece express complex trajectories of organisms that seem to collide one against the other. This interaction highlights a causal relationship and a living space. The organisms that are protagonists metamorphose themselves through their collision and mixing. They are living acoustical particles that are likened to "photographs of bubble chamber experiments, which were designed to visualise atomic interactions". Therefore, through the composition of this piece, the composer wanted to portray a physical phenomenon.

The piece is composed via the granulation of a synthetic raw material produced via pulsar synthesis. This technique is conceived to create a formant peak in the spectrum above a chosen fundamental frequency. As a consequence, this technique creates electronic sounds that are similar with vocal sounds because of the repartition of energy in their spectrum. As shown in the following sonogram (Fig. 1), the pulses, in their lowest part, create formantic resonations in the highest register. The repartition of this spectral energy follows contrasting directionalities that define the narrative of the piece. The distribution of energy creates geometrical forms in the spectral space that via contrast constitute the main formal vector

[26] Karen Barad, "Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter", *Signs: Journal of Women in Culture and Society*, 2003.

[27] https://www.curtisroads.net/music/ (Consulted December 15th 2018)

of the piece through the creation of rapid and expressive movements that evoke those of small and energetic organisms.

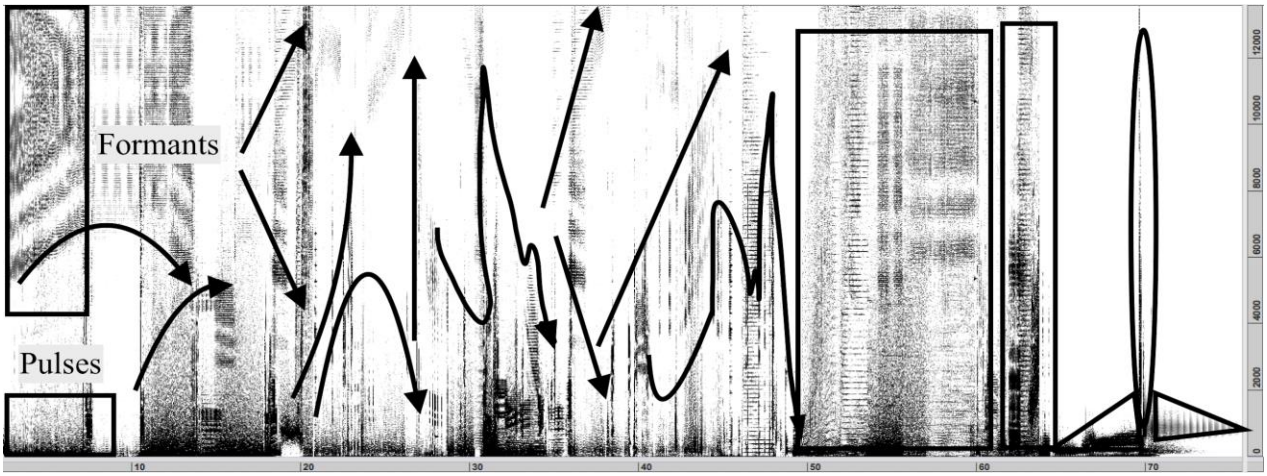

Fig.1: The beginning of the first part of *Half Life, Sonal Atoms*. Through this sonogram I would show the multiple directionalities that characterise the distribution of the formants. In the lowest part of the sonogram are the fundamental pulses, in the highest part the formant frequencies. The directional distribution of the "vowels" in these sonic configurations is quite clear.

To "demonstrate that the medium of electronic music had reached a point of self-sufficiency", Roads granulated the pulsar train. The composer was "[…] tired of the dogma […] that electronic sound was somehow lacking in comparison with acoustic instruments"[28]. However, this approach is in contradiction with the chosen material. Indeed, electronic sound replicates a natural sonic phenomenon. The composer evokes the human phonic apparatus. Thus, he establishes a dialectic between the vocal sounds and their transformations presenting human phonetic sounds in a technomorphic context.

