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ABSTRACT

Mixed music is recent in the domain of music analysis. This musical practice, that is based on the contact of instrumental and electronic music enhances both the traditional music analysis, based on the study of the sources and the scores, and the analysis of the electroacoustic music. This paper proposes to conceive mixed music's analysis as a specific domain with specific methodologies that asks specific knowledges and musicological skills as it is a performative and fixed musical meta-genre which shares gestural notations and programming. This paper proposes a specific methodology for the analysis of mixed music. Based on the original notion of *mixed sound*, this paper will analyse a case study, will discuss the findings and the future researches.

1. INTRODUCTION

Mixed music reunites instruments and electronics. This definition is open-ended: it doesn't define what kind of instrument or what kind of device is used, if the instrument is a DMI (Digital Music Instrument) or if it is "acoustic" – traditional, mechanically activated – and if the electronics is played by a performer or if it is realised by a computer, played or generated; it doesn't define once for ever if the performer is real or virtual, if the sound agency is gestural or electrical. It describes a state of things. Instead of being ineffective, this definition includes, under a similar musical practice – the *mixed music* –, all kind of practices that confront different types of devices, acoustical or electrical. It is a positive and inclusive definition that responds well to the contemporary musical practice dissemination and hybridisation. This practice just *mix*; as definitions of "mixed ensemble" or "mixed choir" explain, this music just superposes different sound sources, as in chamber music a piano and a string quartet in a piano quintet. The distinctive aspect is that the sound is not completely mechanically produced. This music confronts human and computers and results from this interaction (Maestri 2017). *Mixed music* is a human-computer music-making practice (Stowell and McLean 2013). Indeed, this music meta-genre stimulates the encounter of "acoustic" instruments and "electronics". This encounter has consequences in both practices. In mixed music's history, composers and performers have developed aural and poetical strategies to mix the instruments and the electronics, to create an hybrid new sonority putting in contact the traditional sound devices, the instruments, and the new devices, the computers and the interfaces for musical expressions. I think that the goal of this contact is the organisation of a sound that can't be reduced to the electronic or the instrumental part and that the compositional strategies and technologies respond to this goal.

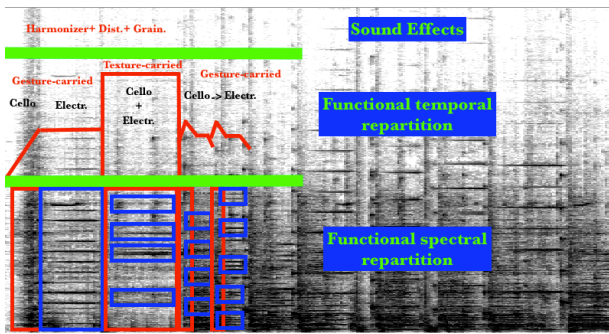
2. MIXED MUSIC AS TRANSFORMATIONAL

In the analytical literature there is the tendency of conceiving this *mixed music* practice as the sum of two already existing music genres, the instrumental-vocal and the electronic. I think that, on the opposite, *mixed music* is transformational (Dack 2017): it contributes to the transformation of both electronic and instrumental music pointing their contact and their conjugation in achieved musical works. I think that *mixed music* is an emerging musical practice that has an impact on both electronic and instrumental-vocal writing. The signs of this reciprocal conjugation are the utilisation of extended techniques in instrumental writing and the invention of strategies that adapt the electronics' time to the performer's tempo. In this musical practice we try to humanise the electronic sounds and to technomorphise the instrumental ones. *Mixed music* organises the human produced sound and the computer generated ones components. The organisation of a *mixed sound*, that organises and orchestrates the instrumental-vocal and the electronic one is part of the historical definition of mixed music as a specific practice (Dack 2017). This *mix* of the electronic and instrumental sound types and their sound sources is the most specific contribution of this musical genre and has fallouts in both electronics and instrumental composition conceptions. Their contact defines the conjunction of two dimensions that share the same sonic space with different functions. This contact emerges as the segregation of two sound sources and sound generators. *Mixed music* is characterised by a sound that is a complex object based on instrumental and electronics sound sources, agents and types. I think that this emerging object, the *mixed sound*, is the main objective of the mixed musical practice and that programming and instrumental techniques are orchestration strategies acted to realise this mix.

For the *Gestalt* theory, two types of emergent properties exist. The first one is *eliminative*: the elementary elements that compose the object are invisible or cannot be perceived separately; the second one is *conservative*: the emerging property conserves its constitutive elements (Di Bona and Santarcangelo 2018, 56). *Mixed-sound is a conservative emergent property*. Its parts are conserved as transformed. The instruments and the electronics collaborate creating a sound that is both, that transcend its elements and at the same time conserve them in a new dimension.

