COMPOSITIONAL INFLUENCES IN *JONCHAIES* FROM *LA LÉGENDE D'EER*[1]

Said Athié Bonduki : Unicamp, sabonduki@gmail.com
Adriano Monterio : Unicamp/nics, monteiro.adc@gmail.com

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ABSTRACT

The present research concerns itself with the compositional procedures that link two works that Iannis Xenakis composed during the year 1977: *La Légende d'Eer*, for 7 tracks of electroacoustic tape and *Jonchaies*, for large orchestra. In the score of *Jonchaies*, Xenakis states that one of his main sources of inspiration was the compositional process of the eletroacoustic work mentioned.

The objective of this research is to further explore this relationship and to clarify how *La Légende d'Eer* influenced the composition of *Jonchaies*. In order to analyze this relationship a method of analysis was established. The matters related to sonorities obtained and reproduced, and the compositional techniques are the main subject of this analysis. Spectrograms and sound descriptors are the analysis tools utilized to obtain data from both works. Similarities and differences are presented in both macro and microstructure.

1. INTRODUCTION

Xenakis quotes in the music score of *Jonchaies* that this work was inspired by the obtained results from the composition of *La Légende d'Eer*, both from 1977.

> "This piece is inspired by results obtained and used in the «Legend of Eer», music of the Diatope of the Centre Pompidou, (…). These results stem from my theoretical work in sound synthesis and music aided by computer, work which employs a different path than that of the classical Fourier harmonic analysis (…). This difference uses stochastic walks and Brownian movements. Indeed according to this theory that I introduced twelve years ago, one starts from noise and, with the aid of these stochastic functions periodicities are injected into it." (Xenakis, 1977)

[1] Special thanks to Dr. Stéphan Schaub for supervising this research and also our financial supporters, where Bonduki had a scholarship from CAPES and Monteiro from CAPES and later FAPESP.

Starting from this statement this research intends to trace the relations between both works and demonstrate how the influence from the eletroacoustic media takes place over the instrumental media.

In a detailed analysis of *La Légende d'Eer* - based on the 7 separate audio tracks of the work and on some of the composer's preparatory sketches - Makis Solomos briefly mentions the relationship that this work might have with *Jonchaies* (Solomos 2004, p.13). In an article published four years later and entitled "Quelques réflexions sur les rapports entre l'électroacoustique et la musique instrumentale de Xenakis: le cas de la *Légende d'Eer* et *Jonchaies",* Isabel Pires specifically set forth to explore the possible traces of this transfer from the electoacoustic to the instrumental medium mentioned by the composer. She concludes that, in general, the abstract nature of Xenakis's compositional thinking and technique allows him to operate in either one of them.

Based on these previous analyses, the present article proposes to approach the matter of relations in both pieces trough the sound scope. Aiming to clarify how compositional choices made in *Jonchaies* were influenced by the compositional experience of *La Légende d'Eer*.

The following article is structured in the following way: after a brief presentation of the technology applied to our analysis, the relationships between both works are presented and commented, following with a more detailed analysis of excerpts to demonstrate these relationships in depth.

3. METHODOLOGY

3.1. Sources

One of the main difficulties regarding the comparative analysis between both works is the two different medias in which they are composed for, one instrumental and the other electroacoustic. Concerning this matter a common ground was needed, and the established one was the sound scope. From this perspective the methods of sound analysis through sound spectrum and descriptors were defined. Procedures that can assure a methodological equality that can clarify points of relationships between both works. Used for such analysis were the CD version of *La Légende d'Eer*[2] and a recording of *Jonchaies*[3]. It is important to state the fact that sound analysis from different recordings of *Jonchaies* results in differences in the sound spectrums among them. However the overall instrumental behavior that establishes the internal movements of a texture remains the same, since the sound score defines them and the consequent variations of different interpretations aren't sufficient to modify that. For this analysis the information that is needed to establish a valid set of information for the comparisons defined are the same with the different recordings available of *Jonchaies*.

As additional sources of material we also have the *Jonchaies* music score and analysis from other authors regarding such work. For *La Légende d'Eer* we have Solomos's analysis that has for source the

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[2] The reording used for the sound analysis is from the álbum Orchestral CD Xenakis Eletronic works, vol.1 Lá Légende d'Eer, mode, 2005.

[3] The reording used for the sound analysis is from the álbum Orchestral works, vol. II Jonchaies, Shaar, Lichens, Antikhthon. Orchestre Philharmonique du Luxembourg, dir. Arturo Tamayo, Timpani, 2001.

documents at the Xenakis's archives. Texts form Xenakis contributed to the clarification of the musical issues that were present at both works[4].

3.2. Methods of sound analysis

Spectrograms and sound descriptors were utilized for the sound analysis[5]. Three descriptors were combined in one graphical representation. The parameters of loudness, sound brilliance and noisiness were used in order to create a spectral contour. Mikhail Malt and Emanuel Jordan first used the representation achieved by this combination, which inspired the analysis presented in this article. The extraction of information from the audio analysis had a delimited set of parameters established, resulting in a reduction of the information obtained, aiding on the visualization of the behavior of the pieces in question. The parameters are: 1) The spectral centroid, which is the gravity center of the energy distribution over the sound spectrum which allows to trace a profile of the energy movement over the excerpt analyzed. 2) The bandwidth, spectral standard deviation that presents the medium energy detour over the spectrum in relation to the centroid, and is represented by the thickness of the red lines through the graphics. 3) The RMS, the loudness present in the analyzed section that is indicated by the intensity of red.

This method of analysis allows the visualization of such characteristics of sound behavior that were used to clarify global similarities between both works. Spectrograms were used to obtain a more detailed set of information regarding selected elements, allowing a more in depth analysis.

4. SIMILARITIES AND DIFFERENCES IN THE OVERAL FORM

Both works start with high-pitched sounds in a rarefied texture, proceeding to the development of heavily dense textures in a lower frequency region and then returning to a rarefied texture with high-pitched sounds similar to the initial ones (as seen on figures 1, 2 and 3)[6], creating an overall arc form. The next examples are a result of the sound descriptor mentioned above.

