

Listening and Analysis of Mixed Electroacoustic Music as Tools for Interpretation's Construction

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Abstract

The development of methodologies and tools for performing construction is important to broaden the scope of opportunities available to the performer for their musical practice. This article deals with the analysis of mixed electroacoustic music from listening as well as analysis of a specific tool for this genre, the functional analysis conceived by Stéphane Roy. All the proposed analytical approach is oriented towards the development of interpretative choice and performative construction directly related to the analyzed elements and to the sound units recognizable by listening within the set of sounds fixed by the electronics. Specific elements of this theoretical analytical model and its applicability in musical practice are covered. Listening is the way of accessing to different informations while analyzing the tape and preparing the performative version, but it is also the important link between performer and electroacoustic sounds during the liveperformance. This article proposes the use of the described method using spectrographic visualization software for the comparison of obtained data and published comparative results.

Keywords: Electroacoustic, functional analysis, electronics, performative construction, listening, hearing.

1. Introduction

« *The first of all commandments is: work your instrument.*

[...] *And the second is similar to the first: work your ear as much as your instrument.*»

Pierre Schaeffer ².

Electroacoustic approach has a primal importance in the characterization of the 20th and 21th century music. It was the source of new musical and aesthetic thoughts and the stimulus of a new form of perception and sound processing, with a special attention to its intrinsic and constituent qualities. As stated by ROY (2003), "If the electric flow had not activated a speaker membrane, if the groove had not closed in on itself, the contemporary music environment would have been very different" ³. By mentioning the experiences of Pierre Schaeffer, the author exposes the importance of this music that has also stimulated the development of new textures and musical forms in relation to the treatment of strict acousmatic sounds or vocal and instrumental forms.

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2. CHION, Michel. *Guide des objets sonores. Pierre Schaeffer et la recherche musicale*. Éd. Buchet/Chastel, Paris, 1995, p. 12.

3. ROY, Stéphane. *L'analyse des musiques électroacoustiques: modèles et propositions*. Ed. L'Harmattan, Paris, 2003, p. 21.

Concerning music composition, electroacoustic researches and computer environment contributed to a multitude of sonic possibilities, and tools for materials' design and work. As stated by Tristan Murail in his interview with Cohen-Levinas (1992): "The data processing environment provides us with a sound universe without visible limit, without restraint. This point seems new, fundamental and fascinating to me." ⁴ Understanding the sound phenomenon and its constituent aspects in the history of the 20th century was a milestone of the initial work of Pierre Schaeffer and, from its activities, several studies have taken place. "It is through a true restoration work of listening that Schaeffer tried to give back the 'sonorous' into the music to reinstate the communication between composer and listener"⁵. The electroacoustic was therefore characterized since its inception by a sound approach guided by ear, hearing, listening and the consciousness of this act. Schaeffer was extremely sensitive to this subject and it is quite visible in his Treaty of musical objects (*Traité des objets musicaux*⁶, the TOM), where an entire book (Book II, called the "Hearing" containing 4 chapters) is dedicated specially to human action of listening to the sounds. As Schaeffer said himself, "The Treaty of musical objects is primarily a Treaty of listening" ⁷ and it is quite significant that his approach has gradually evolved and has mixed the art of making the sounds to the art of listening to the sounds.

As GUERTIN (1988) says: "Listening to music is never a simple act and perhaps as such, one of the lessons of contemporary music would be to confront ourselves with our auditor limits - limits of our hearing, of our intelligence, of our sensitivity, of our curiosity - and to show us that the meaning is never granted" ⁸. But this "auditor limits" stated by the author may be confronted by the analysis and thus exceeded. Listening and analysis can influence each other and thus stimulate a musical construction related to the interpretive practice and electroacoustic music in the mixed genre (in which there is an instrumental part and electroacoustic sounds association). For Stéphane Roy, electroacoustic analysis is still a "marginal enterprise" and he says: "Musicologists do not dwell extensively on this, often for lack of aesthetic affinities, sometimes for lack of adventurous spirit. It is significant in this regard that the principal general books dedicated to musical analysis as those of Brent, Cook, and Dunsby/Whitall make no reference, even summary, to analysis of concrete music, electronic, electroacoustic, acousmatic or even *computer music*" ⁹. For him, the analysis of electroacoustic music would benefit "our overall knowledge of the musical phenomenon and its universals" ¹⁰. But if until now this area has contributed to the development of new musical concepts and to the refinement of the understanding of the world of sounds, we should dedicate more studies to understand it.