Indeed, this piece presents, aesthetically[29], vocal sounds surrounded by an electronic environment[30]. In *Half Life*, Curtis Roads represents physical collisions of particles. However, the sounds are clearly vocal. Thus, electronic sound evokes the sonic articulations of human mouth. In this manner, music presents the cohabitation of two kinds of living beings. The voice is presented as transformed, immersed in random noises and rich sonic morphologies. The human sound type is confronted with another one, belonging to another kind of nature. In this case, the naturalisation of synthetic sounds is parallel with

[28] *Ibid.*

[29] The concept of aesthetic presentation, proposed by the philosopher Bernard Sève, indicates the representation, in music, of music itself or of its instruments. Cf. Bernard Sève, "Utilisation et 'présentation esthétique' des instruments de musique", *Methodos [En ligne]* 11 (2011).

[30] Sève proposed as example of "aesthetic presentation", the series of *Sequenza* for solo instrument composed by Luciano Berio.

the virtualisation of instrumental techniques that are presented together and are an "epistemological metaphor"[31] of contemporary sound environment.

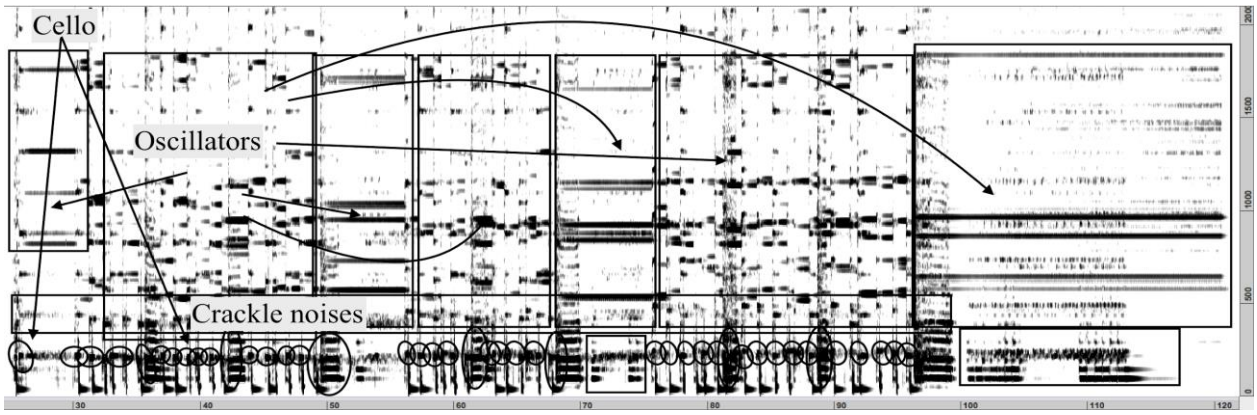

Fig. 2: Initial part of the piece *asinglewordosnotenogh III (2015),* for cello and electronics by composer Pierre-Alexandre Tremblay. In this part the cello and electronics play together and have a different role in the emerging global sound. This section is characterised by two kinds of figures, highlighted in the sonogram. The cello plays short notes of a descending chromatic scale with bow and pizzicato. These short notes are accompanied by electronic sounds that are composed of sustained notes and other noisier sounds, like the "crackle noises", that repeats randomly a following instrumental morphology. In this image is possible to see the superimposition of both musical "dimensions" (electronics and instrument) and the confrontation of their type. The instrument is characterised by a very complex spectrum from the point of view of its form (it is irregular and disordered) while electronics is ordered, geometrical. Thus, the living organism's spectrum is surrounded by a rigid and geometrical, more abstract, one.

"Mixed music" is also an important vector to be considered as a case study of this fourth phase of intimate transformation. By means of real contact, on the scene, of instruments and electronics, this musical genre fosters and clearly represents this kind of process. In "mixed music", the contact of its electronic, instrumental and vocal aspects determines mixed sonorities that integrate and mutually modify the standard instrumental-electronic dimensions. In this musical genre the sonic agency is displaced but real, sublimated, transformed, even exalted.