From the sound analysis we have established a segmentation of 6 distinct sections for both pieces[7], basing this affirmation over the differences in pitch frequency, density and sound intensity. It is clear in the figure that follows that the sections between works does not necessarily relate. Although the formal structure has a similar segmentation, the common elements not necessarily occur in the equivalent section.

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[4] There are also the analyses from James Harley, where he analyzes both works separately (Harley, 2004, p. 108, p. 110).

[5] The software's used are Sonic Visualiser for the spectrograms and Pure Data for the descriptors.

[6] Both works have distinct time durations, so the graphics window has been made so that they would result in functions with the same number of values. *La Légende d'Eer* has approximately 2.8x times the duration of *Jonchaies*, for that the analysis window in *La Légende d'Eer* is approximately 2.8x bigger than that of *Jonchaies*.

[7] In *Jonchaies* the third and second sections presented can be considered as one, since the third section is a continuation of the second section. There is a constant and gradual transformation of the layers involved in this passage that starts the second section and ends with the third section. Nonetheless there are differences in the spectral contour, with a decrease of intensity and increase of the bandwidth between these two sections, and these parameters are taken into consideration for this research.

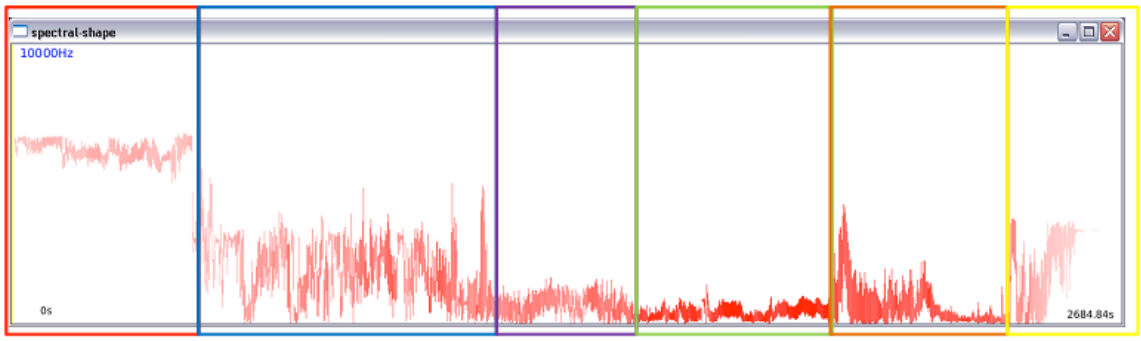


Figure 1 - *La Légende d'Eer* sound analysis.

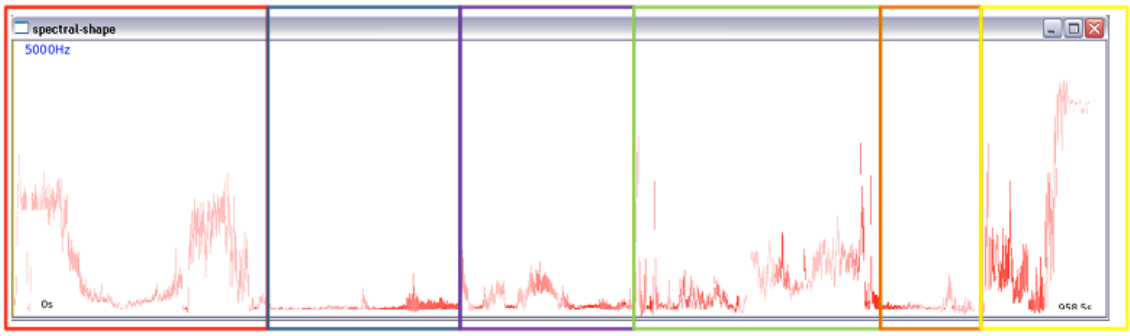


Figure 2 - *Jonchaies* sound analysis.

5. SIMILARITIES BETWEEN SPECIFIC EXCERPTS

5.1. Overview

For the exposition of the relationships that exist between these two works the analysis follows a specific approach concerning common elements present in both of them.

From the gathered information of the sound analysis, music score of *Jonchaies*, the preparatory sketches of *La Légende d'Eer* and previous analysis from the others authors we have determined to regard these 5 common elements between the 2 pieces that can be seen in the following figure. Note that some of them have sub groupings.

If we take into consideration the elements 1a, 2, 4, 5 and 1b, the presented similarities do have an equal order of occurrence for both works. The specific content of each section of *Jonchaies* was not defined by the order of the sections of *La Légende d'Eer*, with the only clear exception to the end and the beginning.