Some arguments may explain why there is a certain gap between analyses and electroacoustic music. For GUBERNIKOFF (2007): "If electroacoustic music seems a challenge for musical analysis it is because the analysis is based on the notation, in the form of written text, not on music actually played or listened. What musical analysis often observed is the score and not the sound result or the listening experience" ¹¹. It is possible to demonstrate that scores accompany certain electroacoustic compositions. Nevertheless, the composer is not obliged to make a previous score in order to be interpreted or sonorised afterwards. He then builds his work in a constant interaction with the sound material he chooses.

4. COHEN-LEVINAS, Danielle. « Entretien avec Tristan Murail ». *Les cahiers de l'IRCAM*, 1, 1992, p. 19-20.

5. ROY, 2003, p. 51.

6. SCHAEFFER, Pierre. *Traité des objets musicaux. Essai interdisciplines*. Éditions du Seuil, Paris, 1977 (First edition: 1966).

7. ROY, 2003, p. 51.

8. GUERTIN, Marcelle. « Le sens de l'oeuvre musicale contemporaine depuis l'acte d'audition ». *Revue Contrechamps*, 10, 1988, p. 83.

9. ROY, 2003, p. 43.

10. ROY, 2003, p. 45.

11. GUBERNIKOFF, Carole. « Metodologias de análise musical para música eletroacústica ». *Revista eletrônica de musicologia*, 11, 2007, p.1.

There is therefore this 'empirical' aspect guided by listening that is hardly reducible to any musical notation, although many composers have tried, in their own personal way. It is clear that the development of the concept of timbre and the search for new sounds have played a key role in this quest for a new electroacoustic compositional approach, as is the fact that the composer worked directly on sounds "manufacturing the material somehow in the way of a visual artist and bypassing through a writing code" ¹².

But if the composer had direct access to sound factory and its intrinsic properties (and the writing and score making were no longer an essential models *a priori*), a direct approach stepped between him and his work through the act of perceiving and listening to the sounds. For GUBERNIKOFF (2007) there is therefore, throughout the history of electroacoustic music, a questioning of important matters about the nature of the hearing and on the creation of an "oral tradition" and "unwritten" posture, which would be a possible motive of difficulty and a refusal of analysis among some researchers ¹³. It is thus evident that many aspects of listening may help analytical procedures to electroacoustic music.

Listening, by being the relationship established between the human organism and the environment through its sounds, is the appropriation of the world in the shape of sound(s). It is also the relationship between composer and thought work, between composer and performer, between performer and work, between multiple performers in chamber music and, of course, between public and work. This relationship will be translated into music based on personal knowledge and material conditions available. The hearing is the fulcrum responsible for linking these different elements. GUERTIN (1988) offers various pertinent questions about the hearing of contemporary music from the perspective of the viewer: "What is the meaning of what I hear? How these events from a sound universe that is hardly or not at all familiar to me make sense? How does this hold itself together? How to organize it?" ¹⁴

From these questions, it is interesting to ask some more to the performer, that will be used here in parallel and linked with electroacoustic music: What is the relationship between listening and analysis for interpretative purposes in works for mixed electroacoustic music? What is the meaning of what is heard on the tape and how to use these elements for the interpretation? How to appropriate these elements and become familiar with them so that the interpretation is the most refined between tape and performer? Which aspects of listening can therefore assist the analysis of the work to help build the interpretive meaning? How to organize what is perceptible by listening in information for the interpretative act and the public during the performance?

All that was discussed so far can be summarized in three elements: Electroacoustic music, listening and analysis. It is from the connection of these three benchmarks that the interpretative act will be identified and will be discussed with the aim of musical construction.

2. Listening and electroacoustic music

2.1. Listening: a quest for definition?

If electroacoustic music is directly related to technological computer media development, these new technologies have brought new challenges for human listening. As BATTIER (2003) explicits very precisely, electroacoustic music was born from the recording and listening and was served by whole electroacoustic equipment ¹⁵.

¹². DURIEUX, Frédéric. « Réseaux et création ». *Les cahiers de l'IRCAM*, 1, 1992, p. 93.

¹³. GUBERNIKOFF, 2007, p. 3.

¹⁴. GUERTIN, 1988, p. 75.