3. EXCEED THE TRADITIONAL APPROACHES

The traditional approaches in the analysis of mixed music divide two paradigms: the analysis of the device, its conception and usage and the analysis of the sonic output (Bonardi et al. 2017). The first paradigm develops methodologies of reverse



Ex. 2. Event number 4 functional temporal and spectral repartitions.

Functional temporal repartition. In the first sound event the cello anticipated the electronics. The cello and the electronics filled two functions of the envelopes, they are divided between the *onset*, the cello, and the *sustain*, the electronics. There is a consequential relationship between the instrumental and the electronic part. The second event is defined by the equal superposition of both the instrument and the electronics: the cello crackles the bow's hair on the bridge and the electronics plays the electronics, at the same time, a noisy sound file. This superposition make it difficult to separate the sound sources. The electronics and the instrument create a unique noisy sound morphology in which both are very closed. The third part is characterised by the repartition of the temporal envelop that is characterised by *onsets* played by the instrument and *sustains* played by the electronics. It is a functional repartition that define a consequential relationship between the instrument and the electronics.

Functional spectral repartition. From the point of view of the spectral repartition, the first event is determined by two sound types. The first one is the *crescendo* note played by the cello and the second is oscillators bank played by the electronic that holds a fixed group of frequencies. This repartition follows the temporal one and highlights the consequential relationship of the instrument and the electronics. The second part of the event is determined by the repartition of the spectrum's energy towards the noisy sounds of the cello and the electronics that highlights emergent frequencies, as we can see in Ex. 2. The third event presents a spectral repartition of two plans: the cello is in the foreground playing a descending line of *pizzicato* and low notes while the electronics holds frequencies banks and doubles the *pizzicato* of the cello.

5. DISCUSSION

Both the cello and the electronics create a dense sonic whole in which the instrument is followed by the electronics and the sound is exalted by the richness of the instrumental play. I tried to analyse the sonic output of a mixed piece envisaging the hypothesis of a *mixed sound*, that emerges from the contact of the instrument and the electronics without erasing its elements. I propose to analyse this emerging object from the point of view of the functional repartition of its elements. In the example the cello and the electronics create a repartition of both temporal and spectral dimension. The first one is characterised by two types of repartition. The first one is *consequential*, the

instrument anticipate the electronics. There is a causal relationship between the two elements. The second is characterised by their *superposition*. They coexist in the same event creating a more static sound morphology. These two types of functional temporal repartition are well described by the notion of spectromorphological behaviour. Smalley proposes the notions of *horizontal-causal* and the *vertical-togetherness* of the spectral behaviour of the spectromorphologies to indicate this phenomenon (Smalley 1997, 119).

The spectral functional repartition highlights a subdivision of the roles of the instrument and the electronics. In the first event the instrument is fixed in a register and the electronics plays a large bank of frequencies that contrast with the instrumental precedent part; in the second event they share the same space. This coexistence make it difficult to clearly listen to the two dimensions. However, it is possible to identify their repartition thanks to the division of the spectrum between both dimensions. The cello plays noisy and disordered sounds, the electronics a noisy sound in the background and fixed granularized frequencies in the higher register. The instrument and the electronics share the same spectral space but they occupy contrasting bands of the spectrum. In this manner the electronics and the instrument collaborate creating a rich and unique sound morphology.

6. CONCLUSION AND FUTURE WORK

Mixed music is usually studied from the point of view of the devices or from aural perspectives. Interactive aural analysis presents an alternative methodology capable of linking the poetic and the aesthetic aspects of this practice. In this paper I proposed to consider the sound result of the contact of instrument and electronics as a global whole. Inspired by the *Gestalt* psychology concept of emergence, I proposed to think the sound result of the contact of the elementary dimensions of *mixed music* as an emergent conservative property. This notion grounds this analytical perspective.

The instrument and the electronics are analysed as interacting in the sound event. The analysis allows to understand this interaction and the functional repartition of both dimensions. The temporal repartition highlights the consequential and the togetherness of the mixed sound organisation. The spectral repartition shows the differences of the two parts in terms of the spectral energy in the whole spectrum and the repartition in the vertical domain. The organisation of the temporal and spectral aspects of the *mixed sound* highlights the orchestrations strategies implemented by the composer and solicit further researches in this domain. Indeed, this analysis shows that the organisation of the temporal and spectral space of the instrument and the electronics implies the utilisation of specific instrumental techniques and the conception of specific sound morphologies in the electronics. The organisation of the *mixed sound* is transformational in this sense. This analysis is highly time consuming. For this reason further developments of this methodology will apply machine learning and automatic sound extraction in order to visualise the interaction of the instrument and the electronics in a larger number of case studies. This approach will allow to compare a wider number of cases studies and to define a complete typology of the interaction from the point of view of the devices and the sound morphologies.

KEYWORDS

Mixed music, functional analysis, mixed sound

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