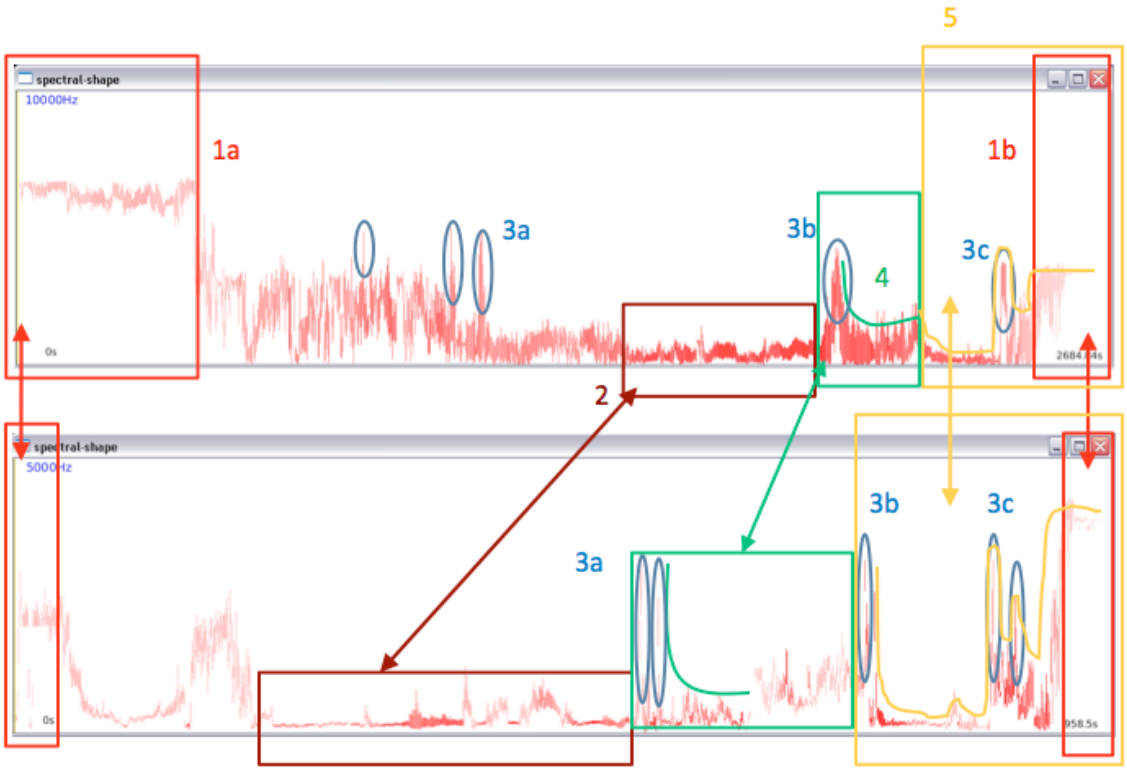


Figure 3 – Correlations between elements in *La Légende d'Eer* (above) and *Jonchaies* (below).

The first marking is relative to the similarity between the high-pitched sounds at the beginning and end of both pieces. For the second one there is a specific region with similar characteristics concerning their behavior, where in both pieces we have a texture with sonority similar to that of the Doppler effect[8]. The third correlations to consider are the high peaks; well detached form the regions that they are in both pieces. The fourth is a region with an "L" shaped curve (based on the spectral centroid) and proportionally they have a similar duration in both works, having a larger bandwidth in *La Légende d'Eer.* In *Jonchaies* this texture is further developed until the end of the section. The fifth engulfs the last two sections of each work, having a similar profile. Following the next item we have a further analysis of each correlation.

The first section *Jonchaies* does not have any clear procedure or structural relations with *La Légende d'Eer,* but there is one common element that goes beyond the structural factors. This first section has a segment (between measures 10 and 63) created using harmonic sieves, from the first section of the orchestral piece. This sieve has a similar structure to the *pelog* scale from gamelan music (HARLEY, 2004, p. 108). Xenakis used instruments from folkloric music in *La Légende d'Eer* from African and Japanese traditional music such as the *mbira* and the *tsuzumi* (Solomos, 2004, p. 17). Together with these instruments there are sounds of impacted ceramics that may resemble some sonorities from gamelan music.

[8] Solomos refers to this sonority in *La Légende d'Eer* as spirals.

It can be speculated that the desire to explore folkloric-based sonorities in this passage was influenced by Xenakis compositional experience from *La Légende d'Eer*.

5.1. Correlations between set of elements 1a and 1b.

Both works begin and end with high-pitched sounds shown in the sonograms below[9]. In spite of the glissando from the beginning of *Jonchaies* we have a very similar sonority between them both. The same is true to the end of them, where there is also a similar procedure of repetitions of short sounds, superimposed in *Jonchaies* and sequential in *La Légende d'Eer*.

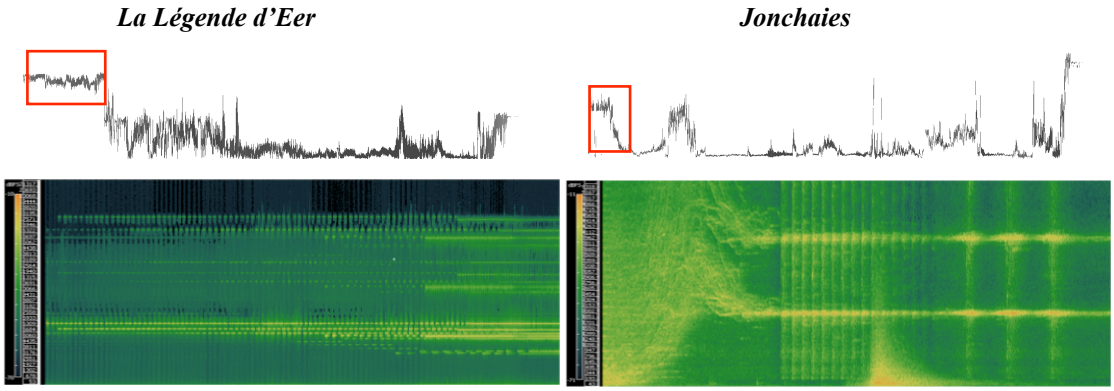


Figure 4 – High-pitched sounds in the beginning of *La Légende d'Eer* (left, 0'00'' - 5'52'') and *Jonchaies* (right, 0'0'' – 0'23'').

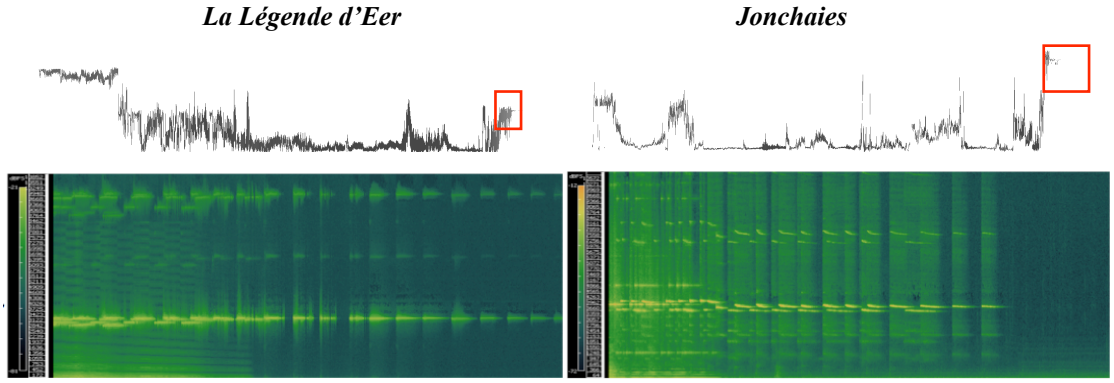


Figure 5 – High-pitched sounds in the end of *La Légende d'Eer* (left, 41'48'' – 44'45'') and *Jonchaies* (right, 15'16'' – 15'58'').