¹⁵. BATTIER, Marc. « Science et technologie comme sources d'inspiration ». In: *Musiques. Une encyclopédie pour le XXI^e siècle*, Jean-Jacques Nattiez (dir.), Actes Sud/Cité de la Musique, Paris, 2003, p. 527.

Listening is not a phenomenon that can be summarized in a few words. CASANOVA (2009), for example, characterizes the definition of listening in different centuries, from the origin of the word at the end of the 9th century with the term *ascultare* from the Latin to the most different terms and says: "The word as we use today has actually made sense in the early 20th century in connection with radio broadcasting and telephone and - is this a coincidence? - it's contemporary with the birth of psychoanalysis that has been - for certain uses, not intrinsically - used to establish laws in human relationships" ¹⁶.

It is possible to perceive how the creation and development of radio, telephone, recording and broadcasting sounds changed everything. His discussion highlights this aspect of the early 20th century which - "is this a coincidence?" - is in direct connection with the birth of electroacoustic music and musical phenomenon of fixed sounds. On listening, DELALANDE (2003) compares the relationship of activity and passivity of human beings in history; he thus exposes manifestations of listening over time in comparison to subjects practices. So he says: "From the late 16th century - when the most specific musical situations (leaving aside the parties and shows where music is integrated to an action that partly masks it) consisted mainly of "making" music - we have moved, at the end of the 20th century, to a musical society where "listening" is the dominant practice. At the end of this evolution, "acousmatic" listening, a sort of pure listening, represents a borderline case" ¹⁷. It's in a newer sense of the discussion about perception and musical listening that CLARKE (2005) defines: "Perception is the awareness of, and continuous adaptation to, the environment, and, on the basis of that general definition, the perception of musical meaning is therefore the awareness of meaning in music while listening to it" ¹⁸.

The researcher outlines what he calls the "contemporary listening", which he defined as the experience of the auditors of the early 21st century. He adds that those listening attitudes and practices did not just appear from nowhere, they have their own history and have come about by means of a historical process that continues to exert its influence ¹⁹. If, for him, there was this historical and community aspect, there are also aspects related to individual perception and prefiguring the act of personal listening: "what the listeners were hearing most recently, differences in how they focus on the sounds, their previous experience or training, and so on - in short a whole variety of "treatment" differences largely based on mental representations or memory processes of one sort or another" ²⁰. DELALANDE (2003) says: "The emergence of radio broadcasting and disc [...] make listening to music by far the most widespread musical practice. Not only the act of playing music is no longer one of the preferred aims of the partition, but it disappears from view. Ultimately, the instrumental performance, relayed in the case of the disc, by studio techniques of successive "takes" and editing, is no longer more than a backroom job that the auditor is not even informed of" ²¹.

The music's historical process has really undergone a great change in the early 20th century, which triggered a change in the skills of listening and relationship of the human being with his soundscape. This change has been consciously perceived since the early history of electroacoustic music, evidence that can be found in the writings of Schaeffer and which is also present throughout the German debate on sound synthesis. Schaeffer wondered a lot about his own act of listening, and the concrete music was the consequence of this process. Thus, for BATTIER (2003), faithful to his intuition, Schaeffer claimed the creative power of the ear and Concrete music is not born of the machine, it is generated by listening and gesture of the musician ²². Meyer-Epler also had marked preoccupations with listening and acoustic phenomena, and, when expressing his ideas, he says: "It is necessary to revise the acoustic terminology naming sounds and noises, not by their origin but according to their physical constitution. However, in doing so, we must consider the capabilities of the human ear.

¹⁶. CASANOVA, Vincent. « Au seuil de l'écoute ». In: *L'écoute, Séminaire du 13 février 2009*, Ed. du Conservatoire de Strasbourg, Strasbourg, 2009, p. 14.

¹⁷. DELALANDE, 2003, p. 538.

¹⁸. CLARKE, Eric F. *Ways of listening, An Ecological Approach to the Perception of Musical Meaning*. Oxford Press, Oxford, 2005, p. 4-5.

¹⁹. CLARKE, 2005, p. 9.

²⁰. CLARKE, 2005, p. 11.

²¹. DELALANDE, 2003, p. 538.

²². BATTIER, 2003, p. 560.

