

INTRODUCTION TO WESTERN AND EASTERN APPROACH OF CHANCE IN THE MUSIC OF XENAKIS AND CAGE. THESES AND ANTI-THESES

Kostas Paparrigopoulos
PhD Candidate
National & Kapodistrian University of Athens,
School of Philosophy
Music Department
kparrigopoulos@yahoo.com

In Makis Solomos, Anastasia Georgaki, Giorgos Zervos (ed.), Definitive Proceedings of the "International Symposium Iannis Xenakis" (Athens, May 2005).

Paper first published in A. Georgaki, M. Solomos (éd.), *International Symposium Iannis Xenakis. Conference Proceedings*, Athens, May 2005, p. 346-349. This paper was selected for the *Definitive Proceedings* by the scientific committee of the symposium: Anne-Sylvie Barthel-Calvet (France), Agostino Di Scipio (Italy), Anastasia Georgaki (Greece), Benoît Gibson (Portugal), James Harley (Canada), Peter Hoffmann (Germany), Mihai Iliescu (France), Sharon Kanach (France), Makis Solomos (France), Ronald Squibbs (USA), Georgos Zervos (Greece)

ABSTRACT

Through their work in music theory and composition, Iannis Xenakis and John Cage approach chance from two different points of view. Xenakis adopts a western - scientific approach while Cage adopts an eastern - Zen Buddhist approach. Cage uses chance as a means to reduce personal intervention in the process of the composition, while Xenakis uses probabilities to control chance in the sound masses. In this paper we will deal with the following question: how is it possible for both Xenakis and Cage to realise a music event, following an extra-musical theoretical framework they have set - scientific for Xenakis, Zen Buddhist for Cage? Might it be that the requirements of the musical act impose a differentiation, a deviation from this framework? We will search for answers referring on two of their works, *Music of Changes*, for piano (1951), by Cage and *Herma*, for piano (1960-61), by Xenakis.

EST - WEST

Juxtaposing Xenakis and Cage may appear strange. What have they in common, besides the use of chance in their works? Even that, though, they see from a completely different point of view and apply it in a very different way in their compositions. Furthermore, their theoretical investigations appear so much diverging, that they seem as polar opposites. Xenakis adopts a western-scientific approach of chance, while Cage adopts an eastern-Zen Buddhist one.

Lets make clear what we mean by "western" and what by "eastern" approach. Summarizing, we can say that: the West is characterized by a tendency towards rationalism. For the West, logic is the means to gain access to knowledge, the means to reach an "objective" truth generally accepted. Philosophy, developed in the West, and science that evolved from it, are based on this very acceptance: the superiority of logic.

Eastern concept is different. In Zen Buddhism, logic is an obstacle to the conquest of truth. Truth is not gained but revealed. And in order to be revealed to each one, the abandonment of the ego is essential; one has to extinguish his personal story, leaving behind both what he likes and what he does not. Knowledge here may not be but "subjective". D. T. Suzuki says, "[...] Zen is a real and personal experience and not knowledge we obtain through analysis or comparison" [13: 34].

Of course, deeper analysis of western and eastern concepts could reveal aspects that may contradict the thesis just exposed: for instance, revelation did not prevent the flowering of mathematics in India, nor did rationalism prevent the emerging of mysticism in the West as well as subjectivity in 19th century art. Nevertheless, the main scheme remains as we have outlined it and this characterizes the one and the other thesis.

Lets see now in which way these two attitudes - western and eastern - are related with chance in Cage and Xenakis. Cage uses chance as a means to reduce - as far as possible - personal intervention in the process of the composition. He believes - according to the eastern point of view - that a human being must be liberated from his critical ego, from logic, from what he likes or dislikes, in order to create an indispensable internal void and get prepared to accept the "music" of the sounds of nature, in which he belongs. For Cage, the composer is someone who creates the premises, someone who gives the opportunities for the musical event to happen, renouncing any intention of personal expression or choice. This is a clearly eastern aesthetic approach. Cage writes: "Since the forties and through study with Daisetz T. Suzuki of the philosophy of Zen Buddhism, I've thought of music as a means of changing the mind. [...] I saw art, not as something that consisted of a communication from the artist to an audience but rather as an activity of sounds in which the artist found a way to let the sounds be themselves. And in

their being themselves to open the minds of the people who made them or listened to them to other possibilities than they had previously considered" [8: 42].