[9] Note that in this figure the upper distinct region of frequencies are harmonics from the fundamental group frequencies being used in this section.

5.2. Correlations between set of elements 2

There are different layers of elements in both pieces to create textures with similar sonorities, close to that of a Doppler effect. Mind that both have a gradual saturation of the spectrum, with a higher intensity in *La Légende d'Eer*, as a consequence of the eletroacoustical media, that supports this resource with better precision than an orchestra.

In *La Légende d'Eer* this section is constituted by the predominance of synthesized sounds with undulated profiles that constantly ascend, which characterizes the sonority of the spirals. On the spectrogram an overlapping of layers can be seen with their continuous transpositions creating these arcs that are seen during all the section, firstly clear and then much more diffuse due the high degree of overlapping of the layers.

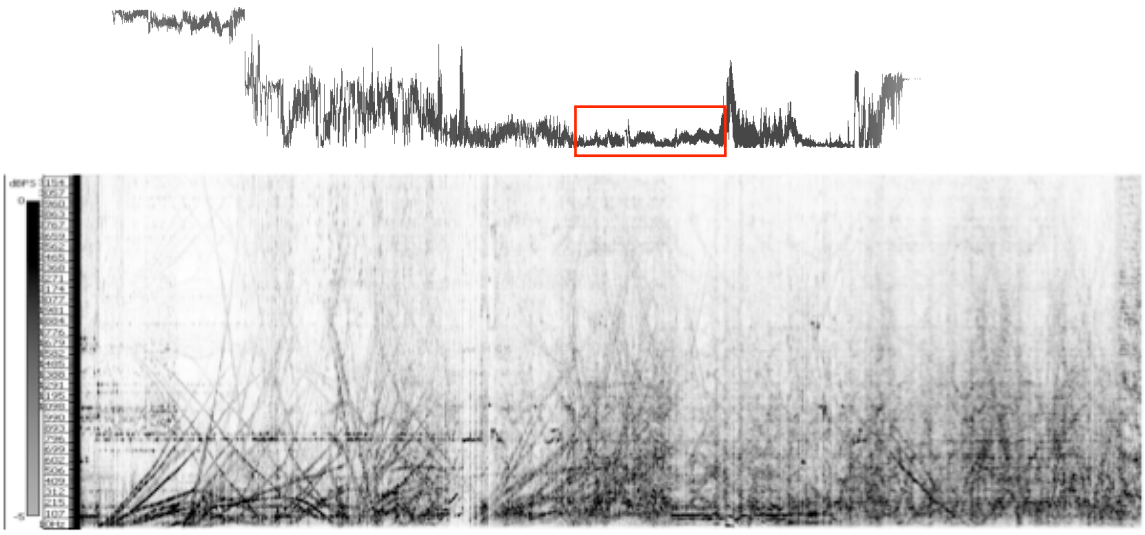


Figure 6 – Spirals in *La Légende d'Eer* (24'50'' – 33' 08'').

In *Jonchaies* we have the orchestra divided into 5 instrumental groups organized in order to obtain distinct timbristic characteristics, allowing for Xenakis to have a wider control over the internal variations of this texture, mainly through variation of the metric values and overlappings, making this section extremely polyrhythmic. Procedures that are used to create the sonority that Xenakis wanted to emulate, making it through the repetition of binary high-low cells that alternate timbristics sub-groupings inside the respective layers, creating variations of timbrical peaks similar to the ones in *La Legénde d'Eer*. It is noticeable in the spectrogram below the continuous variation of pitch, which happens together with the metric variations previously pointed.

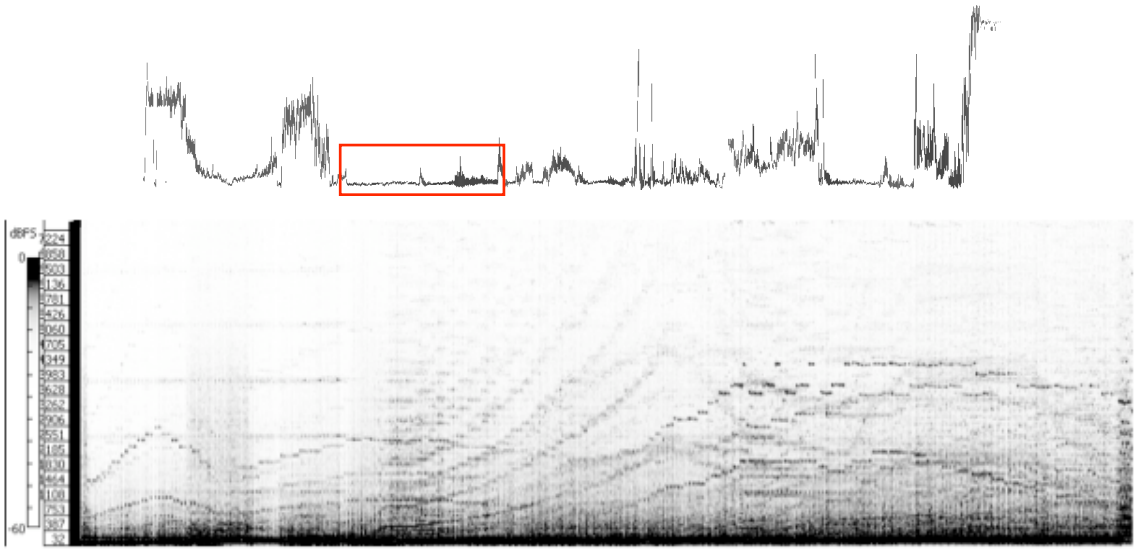


Figure 7 – Spirals in *Jonchaies* (4’30’’ – 6’34’’).