Since Helmholtz, we recognize the ability to analyze 'spectrally' the acoustic phenomena; and as a consequence, given the current development of our knowledge on the functioning of hearing it is appropriate that we represent the structure of causes of our auditory sensations with a *plan based on time and frequency*"²³.

For MENEZES (2006), the new listening factor is also related to the appearance of the spatial dimension of sound. For him, the potential opened by the electroacoustic music, that permeates the air by the phenomena of moves, changing speed, cross stereo or spatial multiphonics, reverses the listening situation: the sounds, due to their extreme spatial mobility, end up making the listener perceive himself in the middle of the space in which listening happens²⁴.

Thus, if the auditor finds the origin of instrumental sounds by means of direct gesture, automatically and often with the support of view, it is the spatial dynamics of the electronic sounds that allows the individual to locate himself in the middle of the sound space in which the work is spreading.

Electroacoustic music is consequent upon the consciousness of a new factors in human hearing, but it also is an agent of this transformation, for it lead the whole discussion from the composition plan, aesthetic and theoretical, to the sound plan, musical and practical.

2.2. Schaeffer: reduced listening and the sound object

To the term 'écouter' (listening), SCHAEFFER (1977) also adds other concepts with which he wanted to make a difference: 'ouïr', 'entendre' and 'comprendre'²⁵. So, beyond considerations about those terms, he's responsible for the creation of two terms linked to his plans for a new listening (a "twentiethist" listening as stated ARBO²⁶): reduced listening and sound object.

Schaeffer had deep concerns on the theme of listening and tried to create a methodology appropriate to the separation between sound (individualized with its own peculiarities and called sound object) and its source of origin. For him, this separation could give to the sound object the opportunity to be better perceived and understood, and he named this "reduced listening act". To succeed, he gave a great importance to the description, characterization and typology of sound objects. The definition of sound object is rarely encountered in his work (TOM); on page 95, he defines what is not a sound object (this is not the "instrument that played" nor "Tape part" or "a state of mind") and says: "There is the sound object when I've achieved, both materially and spiritually, an even more stringent reduction than acousmatic reduction: not only I stick to the information provided by my ear [...]; but this information concerns only the sound event itself: I do not try, through it, to find out about something else (the interlocutor or his thought)"²⁷.

It is evident then that the definition of sound object is directly related to the act of reduction of this object, since "The sound object is at the confluence of an acoustic action and a listening intent"²⁸. For Schaeffer then "the sound object is what can be perceived when listening intent faces the sound itself. It is a specific act of reduction that allows us to reach it: we must renounce any intention to aim at the origin or at the cause of an object that is scrutinized for himself"²⁹ For CHION (1995), reduced listening is the attitude to appropriate sound for itself, as a sound object by ignoring its origin (real or perceived) and the meaning it could carry, for him, the reduced listening and the sound object are thus correlated with each other; they define each other mutually and respectively as a perceptual activity, and as an object of perception³⁰.

²³. SCHAEFFER, 1976, p. 134.

²⁴. MENEZES, 2006, p. 365-366.

²⁵. SCHAEFFER, 1976, p. 104.

²⁶. ARBO, Alessandro. « Qu'est-ce qu'un "objet musicale" ? ». *Les cahiers philosophiques de Strasbourg*, 28, 2010, p. 225-248.

²⁷. SCHAEFFER, 1976, p. 268.

²⁸. SCHAEFFER, 1976, p. 271.

²⁹. ARBO, 2010, p. 228.

³⁰. CHION, 1995, p. 33.

This 'perceptual activity' aimed to emancipate the sound from its denotative possibilities, from allocation of foreign meanings and from direct association with other sounds or with a specific object, which for Schaeffer was fitting his quest for a phenomenological thought in the act of listening and an understanding of the meaning of the sound phenomenon. Giving a practical example, MENEZES (2006) says that when listening to sounds through speakers, the subject of listening can not rely anymore on the traditional support of the vision for the detection of the origin of musical sounds and he would pay more attention to the perception of the peculiar constitution of sounds (sound typology) and to the behavior of sound in time (morphology of sound spectra) ³¹.