The piece *asinglewordisnotenough III* (2015) by Pierre Alexandre Tremblay, for cello and electronics, is a very clear case study. In this piece, the composer creates mixed sonic configurations. In some sections, both dimensions collide in a unique sound and present a complete contamination between the instrument and the electronics. The sounds mix together to create a vivid mixed morphology, that is both instrumental and electronic, human and non-human. These sounds conjugate the spaces of the performer with evoked alternative electronic and hybrid sound sources. It is an imaginary environment in which the sounds that compose the piece cohabit freely and organically, thanks to their rooting in the reality via instrumental presence. The cello and the electronics melt together using instrumental gestures realised with extended techniques and a noisy electronic configuration, living space to the controlled

[31] Umberto Eco, *Opera aperta: forma e indeterminazione nelle poetiche contemporanee* (Bompiani, 2011).

improvisations of cellist. This kind of mixed morphology is very developed during the piece. The mixing of these immiscible dimensions[32] is a fundamental aspect of the success of the piece.

One of the most specific aspects of the piece emerges, in my opinion, looking at the vertical confrontation of the instrument and the electronics. The very expressive sounds of cello are surrounded by a rigid, right and non-human synthetic sounds produced by the electronic device. The cello is contextualised in a synthetic environment. The resonances produced by instrumental gestures are unnatural if conceived from the point of view of traditional ecological mind-set. These reverberations represent the actual sonic environment and provide a sense of accustomation in the listeners – and by consequence the musicians – to a resonating space based on sound durations and morphologies that were radically unreal – in the sense that they did not belong to either the usual musical or everyday sounds experience – but are anchored to the contemporary living contingencies. Moreover, in this piece, the composer compares three levels of sonic subrogation: the instruments, the electronic sounds and the evocation of living sound sources. In the last section, the instrument and electronic sounds create an interaction of synthetic morphologies, instrumental and environmental. Environmental sounds are presented in background.

The contact of these different sound morphologies shows types of experimentation in many recent musical languages. They show the concrete influence of electronics on instrumental techniques, the attempt to create a "transfer"[33] that technomorphise the procedures and the musical elements from the point of view of figures, timbre and global form. In this piece, the local dimension and the one on the field[34] interact by representing three different stages of a complex sound morphology. Thanks to these kinds of music, the distinction between electronic and instrumental-vocal sounds gradually decreases, becoming usual. Thus, the unknown sonorities are integrated in a known environment thanks to the musical works.

Let me introduce the beginning of the piece (Fig. 2). In this part, the cello plays a descending line with a *pizzicato* technique. These figures are prolonged by the electronics that resonate in function of the note played by the cello. Electronic sounds interact with the instrumental part and create a resonance that continues behind the pitch played by the cellist. This electronic sound is geometrical, the notes are straight and in contrast with the instrumental part. If we look at the piece in its entirety, it is clear that this attack-resonance figure is the most present. However, the resonance, that follows the instrumental attacks, does not decrease towards an extinction, but continues, driven by an alternative energy. These contrasting morphologies create a unique sonority. The unreal continuation and energetic stability of this sound placed aside in an instrumental limited envelope creates a perceptive contradiction that is resolved

[32] Pierre Alexandre Tremblay, "Mixing the Immiscible: Improvisation within Fixed-Media Composition", in *EMS 2012 Proceedings* (Proceedings of the Electroacoustic Music Studies Network Conference, Stockholm, 2012).

[33] Johan Girard, "Les répétitifs, la machine et l'instrument", *Methodos [En ligne]*, nº 11 (2011).

[34] Simon Emmerson, "Local/Field: towards a Typology of live electroacoustic music" (Proceedings of the International Computer Music Conference 1994, San Francisco, 1994), 31-34.

by our perception and understood as something that is totally normal. This process of adaptation modifies the cognitive horizon of the sonic environment.