5.2. Correlations between set of elements 3

The detached peaks taken for consideration for the third group of correlations are the peaks 3a and 3b from *La Légende d’Eer* and *Jonchaies*. Below we have the peaks produced in the eletroacoustical media, note the similarity in the spectral saturation with energy until high values of frequency and most important the similarity regarding the wavy internal profile. We know that for its characteristic sonority and behavior these elements correspond to the stochastic synthesis[10]. This profile presents a feature similar with Brownian movements[11] (random walks) with a certain band limit.

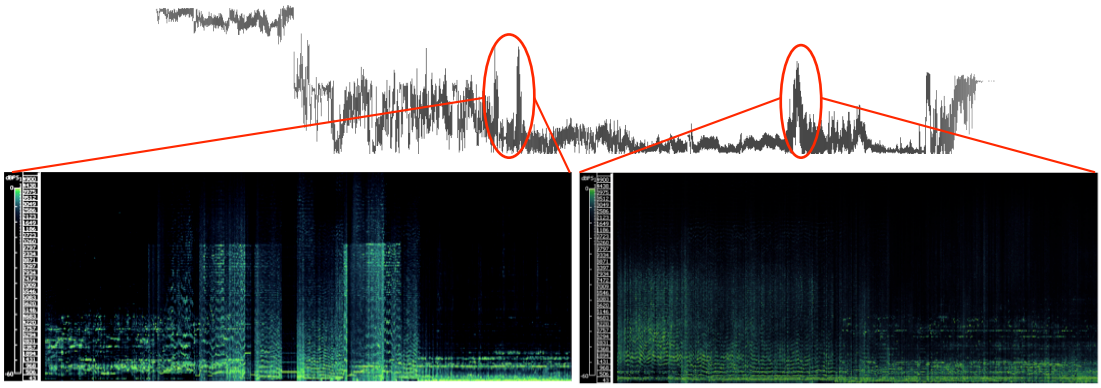


Figure 8 – Peaks 3a (16’23’’ – 20’30’’) and 3b (16’23’’ – 20’30’’) in *La Légende d’Eer*.

[10] *La Légende d’Eer* is the first eletroacoustical work from Xenakis where he uses the stochastic synthesis.
[11] Solomos makes a transcription of this brownian movent is his article *Le Diatope et La Légende d’Eer,* 2004, p.11.

It is noticeable that in the composer preparatory sketches of *La Légende d'Eer*, Xenakis presents the synthesis with the notation log, on the first time it occurs, (probably relative to the term logistic that could refer to one mode of creating stochastic synthesis, using a logistic function) and associates a waved symbol to this sound element:  . The other examples are relative to the appearance of this element in 3a and 3b, appearing without the log notation.

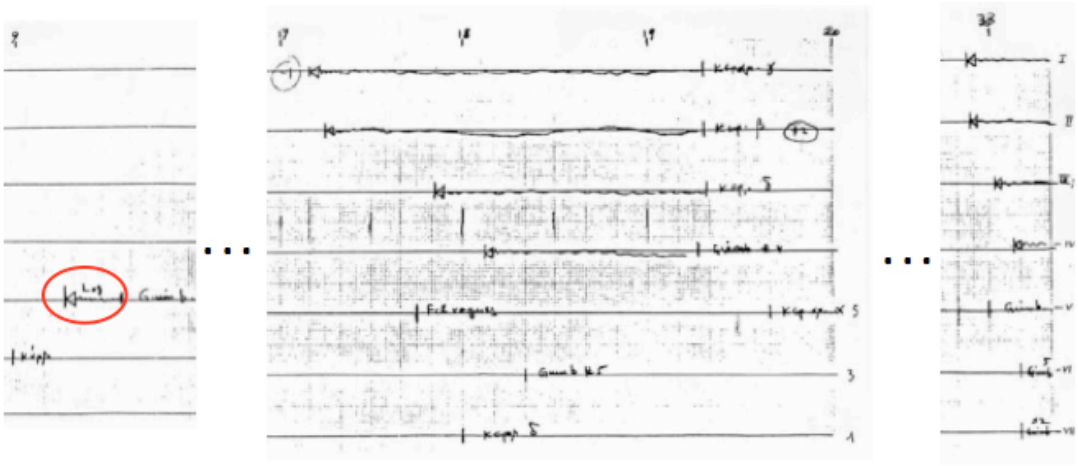


Figure 9 – Peaks 3a and 3b in *La Légende d'Eer* compositional score.

In *Jonchaies* we have a similar wavy profile with spectral saturation and undulations through the notes that compose the texture, as seen below.

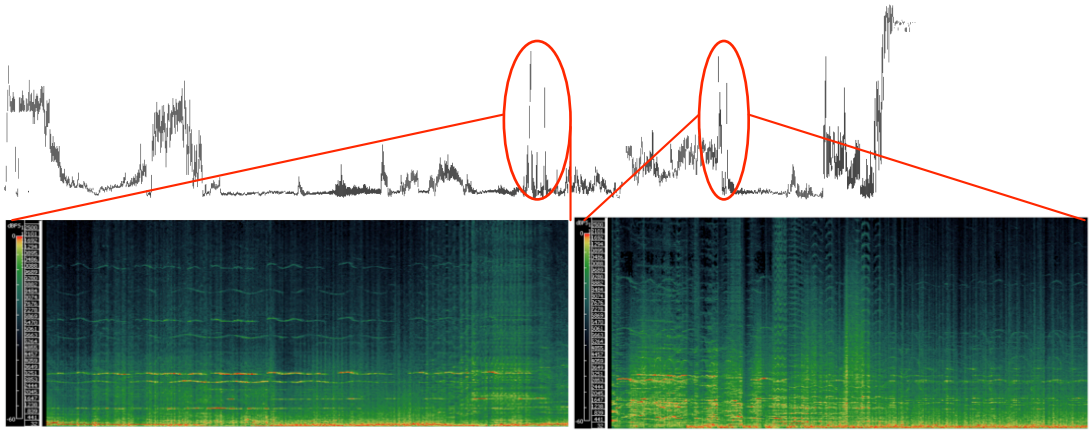


Figure 10 – Peaks 3a (8'56'' – 9'27'') and 3b (12'22'' – 12'53'')in *Jonchaies*.