Xenakis, on the other hand, uses chance considering it in a scientific way. His intention is not to introduce chance in music; for him this is a necessity. He proposes, as he states, "a new sound plasticity" that "[...] permits us to compose with eighty or a thousand sounds if we want, using the sounds like a mass in a spherical and not in a linear way" [17: 9-10]. But the composition of these sound masses - sound clouds as he names them- is governed by chance. So he resorts to science, which having studied similar mass phenomena, gives him the possibility to have a rational view on chance. The scientific instrument that he chooses to apply is the mathematical Theory of Probabilities, through which he may control and form these sound clouds. As he says, "[...] we can reduce the amount of chance contained in our choice or the more or less strict adaptation of our choice in a law of distribution that might still be absolutely functional" [17: 11]. His approach is clearly scientific - western. He wants to harness... to control chance.

The present distinction between western and eastern approach of chance, does not aim at the introduction of a new classification. It's not us that make this distinction, but the composers concerned, Xenakis and Cage. They both take an almost clear position on the one or the other side. Therefore, we may say that we are obliged to accept these positions and study the composers through the point of view they have put as a base of their theoretical construction; the western-scientific point of view for Xenakis and the eastern-Zen Buddhist for Cage.

In this paper we will deal with an arising question: how is it possible for both Xenakis and Cage to realize a music event, following an extra-musical theoretical framework they have set - scientific for Xenakis, Zen Buddhist for Cage -? Might it be that the requirements of the musical act impose a differentiation, a deviation from this framework? We will search for answers referring on two of their works, *Music of Changes* by Cage, and *Herma* by Xenakis.

These two pieces for piano are appropriate for comparison, as they appear "similar" in the way that chance "enter" into. In *Music of Changes*, Cage use chance in the same manner as Xenakis, that is only during composition, while the final score for the execution is entirely deterministic. Notice that later, Cage will use chance also during execution, while Xenakis will almost never do it (perhaps with the exception of *Atrées*, and the pieces of *Game Theory Duel*, *Stratégie* and *Linaia Agon*).

Furthermore, *Herma* belongs in a period during which Xenakis move towards more deterministic techniques, more "westerns" (Set Theory) while simultaneously, the piece includes a part of indeterminacy (Stochastic). Choosing this piece of Xenakis, - and not on a "pure" stochastic piece - we have the opportunity to make more clear, and surely more "impressive", Xenakis' gaps, "écarts" and "bricolages" [11].

MUSIC OF CHANGES

Cage's *Music of Changes*, for piano (1951), is in four parts, and its duration is approximately 43 minutes. Here, as in his previous compositions, Cage uses the "micro-macroscopic rhythmic structure". This means that we have as a basis a structural unit consisting of a small number of phrases. In *Music of Changes* this structural unit consists of 6 phrases. The first phrase is 3 bars long, the second 5, the third $6\frac{3}{4}$, the fourth $6\frac{3}{4}$, the fifth 5 and the sixth $3\frac{1}{8}$ bars long. The sum of these 6 phrases is $29\frac{5}{8}$ bars. This basic structural unit is the "microscopic rhythmic structure". The "macroscopic rhythmic structure", which is the duration of the whole composition, will be the square of the basic structural unit which means that it will be $29\frac{5}{8} \times 29\frac{5}{8} = 877\frac{41}{64}$ bars long. Finally, Cage divides the whole composition, this total number of bars, in four large parts that consist of 1, 2, 1, and 2 sections each.

To create the content of the composition, Cage uses the chart technique. He constructs 8 charts for the sounds, 8 charts for the duration and 8 charts for the dynamics. There is also a chart for tempi and another for density. The charts for sounds consist of 8 rows and 8 columns each, so there are 64 cells in direct correspondence with the 64 hexagrams of the *I Ching*. In this way, in each hexagram of the *I Ching* that Cage creates tossing the coins corresponds a cell of the chart, whose content is chosen to be transferred in the score. Each cell may contain only one note, or two, or a chord, or an ensemble of notes in horizontal or vertical or mixed order. The piano is not "prepared", but besides the sounds produced by the keys, sounds are produced by playing directly on the strings with the finger or various objects. There are also different noises, for example by slamming the keyboard lid. The 32 of the 64 cells (number 1, 3, 5, ... 63) are empty and represent silence.

In the charts for durations there are no empty cells, - all 64 cells are complete -, as duration is characteristic of both sound and silence. In every cell, there is a rhythmic pattern, which after been chosen by *I Ching*, will be combined with the pre-chosen sound. The charts for dynamics function differently. Only 16 cells out of 64 are used, the remaining 48 being empty. If in the process of composition *I Ching* chooses one of the 16 completed cells, then, the content of this cell will be used. If, on the next coins toss, one of the empty 48 cells is chosen, the previous dynamic indication will be used until another complete cell is chosen. These three charts are combined to produce the final-completed sound to be written in the score. A first hexagram will give the pitch or silence, a second one the duration and a third one the modification - or not - of the dynamics, if we have to do with a sound and not with a silence.