If Schaeffer seems to have created a complete, exhaustive and persuasive overview about listening, many criticisms were addressed to its definitions and concepts, with many of his proposals discussed anew. Schaeffer's research on these "universal" and "timeless truths" can now be seen as a first problem. Even by drawing comprehensive arguments, he always falls back on definitions which he believes are applicable to everything. Another criticism is related to the depersonalization implied by a reduced listening as the one he had been propagating. By rejecting the personal involvement, the imagination, the previous references of the individual, the socio-cultural relations established with the music, the interference of personal moods while listening and the peculiar individual reality, this act became an exercise against human reality. ARBO (2010) specifically discusses the sound object and he criticizes *yet a priori* the term 'object' for sound and musical implications. For him, conceiving them as objects (rather than as a process or an expression of an activity), means shaping time units from the uptake of a visual experience, which is not the case with sounds. He says: "On one hand, it is understandable that Schaeffer there resorted to stand away from a speech traditionally focused on the notes and chords; but on the other hand, it should be noted that on a phenomenological level, this concept involves a coexistence of elements or parts in space that sits uncomfortably with how the sounds exist. These are normally seen as events, or sometimes process, rather than as objects. This is not only a matter of lexical precision: such concept seems indeed to disrupt the speech, hiding the side constitutively dynamic of the sounds and their perception" ³².

Through a discussion related to the term object, ARBO (2010) will give its definition of musical object and in its conclusions, he states: "What could bring us the notion of object? I think it would help us to focus our attention on a crucial point, the idea of understanding music [...] of a performer's point of view or from a listener's (nothing prevents, although of course, that the latter is at the same time a composer)" ³³.

So this "idea to understand the music" might stimulate us to define a notion of music listening. As stated CLARKE (2005), listening to music is to engage with the sense of music ³⁴ and, if listening is linked to the meaning of the music, it is by analyzing that these elements can be clarified and highlighted, whereby it will be possible to prove that an event or thing contributes directly to each other, being invariably linked.

3. The musical analysis

For DUNSBY (2004), the circles of music theory seem more and more aware that the relationship between the analysis of music and its performance deserves further study and music analysts "are not surprised to see the interpretation in an important and evident place" ³⁵. With specific regard to the analysis of electroacoustic music, DELALANDE (1996) says: "Mostly without partition, or in the case of a mixed electroacoustic music, with a prescriptive notation that makes it difficult to get an idea of the sound realization. Furthermore, a very exploratory use of its resources for which all analytical model "rehearsed" on a previous repertoire is generally unusable." ³⁶

31. MENEZES, Flo. *Música Maximalista – Ensaios Reunidos sobre a Música Radical e Especulativa*. Editora Unesp, São Paulo, 2006, p. 347.

32. ARBO, 2010, p. 229.

33. ARBO, 2010, p. 245.

34. CLARCKE, 2005, p. 188.

35. DUNSBY, Jonathan. « Analyse et interprétation ». In: *Les savoirs musicaux*, Jean- Jacques Nattiez (dir.), Vol. 2, 2004, p. 1040.

36. DELALANDE, François. « La musique électroacoustique, coupure et continuité ». *Musurgia*, Vol. III, no. 3, 1996, p. 7.

Thus, it can be perceived in his arguments the difficulty of the analytic act in electroacoustic music, even if there is a score given in mixed repertoire. An analytical approach may raise several new questions around the relationship between the instrumentalist, the score he should play and the electroacoustic recording that he is supposed to “accompany” or by which he must be “accompanied”. The constitutive element of this relationship and which allows to link the different constituents may be that of listening. As stated ARANDA (2006): “Questioning about the electroacoustic music and doing it right from the position of the listener starts processes that go beyond the mere sound.

In this way, the analysis of the music from its listening involves semiotic implications and resonances due to its ability as a sign of a reference to something stranger to the proper soundfact, and psychological implications since this requires a sensory input from which our mind can re-articulate what it perceived. In both cases, the individual organizes what he heard and gives it coherence and meaning beyond the traditional analytical frameworks”³⁷.

It’s in this perspective that we situate the need for specific analytical tools for mixed electroacoustic repertoire. It is through listening that the interpretative construction can be done and should bring important elements to the performer and the audience. The specific analysis for the electroacoustic repertoire is also an essential tool in this case and must be realized by a clear methodology that can establish links between the various components to enlighten the relationship between electronic sounds and instrumental sounds in the repertoire for the mixed electroacoustic genre. About this, ROCHA (2008) states that: “The relationship with the electronic device and with the specific characteristics of this new repertoire presents new challenges to the performer and requires new skills, including learning new musical gestures and a basic knowledge of music technology”³⁸.