In the music score of *Jonchaies*, the notation relative to peaks 3a and 3b uses the same wavy pattern, with lines indicating free vibratos constrained inside a limited range stipulated by Xenakis. We assume that these notations are correlated and that Xenakis tried to mimic the sonority of the stochastic synthesis with these blocks of vibrato in the winds and further on the music with the metals.

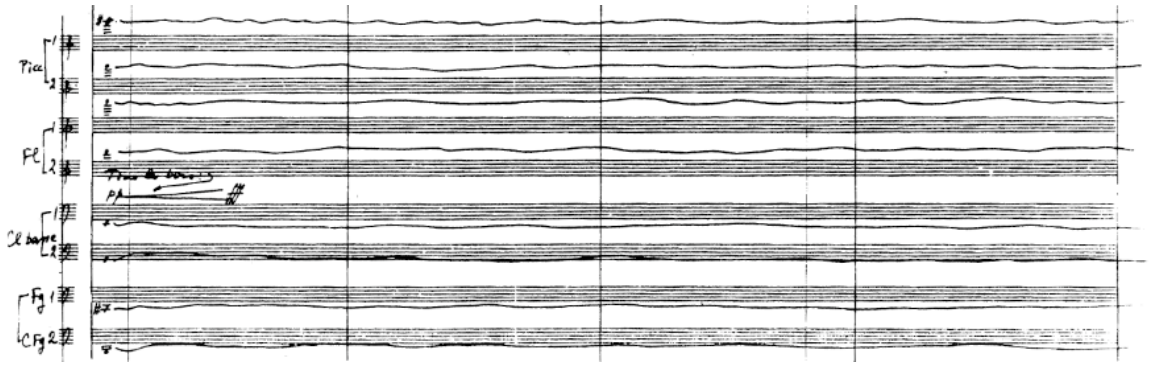
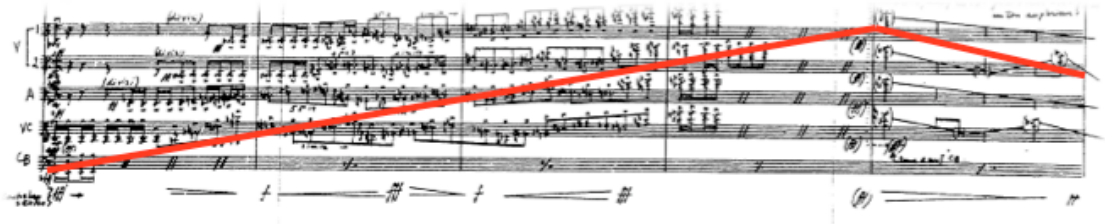


Figure 11 – Winds notation in *Jonchaies* (measures 142 – 144).

Throughout *Jonchaies* Xenakis uses one of his most known instrumental characteristics, his strings glissandos, which can be seen on figure 12. This way of writing is characteristic to the writing technique used to imitate the Brownian movements, employed by Xenakis in previous works as *Mikka*, *Mikka S* and *N' Shimma*. This writing technique appears in *Jonchaies* almost exclusively together with the blocks of vibratos in winds or metals[12], simulating the stochastic synthesis.

In the detached passage of the strings seen below there are parts played in diatonic ascending movements to high pitched notes, then movements in glissandos descending to lower notes and in between these movements there are repeated notes. This sequence is repeated four times creating a layer with an adulatory movement in the macrostructural dimension.



[12] Only exception is the glissando from the beginning of *Jonchaies*.

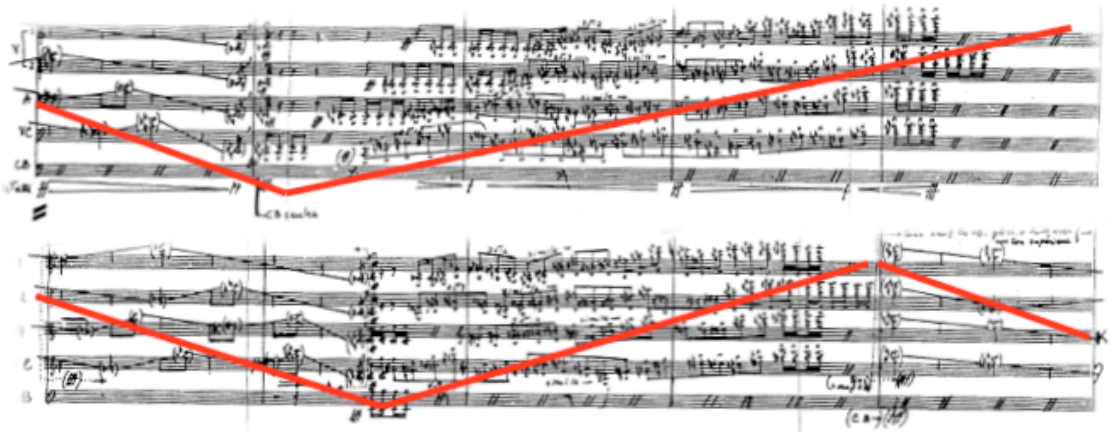


Figure 12 – Excerpt of waveform structure (measures 141 – 160).

The mentioned procedures for instrumental notation takes place trough the second section of *Jonchaies* (from measures 141 to 217) with the presence of no others. This whole section can be considered to have been composed after the idea of exploring different ways of transcribing to music notation the behavior of stochastic synthesis.