In order to have a variety of sonorities, Cage divides the 8 charts of every category in 2 groups with 4 charts in each. The charts of the one group may be "mobile" and of the other "immobile". Mobile means that if an element of the chart has been already used, it will be not used again and something new will be composed to replace it. Immobile means that an element of the chart that has been used remains in its place and may be used again. During the composition, Cage decides through *I Ching* which group will be mobile and which immobile: for example, charts number 1, 3, 5, 7, mobile and number 2, 4, 6, 8, immobile.

As mentioned, there exist also a chart for tempi and one for density. The chart for tempi has 32 complete cells while the remaining 32 empty cells mean that the previous tempo continues to apply. The change or not of the tempo is decided through *I Ching* in relation with the rhythmic structure. For density, Cage uses 1 to 8 layers of sounds, which he superimposes. The number of layers (1 to 8) is determined through *I Ching* at the beginning of each phrase.

Considering *Music of Changes* through the eastern point of view, that is, knowing that Cage's aim was to be freed from the critical filter of the ego, from logic, from what he likes or dislikes, and having the intention to find out the deviations from this point of view, we would note:

- The extremely rational organization of the compositional process through the chart technique. It seems that Cage is obliged to use a mathematical way in order to organize his materials in relation to the number 64, or, more generally, to the numbers resulting from 2^X (2, 4, 8, 16, 32, 64...) because only then may he have equivalences to the *I Ching*. On the other hand, and contrary to his theoretical statements, the content of the cells is created with personal criteria. Sounds, rhythmic patterns, dynamics, and tempo changes within the cells do not result through chance operations. They are simply Cage's personal choices that come in contradiction with his intention for non-personal involvement in the decision-making.

- The existence of the "micro-macroscopic rhythmic structure" as a logical and mathematical base depends on the relation X^2 . There are also personal choices here perceived in the symmetries created by the number of bars per unit (3, 5, $63/4$, - and his opposite - $63/4$, 5, $31/8$), as well as by the symmetrical division of the piece in 4 parts with 1, 2, 1, 2 sections each.

Cage is aware of the coexistence of logical and non-logical elements in his pieces during the period in which *Music of Changes* belongs. Talking in Darmstadt in 1958, he said: "Composition, then, I viewed, ten years ago, as an activity integrating the opposites, the rational and the irrational [...]" [2: 18]. Cage considers the existence of a completely determined structure as an indispensable and fundamental element of a composition. In 1949, in his article *Forerunners of modern music* [2: 62-66], exposing his own model of composition, he divides music composition in four sectors: *structure, form, method* and *materials*. Cage wrote: "Structure in music is its divisibility into successive parts from phrases to long sections. Form is content, the continuity. Method is the means of controlling the continuity from note to note. The material of music is sound and silence. Integrating these is composing". *Structure*, for Cage, is controlled by the "mind", and needs "[...] precision, clarity, and the observance of rules", while *form* which belongs to the "heart", "[...] wants only freedom to be" [2: 62]. This distinction between mind and heart, logical and -illogical, rational and irrational will occupy Cage, and during the following years, he will try - according to Zen - to eliminate this opposition, reducing the role of structure in music [9]. He will also try to do the same thing with his personal choices. We could say that an important characteristic of Cage's evolution is his very effort for the coexistence of Zen with his music practice.

However, Cage is self-defined as a musician. He did not get from Zen special practices but rather a general philosophical contour, which he tries to incorporate in his music. In 1979 he says: " And rather than taking the path that is prescribed in the formal practice of Zen Buddhism itself, namely, sitting cross-legged and breathing and such things, I decided that my proper discipline was the one to which I was already committed, namely, the making of music. And I would do it with a means that was as strict as sitting cross-legged, namely, the use of chance operations, and the shifting of my responsibility from the making of choices to that of asking questions" [8: 42-43].