Thus, the understanding of electroacoustic creation process and the results desired by the composer can affect performance decisions. The analysis of electroacoustic sound material is therefore an important reference point for interpretation and may represent an interesting and constructive challenge, or even essential, for the interpretative capacities of the musician.

3.1. Functional analysis of Stéphane Roy and opportunities for performative studies

To ROY (2003), the analysis of electroacoustic music by perception requires two levels of approaches, one from “above” (“par le haut”) and the other from “below” (“par le bas”), where are observable two aspects respectively classified as macro and micro level. The macro level (from above - “par le haut”) must be linked to a method that can allow to identify and assess the role and relationships of units depending on the context of appearance and development. The micro level (from below - “par le bas”) is enlightened by a methodology that identifies the specific and individual morphological units. The units that Roy specifies in his analysis are demonstrated in Figure 1.

³⁷. ARANDA, Antonio Alcázar. « Analyse de la musique électroacoustique, genre acousmatique, à partir de son écoute : bases théoriques, méthodologie et but de la recherche, conclusions ». *LIEN Revue d'Esthétique Musicale*, L'analyse perceptive des musiques électroacoustiques, 2006, p. 21.

³⁸. ROCHA, Fernando de Oliveira. *Works for percussion and computer-based live electronics: aspects of performance with technology*. Thèse de Doctorat, McGill University, Montréal, 2008, p. 2.

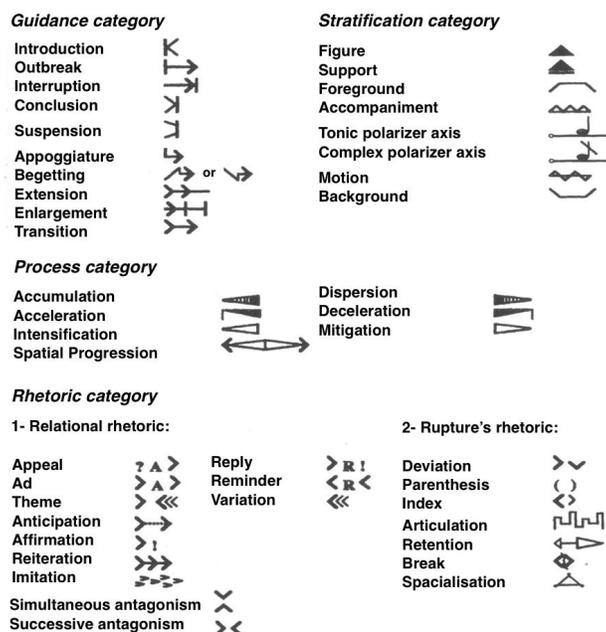


FIG. 1: Stéphane Roy's functional grid with 4 categories of rankings (guidance, stratification, process and rhetoric categories).

For Roy, the semiotic point of view adopted for functional analysis is the product of an inductive aesthetic that places the listener of an electroacoustic work in contact with its spontaneous perception. Thus, for him, the listener not only recognizes listened units from its morphological features, but also from the function they have and play in the work. In his description of the functional analysis, Roy present a grid of forty four functions, divided into four main categories (FIG. 1): guidance, stratification, processes and rhetoric.

For Roy, a unit carries a function if it has two essential characteristics: 1 - It presents a minimum of salience to the perception and possesses well-defined morphological boundaries (to differentiate itself from other units); 2 - It plays a role within a group (sometimes, the unit will also present several functional roles within the analyzed structure, being characterized as multifunctional). To fulfill a function, the unit must express two criteria: morphological and contextual. The first is related to the individual, constitutive and proper characteristics of the unit, and its functional roles depend on the presence of some "morphological and characteristics traits" that will determine its properties and individualities. The second is linked to its relationships with others units in the acoustic time and space; according to the author, it "is taking shape thanks to the relationship network that is woven between the units in a local context as in a global context of a work"³⁹. Thus, functional analysis proposals seem important for their application to the interpretive creation and to provide resources of comparability and establishment of principles and possibilities of performative choice.

The Figure 1 shows the functional grid with the four categories of classification (guidance, stratification, processes and rhetoric categories) established by Roy and the specific units to each one of them (44 in total). For the author, the functions of the guidance category (with 10 types of units) have in common their role as an operator, whose purpose is to initiate, to stretch, to contract, to agitate, to "move to" and achieve, often unexpectedly, progressions in the local musical tissue⁴⁰. It is evident that this criterion will feature elements that are connected and which occur in a horizontal structure and the author will describe the units according to their positions as antecedent or consequent.