5.2. Correlations between set of elements 4

The fourth element concerns two similar profiles identified in both pieces through the sound analysis, the "L" shaped profile. In *La Légende d'Eer* it is made through the stochastic synthesis and in *Jonchaies* there is an instrumental simulation of the internal behavior of such synthesis, as previously seen in a similar example. Below we have the extracted spectrogram of the profile of the figure in L in both works, and it shows the wavy patterned frequencies (random walks in both parts).

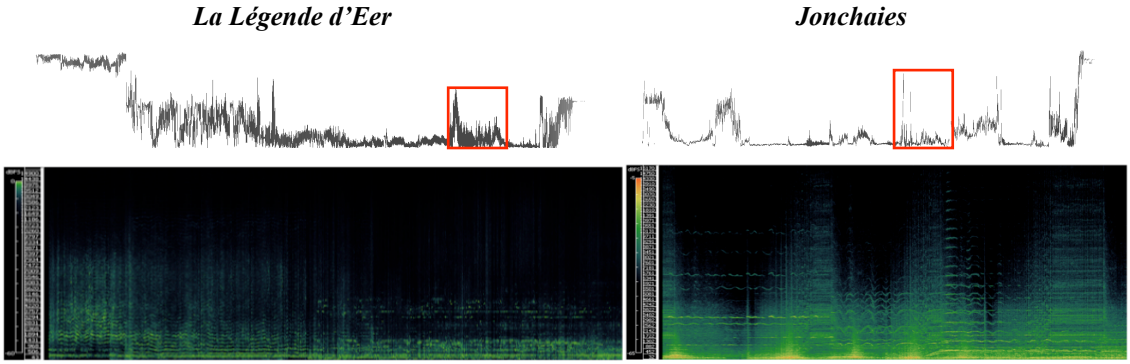


Figure 13 – Brownian movement in *La Légende d'Eer* (left, 33'17'' – 37'24'') and *Jonchaies* (right, *8'54'' – 10'22''*).

5.2. Correlations between set of elements 5

The last correlation of elements is constituted of the last two final sections of both works and the similarity in their profiles. It has an initial region with distribution of the energy in a broad band on the low to the high frequencies, intermediate region with predominance of the energy in the low region and an input of high-pitched elements in the end. For these similarities we have a profile with a similar centroid in both works. The two peaks of the inputs of high frequencies are respectively the peaks 3c mentioned before.

Detached in white are two peaks from *Jonchaies* that are not present in *La Légende d'Eer*. The first one is caused by the ascending movement of the strings that are continuing the Brownian movement simulation and that in this point they converge to high pitches. The second has relations with other elements of *La Légende d'Eer* that will be shown next.

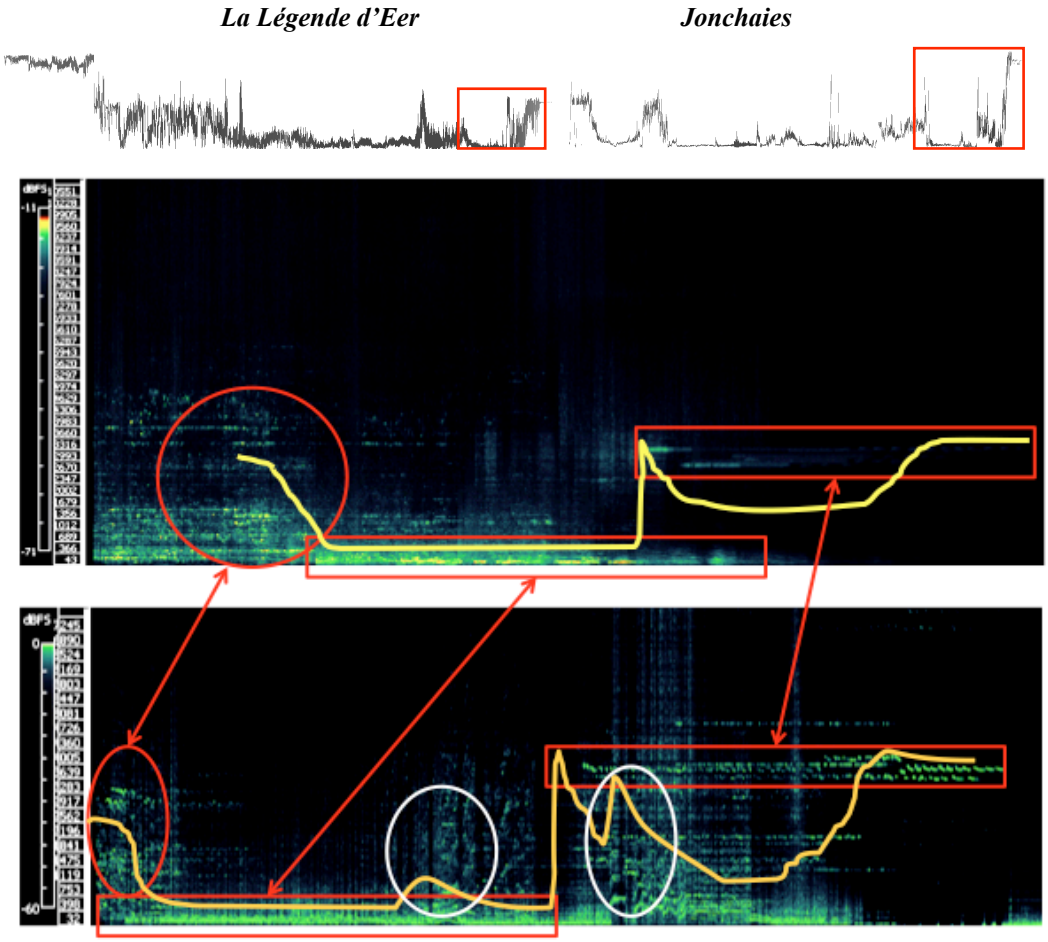


Figure 14 – Last section of *La Légende d'Eer* (above, 32'28'' – 43'44'') and *Jonchaies* (below, 12'19'' – 15'58'').