This process is doubly bonded: electronics and instruments are in an interrelation and reanimate each other. Electronics implies specific gestures which has to be accorded with instruments, i.e. the cello and electronic sounds melt together thanks to the noisy gestures coming from electronics and instrument. Both movements, even if generated by radically different agents, are isomorphic. Cello emerges clearly with some excerpts of melodic profile. These profiles create two sonic levels that merge through the detachment of both sources. It is a hybrid sonic configuration that has the variety of electronics and the nuances, articulations and energy of instrumental sound. This "mixed sound" is a conservative emerging property that conjugates two sound sources and, at the same time, maintains their perceptive differences[35].

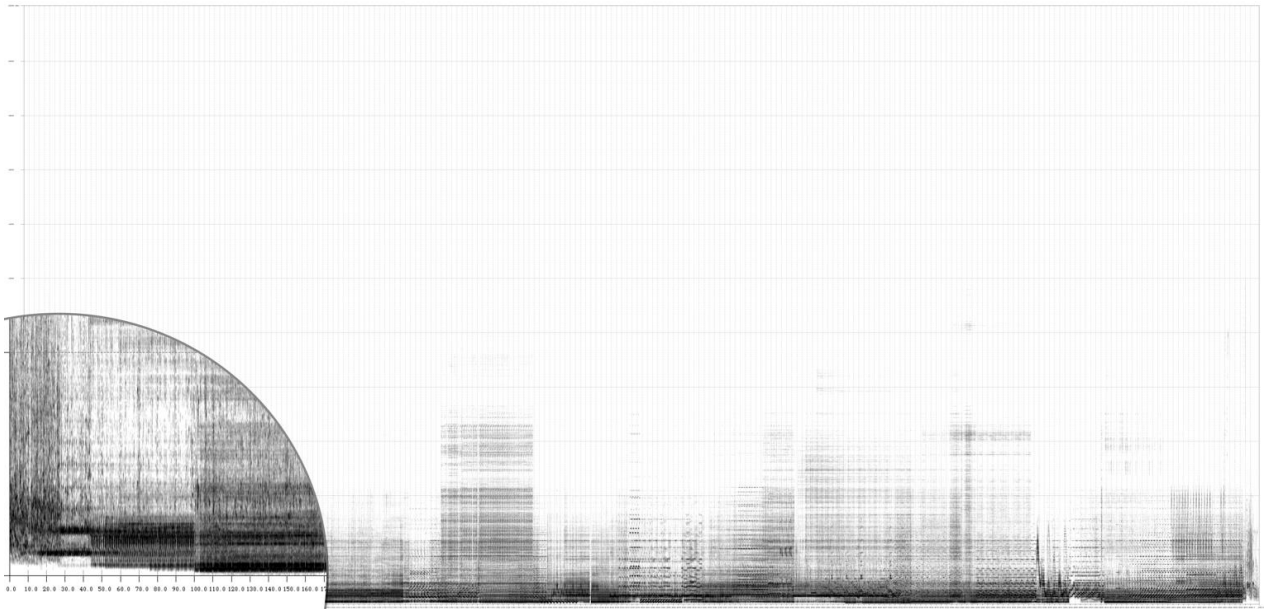

Fig. 3: Sonogram of the entire performance played by McLean and Hett. This musical part is characterised by a succession of musical events defined by a specific repetitive rhythmic structure in which at least two sonic elements interact. In the sonogram, the discontinuities are quite clear and it is possible to perceive the changes in texture of each part. This musical form is non-teleological and monodirectional. It is a succession of musical situations that does not seem to lead to a necessary end. The bubble in the bottom right of the sonogram highlights the first two situations that will be considered in a more detailed manner in Fig. 5.

The contemporary sonic context allows to experiment unknown spaces of musical interaction. In live performances involving videos and programming, the gestures and movements of musicians on stage are coordinated with musical and video morphologies as well, frequently performed in a homophonic or contrapuntal manner.

[35] Elvira Di Bona et Vincenzo Santarcangelo, *Il suono. L'esperienza uditiva e i suoi oggetti* (Milano: Raffaello Cortina, 2018), 56.