³⁹. ROY, 2003, p. 344.

⁴⁰. ROY, 2003, p. 344.

While thinking about the possibilities of interpretative interaction with electronics, we can perceive the relationship between the elements of the guidance class with musical elements of the phraseology. Phraseological directives can be guided by listening references analyzed in this category. The phrases might have their dynamic orientation, articulation and speed designed from the material suggested, seeking a similarity or either to obtain a total deviation with electronic sounds. Thus, the elements of guidance category (in French "catégoried'orientation") contribute to the creation of discursive musical paths in a horizontal layer, in the directional aspects of the sentence and in the sequences of notes.

By cons, the functions of stratification (with 8 types of units) rather correspond to a vertical structure with simultaneous reports, whose units are organized in a perceptive hierarchy of a layered texture: "these functions are a little dependent on the time criterion; they could at a pinch be defined as participating in the formation of a "syntax" of "vertical" reports organizing the axis of simultaneity in which the work unfolds" ⁴¹.

In mixed electroacoustic there is already a certain kind of stratification. Between the sounds of the musician and those from the electronic media there is already a kind of highlighted and order of layers of a different kind and nature. So the analysis of electronics based on stratification categories can give clues about the possibilities of interpretative connections with these layers and therefore with the origins of electronic sounds. The performer will have various possibilities for positioning his choices: he may decide to add his part as an over-layer (looking for some consistency and equality with respect to electronics), as a conspicuous layer (emphasizing his part with regard to the electronics), as a support layer for a more evident material (playing below the layers of electronics). He may also decide on timbre issues in these cases, either by being like a resonant stratum within the rest (if there are possibilities to equalize the timbre with electronics) or a particularly individual stratum in its sound aspect. With the process category (7 types of units) it is observable that its functions (much like those of the orientation) are deployed on the time axis while being highly dependent on specific typo-morphological characteristics. According to author: "The process is defined as a unit endowed with a movement directed towards an end, movement reaching or not its point of outcome" ⁴².

The attributes of this category are characterized by dimensions (dynamic, melodic, spectral or rhythmic) that run in the form of an oriented profile, linear, uninterrupted. As in the requirements of the orientation category, interpretative suggestions are emerging here in temporal level and can play with the intensity, sentence, speed and articulation parameters. But, for this category, the importance is played on the definition of major sections and subsections; the evidence is perceived from the macro level ("from above", "par le haut") of the work and from larger contexts of structuring bonds within the composition. Thus the performative choices will connect the intersections in a broader level within large sections, especially in the features that constitute the sequence of different or homogeneous sections. Here, choices of application of specific timbres can influence the binding of related sections (electronics offer temporally separate sections, but with a correlate process, the player can bring them together by choosing the application of homogeneous timbre); they can also influence discordances between divergent sections (electronics present divergent sections, the player can make that clear by the choice of specific timbres for each section).

About rhetoric category (19 types of units), Roy says that the general rhetoric, understood as a set of resources used to make it more effective a persuasive act, is the backdrop on which stand out all the functions of the grid ⁴³. The rhetoric functions are thus expressive processes that operate by putting units in report (reference, opposition) or simply by breaking effects in the musical flow. The morphologies and functions are closely related in guidance, stratification and process categories. But in the rhetoric category there is a clear break between these two aspects since the morphological dimensions are little involved in the functional attribution. It is then mainly due to the position of a unit in the context of the work that such rhetorical roles are determined.

41. ROY, 2003, p. 345.

42. ROY, 2003, p. 347.

43. ROY, 2003, p. 347-348.

It is also in regard of this fact that the author claims: "More than any other function, assigning rhetorical functions appeals to the power of interpretation of the analyst" ⁴⁴.

All the steps necessary for the analysis also pass by the visual re-creation of the electronic equipment. If the work does not come accompanied by a precise audio score, the performer has to create his own, and the analysis will be recorded on this support for information gathering. This step may also be followed by the use of specific software. As stated COUPRIE (2003): "The first step in text or graphic annotation provides the analyst with a tool for note-taking during the first listening. The acousmograph allows to make these notes match with the sound file of the work. Furthermore, several layers of annotations and drawings can be superimposed and reveal the different steps of labor" ⁴⁵. The analyst-performer therefore establishes his references, his guides and performative ideas on paper and applies them at the time of play.