Figure 15 is a part of the music score regarding the section where the second peak marked with a white circle occurs, specifically the element of the medium-high frequencies pointed previously. In the music score there are ascending scales in metals with a posterior note sustentation.

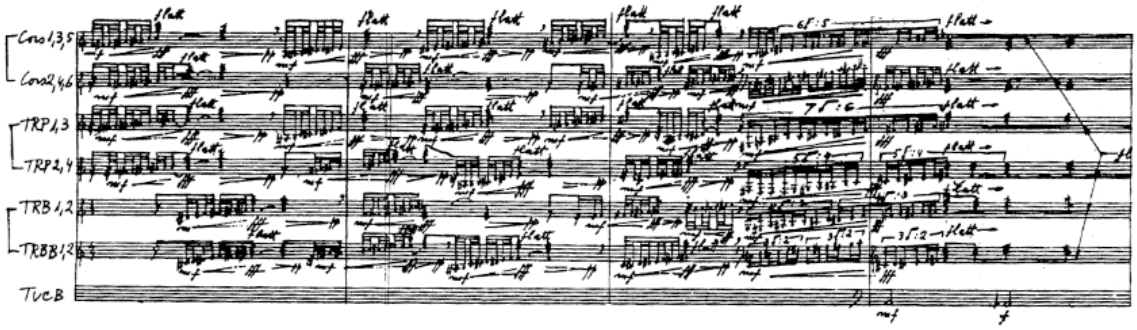


Figure 15 –*Jonchaies* (measures 221 - 224).

This ascending element followed by stability of pitch over a note performed by the metals in *Jonchaies* has the same profile from elements of a passage in *La Légende d'Eer*, glissandos followed by random walks, which are steadier in the register, and can be seen in figure 16. It is noticeable the similarity of this texture with a stochastic synthesis presented in *La Légende d'Eer* in the region of the group of peaks 3a, as is present in the comparison below. The spectral saturation is a consequence of the cymbals in *Jonchaies* and of white noise generated by the stochastic synthesis in *La Légende d'Eer*.

La Légende d'Eer ***Jonchaies***

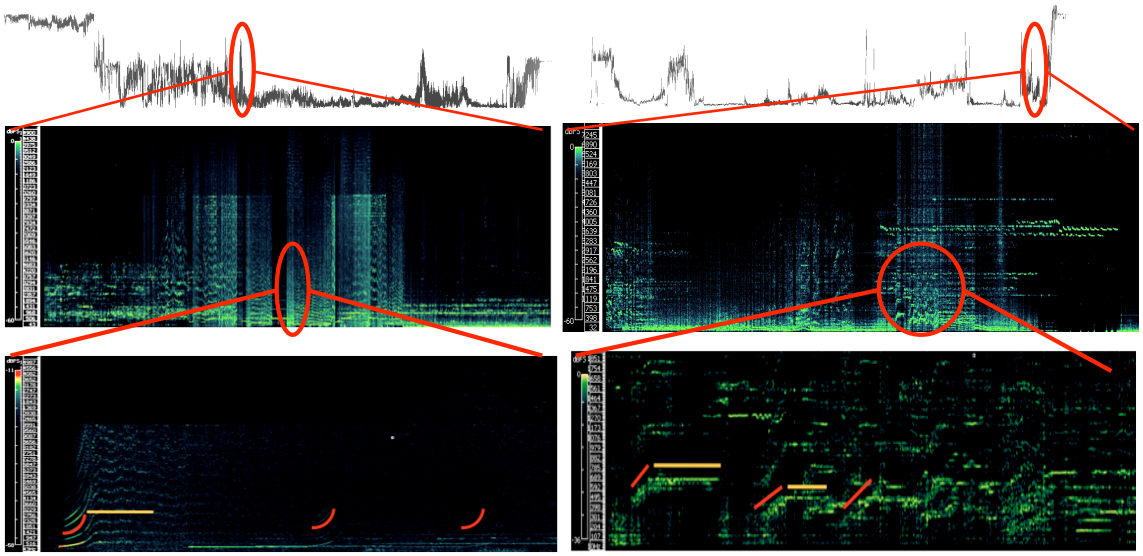


Figure 16 – Upper graphics: Piece's Global Maps - *La Légende d'Eer* (left), *Jonchaies* (right). Middle Graphics: Peaks 3a (16'23'' – 20'30'') in *La Légende d'Eer* and 3c in *Jonchaies* (12'19'' – 15'58''). Bottom graphics: Zoom in the Peaks' Internal structure: Peaks 3a (18'44'' – 18'51'') in *La Légende d'Eer* and 3c in *Jonchaies* (14'18'' – 14'40'').

We can assume that this is another method of imitating the electronically generated synthesis employed by Xenakis, as the transposition for the instrumental media of the consequent profile generated by this element of the synthesis. This profile with an ascendant movement and then stability (or random walk), happens again in other elements in different levels of organization either micro or macrostructural.

6. CONCLUSION

Starting from the information that the process and compositional result of *La Légende d'Eer* have influenced the composition of *Jonchaies*, we employed a methodology, the use of distinct audio analyses, which has conceded us information regarding possible points where this influence may have taken part. Xenakis through his experiences and practice with stochastic synthesis, obtained substratum concerning its procedure as its sonority, being able to exploit from the simulation of synthesis sonorities through instrumental scope, as to employ macrostructurals elements based over his propositions about stochastic synthesis, as we could see in both works. Formal structures and textural behaviors from *Lá Légende d'Eer* were again explored in *Jonchaies*, allowing the composer to re-elaborate his approach over new prisms generating a composition that produces many elements derived form the same foundation.

It is important to consider that these similarities may have occurred in casual way, without the conscious intention of Xenakis, but we obtained consistent results, allowing the possibility for a future study with a new perspective on the subject, as analyzing over the manuscripts of Xenakis to verify the range of the proposed analysis.

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