This is the case of an improvisation played by a musician and programmer, Alex McLean, and a video artist, Dan Hett. The music of this performance is characterised by regular and repetitive pulses, voices, words looped by a kind of superorganism controlled by the musician on stage. McLean is concentrated in writing on his computer the code that is then projected on the screen behind him. This screen shows visual improvisations produced by the video artist as well. The musician here seems me to be a "magician" on the stage, that writes magical words on a screen visible by the participants.

This kind of improvisation, called *live coding*[36], exalts the machine, its intrinsic repetitive sound morphologies[37] and exalts the act of writing as well. It is a multimedia show that put at the centre the figure of the improviser and determines the interaction of phonographic scores – the program projected on the screen –, the sounds and the movements of the programmer-composer. He embodies the interaction playing a program, that is an inherent instrument that employs writing and programming as a performative and multimedia expressive means[38] (Fig. 4).

[36] Nick Collins et al., "Live coding in laptop performance", *Organised Sound*, vol. 8, n°3, 2003, p. 321-330.

[37] For an in deep study of this peculiar musical practice I invite the reader to look at Giovanni Mori's work: Giovanni Mori, *"Live Coding? What does it mean?": An Ethnomusicological Survey on Acousmatic Performance Practices in Europe* (University of Florence, 2016).

[38] Alvin Lucier, "Origins of a Form: Acoustical Exploration, Science and Incessancy", *Leonardo Music Journal*, 1998.

Fig. 4: Screenshot of the video recording published on the artist's YouTube channel. In the image, we can see Alex McLean programming at the computer. The text projected behind the artist is the code written by the musician. The coloured forms that are superposed to the code are produced live by the video artist Dan Hett.

The sound of this piece is defined, mainly, by a repetitive sound morphology. Each section of the piece is characterised by a repetitive alternation of figures. At the beginning, the music alternates the declamation of two numbers "One" and "Two" in a *crescendo*. The second rhythmic configuration continues the former one adding another loop based on the repetition and the delay of two letters, "C" and "B". This configuration is then accompanied by a bass drum (Fig. 5). The successive configurations follow a similar evolutionary schema.

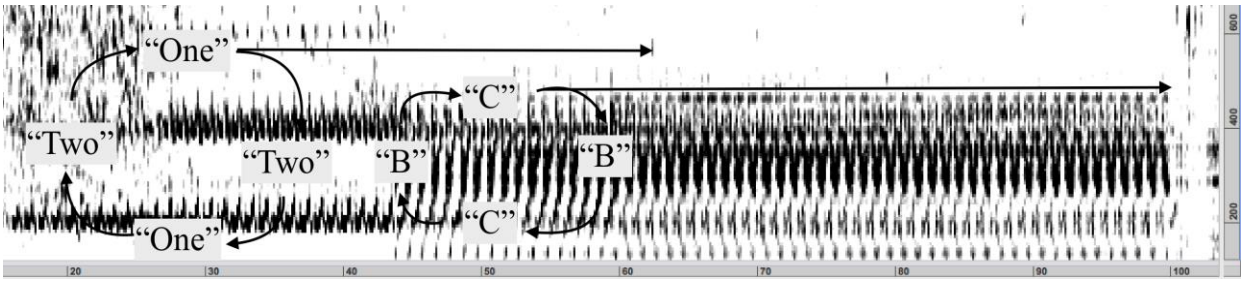

Fig. 5: This sonogram represents the first section showing how each situation is defined by a looped configuration that is then progressively replaced by the following one.

This improvisation is characterised by a series of sonic panels characterised, generally, by linear processes of repetition and accumulation. In this multimedia show the presence of a human being is evoked through the utilisation of regular pulses, the utilisation of samples of percussions. Thus, this repetitive sonic morphology creates the contact point between the human agent and the ordered progression and stability of the sound produced by the device. Its regularity is tempered by the human presence on the scene, that enrich the musical experience rooting it in the usual theatrical situation. The agent is immersed in a mechanical environment. This repetitive music gains an ulterior contact with the human presence thanks to the performance on stage of the composer and the video artist. The piece, played live by the artist on stage, creates a paradoxical perceptive image in which a very repetitive and mechanical sound is played by a present, living and very expressive human beings.