ROY (2003) deeply discusses each function unit with its attributions, its characteristics and qualities. For each unit that appears in the table in Figure 1, he describes in great detail the properties so that each unit can be classified in one category or the other, and so that they would be individualized and differentiated from each other. Here we rather leave the relationship established between categories, functions, features and connections possibilities with the performer. The use of this tool with specific analysis will be accompanied by the characteristics of each unit in a more practical way and with more definition on its application to the performance and interpretation. As stated ROY (2003): "Each new analysis refines the definition of functions and tends to expand their numbers. However the number of these functions should remain limited..."⁴⁶. It is also at each new analysis that will be connected more possibilities of links between listening, analysis and performance.

4. Conclusion

In this work we aimed to establish relationships between listening and musical analysis in search of important tools for the interpretation of electroacoustic music (mixed gender). We referred to the functional analytic methodology of Stéphane Roy proper to Acousmatic gender but, even if the author has not mentioned it, it seems extremely useful in addressing questions related to the interpretation of mixed electroacoustic genre. This functional approach allows us to offer to the musician important landmarks in relation to the soundtrack with which he plays and possibilities of notation of listening phenomena which may establish links between performer and electronics, between fixed sounds and live sounds. The different possibilities of classification of heard sound units (as much as its relations and links) in the musical tissue of the electronics can give to the performer new insights into the audio material with which he interacts and with whom he wants to establish concordance or discordance relations, approximation or distance, aggregation or fragmentation.

This methodology certainly seems applicable to other repertoires. As Roy rather uses it for the acousmatic genre, our proposal for the mixed genre seems important and subject to verification with repertoire pieces. For Roy, each new analysis is to refine the definition of functions and tend to expand their numbers, therefore, it is clear that each new analysis applied to the mixed electroacoustic repertoire brings important elements for establishing performative reports and for the discussion on the practical musical construction with new technologies.

In mixed electroacoustic music guided by fixed sounds (with tape, recording, or otherwise) we can say that this functional approach is even more useful, since in general the set sounds have a strong influence and are likely to be associated with the instrumental part (by unison, by timbre approximation or other). Auditory elements are, in a way, created to build relationships and functional intentions with the played part.

⁴⁴. ROY, 2003, p. 349.

⁴⁵. COUPRIE, Pierre. *La musique électroacoustique: analyse morphologique et représentation analytique*. Thèse de Doctorat, Université Paris IV, Paris, 2003, p. 225.

⁴⁶. ROY, 2003, p. 341.

As the tape is made to have a direct link with another element, it must lead to expectations, confirmed or not by listening (both from the performer who is interacting with it, and from the public who apprehends the whole result) with which the musician needs to relate to be able to adapt to a pre-set, pre-designed and pre-established equipment. The performer needs resources to stimulate the public towards an understanding of the relationship between two different sound objects (recorded music and live music).

Functional analysis can thus be used for its relevance to grasp the structural elements of the composition, as well as for its reports on the directionality and hearing relations between materials. It can directly motivate and determine specific and justified performative choices of reports and proposals of the performer in relation to its performance.

If our suggestions are turning here towards the repertoire with fixed sounds, it is still possible to apply it with the Live electronics. The interactions between musician and computer can also happen through functional analysis of composed sounds, and sequence of sections and electronic parts. New research and publications will enlighten more this area and this discussion with these specific repertoires. The research presented here is thus a proposition step in the experiment of an analysis mechanism that may suggest new tools for performers. This method could make possible the extraction of indices that favors grouping in auditory analysis of the directory to be worked on. These indices can show a path to the interpreter on which to build his choices of sounds, plans and constructions of dynamic climax, and other elements that will be the basis of his interpretation.

Next publications will directly deal with the mixed electroacoustic analysis through functional analysis. The works will be analyzed using graphical representations on AudioSculpt software showing the functional categories and interpretative possibilities of choice from these representations. The more analysis will be done in this way, the more information and tools will be available for interpretation decisions and performance. The contributions of this work can corroborate with the categories and expand the possibilities of use and application of the classification of Roy. This will also contribute to the development of new discussions in the field of performing arts, music practice and possibilities of interaction with electronic music and therefore between performer and technology.

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