These three case studies show the existence of specific musical forms and morphologies dominated by the mutual contamination of mixed sounds coming from machines, voices and instruments. Both human and non-natural sound types coexist. This contact is organised in a scenario in which the human is at the centre and the natural and synthetic sounds are in the foreground. This narrative process, that grounds the musical form, shows a specific type of interaction between the human being and its environment. Two types of figures interact, one coming from the living musician and the other coming from the

mechanical one[39]. Their interaction symbolises mimetically a confrontation that is typical of the contemporary environment. Indeed, the contemporary sound morphologies evolve in a sonic hyper-environment of natural and non-natural objects. This melting, that characterises a big part of the last century music, evolves in a dimension that has become dramatic in our contemporary time.

Electronic music has a role in this cognitive interaction creating symbolic forms in this environment. This music is anchored to our living contingencies. It is, in my opinion, a creative living contingence. Never as nowadays, the presence of generated mechanical and electronics sounds (intentionally produced, or not) occupies social, sound and physical spaces. Thus, music behaves as a natural agent. Therefore, the "return to the concrete", proposed by Pierre Schaeffer with the characterology[40], is practised and updated by the musical uses of the electronic vocabulary. The "as if…" proposed by the characterology has the function of transforming the meanings of perceived sound objects updating their mining and sense. This characterological behaviour, more than a typological function, has a transformational power[41].

Conclusions

The musical appropriation of technological environment is characterised by an adaptation and a transformation of the practice. Indeed, music is not detached from our environment: it participates to the sonic environment. This last one is determined by all the sounds together, that enter, in loop, in a continuous process of inter-contamination. Following Tim Ingold,

> human beings are organisms whose life and reproduction depends upon their interaction with organisms of other species, as well as with abiotic components of the environment[42].

Thus, I argue, if perception, and practice, provides this link, then music constitutes one of its most relevant aspects. To provide this link, music must have an impact on human cognition and then on the most intimate part of its imagination, modifying the horizon in which our actions are conceived and projected. I think that this adaptation is rooted in a representational process made through music. Electronic and instrumental sounds hybrids are the standard sound morphologies of today. They are part of our cultural evolution. They enter in the musical language and are part of us. I think that this evolution

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[39] I'm thinking here to the notion of "figurativisation", proposed by François Delalande in order to qualify one of the form of listening that he proposes. This listening type is oriented toward the recognition of live indexes and movements in the perceived objects. Cf. François Delalande, *Analyser la musique, pourquoi, comment ?* (Paris: INA, 2013), 76.

[40] Schaeffer, *Traité des objets musicaux. Essais interdisciplines.*, 497.

[41] John Dack, "The mediating role of the piano in Karlheinz Stockhausen' Kontakte für Elektronishe Klange, Klavier und Schlagzeug", in *Analyser la musique mixte* (Sampzon: Delatour, 2017), 155-61.

[42] Tim Ingold, *The Perception of the Environment. Essays on Livelihood, Dwelling and Skill* (New York: Routledge, 2000), 2.

passes through the transmission of sonic and syntactical features. Actual musical practice creates specific forms of interaction, that are both sonic and performative.

In McLean's case, the interaction happens between the performer and the computer, the sound and the video, programmed live by another performer. The rigid transformation of electronic sound interacts with the physical and visible movements of the musician and is understood through the sound morphologies that are typically mechanical. In Tremblay's piece, interaction is characterised by the contact of the cello, electronics but also by the mixed performative space[43]. In Roads' case, the interaction happens between sound particles, formantic partials of sound, generated, produced and organised in a vivid confrontation through the evocation of natural, phonetic and living complex wild sounds in an ultra-synthetic environment.

What these examples have in common is that they deal with living forms from an electronic point of view. More than a "mediation", these experiments represent a cohabitation and a transformation, fostered by the musical imagination. By means of music, an appropriation and transformation of instrumental, natural, vocal and electronic pre-existing models is practised. Thus, through perception, this mimetic process involves both minds and bodies and could be highlighted through the observation of "imitation of nature and of aspects of human culture"[44].

Now, Emmerson proposed two kinds of mimesis: the timbral and the syntactical. The contamination of sound morphologies, gestures, sound sources and agencies stems from the transposition of their musical features sonically and syntactically. I tried then to show in the three case studies explained above that, morphologically, there is the emergence of sounds that are human-carried and machine-carried at the same time. This coexistence represents a phenotype of the actual environment, defined by the morphological hybridisation. The internal sound dimensions melt complex sounds enlarging the registers and the timbres. Syntactically, the external sound profile (the "dynamic profile") conjugates electronic and human agents, managing with causality, repetitions, pulses, spaces. At the same time, gestures manage with utopic durations, and broke the hiatus between gestures and textures.

This tecnomorphic[45] feedback defines our habits of perception and fabrication of musical meanings, morphologies and forms. This confronts the mechanical and the natural sounds and creates a space between the ordered and the disordered sounds, recognised as traces of human and mechanical gait[46]. The contact of these kinds of fluctuations is part of our contemporary vocabulary. The mutual imitation of mechanical and natural aspects constitutes one of the engines of the evolution of musical language. This mimetic process is intimately experimental. It concerns the reanimation of electronic and the transformation of the musician's role.

Following Emmerson,

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[43] Pierre Alexandre Tremblay, "Tuning to Trust: System Calibration as Creative Enabler", in *Proceedings of the 43rd International Computer Music Conference 2017* (43rd International Computer Music Conference 2017, Shanghai, 2017).

[44] Simon Emmerson, "The Relation of Language to Materials", in *The Language of Electroacoustic Music* (Palgrave Macmillan, 1986), 18.

[45] Lum et al., "Human or Superhuman: Individual Differences in the Perception of Technomorphism".

[46] Maestri, "A Typo-Morphological Approach to Human-Machine Interaction Analysis in Music".

> when we look at more recent developments and the evolution of genres, the environment finds its way increasingly into music not only via recording and reproduction of *sounds* as such but through simulation of the characteristics of the systems' *behaviours* and their complexities.

Therefore, he argues that

> […] a kind of *underground vernacular* is emerging" and "that the process is one of *exchange* and that a hidden consequence is that the 'live' is also being thrown back from human agency into the (so-called) 'inanimate' world. […][47].

I think, then, that the mimetic process of integration of techno-carried musical forms is part, or even the main vector, of the evolution of our musical languages, the vernaculars and the cultivated. It acts as an agent in our cultural environment. Experimentation is then multiplied and expanded, it belongs to every musical practice of every musician in every space. It must be traced, open and criticized through practice. It creates a vocabulary and an up-to-date syntax adapted to the evolving meaning of the contemporary World.

In the context of this intimate transformation, human being's existential horizon transforms in means and colours. The musical elements referring to human agents are surrounded by non-human and non-natural sound morphologies. Therefore, I tried to show how this horizon, in the context of which human gestures and morphologies are included, is linked with the technological environment. Someone may observe that this observation is quite obvious. That is true. Indeed, the evolutive process that I try to highlight involves instruments, electronic sounds, hybrids and hybrids of hybrids, and it is clear for everyone. What I point to, then, is to look at it from an existential perspective. If the reanimation of live constitutes an evident aspect of electronic music of the last twenty years at least, it solicited a specific modification of the compositional imagination, based on the interaction that we have with this environment and with the representation faced to deal with it. How?

Electronic means are rooted in a renewed experience of existence, that confronts human being with another kind of "possibility of the impossibility" – the death for Heidegger –, that is the infinite time and energy of digital and electronic devices. This ontological definition characterises the type of interaction with environment provoked by the practice and the perception of music and constitutes the crucial aspect of the intimate transformation of expectations and then of musical imagination. I think, then, that the musician, related to electronic means, is confronted with its limits in terms of existence at every moment. Music results from this constitutive aspect of our contemporary contingencies.

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[47] Emmerson, *Living Electronic Music*, 53.

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