HERMA

Xenakis' *Herma*, for piano (1960-61), lasts approximately 10 minutes and its composition is mainly based on the mathematical Set Theory. Xenakis described *Herma* as a piece of "Symbolic Music" in correspondence to Symbolic Logic. He chooses, outside-time, 4 sets of sounds: the referential set R , which contains all the 88 notes of the piano, and 3 subsets of R , A , B , and C . There are some common notes in these subsets, if we take them by two, and some common notes in all three subsets. Out of these 3 subsets come their complements noted by \bar{A} , \bar{B} and \bar{C} . \bar{A} consists of the R notes that don't belong to A , \bar{B} consists of the R notes that don't belong to B , and \bar{C} consists of the R notes that don't belong to C . Except these 7 sets, Xenakis creates new ones that result from the application of the logical operations Union, Intersection, and Negation, on them. According to the organization chart in-time of *Herma*, Xenakis exposes at first the referential set R , then A followed by its complement \bar{A} , B followed by its complement \bar{B} , and C followed by its complement \bar{C} . From now on follows the sets resulting from the application of logical operations on A , B , and C , with increasing complexity of these logical operations until the end of the piece.

Chance, scientifically controlled by the Probability Theory, enters into *Herma* through the uses of the sound clouds. In order to demonstrate the elements and the logical functions of the sets, Xenakis disposes the sounds stochastically. He says: "How can I demonstrate the elements of the sets? By playing theme. But in order to remain neutral I have to play them at random. I emphasize: only the sounds that I play at random demonstrate the logical functions of the sets, nothing else" [14: 85].

Xenakis writes also that in *Herma*, "The intensities and densities, as well as the silences, help clarify the levels of the composition" [16: 175]. According to what Xenakis has just said, we could suppose that clarity in composition is not obtained by the application of mathematics on it. However, clarity holds an exceptional place in mathematics. Or, to say it in a simpler way, mathematics does not exist without clarity. Consequently, maybe Xenakis meant something else? In addition, if we examine the score of *Herma*, we will see that Xenakis permits himself many exceptions from the rules he has posed. Francis Bayer [1: 98-103] remarks that on the exposition of the set R , we should hear 88 notes. In fact, we hear only 78. If this can be justified by the stochastic character of the distribution, how could the small number of octaves and perfect fifths be justified which according to probabilities should exist? And how much stochastic is the beginning of the piece with a 12-note row? [7: 197]

Farther on, at the exposition of A followed by \bar{A} , the total of the notes of these two sets, according to the definition, should be 88. But in the score we find out that A has 31 notes and \bar{A} has 69. The total is 100 notes. That means A and his complement \bar{A} have 12 notes in common, which is opposite to the Complementarity's definition in Set Theory. The same thing happens farther on with B and \bar{B} that have 11 notes in common and with C and \bar{C} that have 9 notes in common. Totally, at the exposition of these 6 sets, 32 out of 293 notes exposed are exceptions, that means more than 10%, number too big to be justified [1: 101-102]. And other analysts of Xenakis' have found in praxis deviations from theory [6]. Makis Solomos in the analysis of *Nomos alpha* has found 14% of exceptions! [10: 449-481]. The ensuing question is: does Xenakis not follow the laws he has posed as a base of his composition? And if he does not, for what reason?

Xenakis gives the answer to this question himself when he considers that music praxis presupposes emotion and intuition as a complement to logic. "To make music [Xenakis says] means to express human intelligence by sonic means". But just after he adds: "This is intelligence in its broader sense, which includes not only the peregrinations of pure logic but also the "logic" of emotions and of intuition" [16: 178]. So, the clarity in composition may be obtained by the composer's personal intervention when he considers that the results of the mathematical calculations do not satisfy him. "At the service of music, as well as of every creative human activity, scientific and mathematical thought has to be amalgamated dialectically with intuition" [17: 39], writes Xenakis.

Olivier Revault d'Allones mentions an incident during a meeting he had with Xenakis: "[...] one day I saw Xenakis at his work table. He was working on a piece. Reviewing it, he was stopped by a detail. He said: "Oh no, that is going to be horrible," and he changed it". And Olivier Revault d'Allones completes: "I believe that happens to all composers" [15: 41]. So for Xenakis mathematic calculation is indispensable, "But," as he mentions, "definitively, instinct and subjective choice are the only guaranties for the value of a piece. There is not tablature with scientific criteria" [17: 19]. Xenakis says that "[...] music is much closer to mathematics than any of the other arts" [15: 21], but, referring on the application of the Markov chains in his music he observes that: "The sonic result thus obtained is not guaranteed a priori by calculation. Intuition and experience must always play their part of guiding, deciding, and testing" [16: 81].

So, Xenakis permits himself to keep a distance from western science when, subjectively, intuitively, he judges it necessary. In 1976, during his Thesis defense in Sorbonne, he uses another dipole: The "eastern" word *revelation* contradistinguished to "western" *inference*. Xenakis says: "I said [...] that in the artistic realm there is revelation. In philosophy, in knowledge, it is the same thing. Yes, revelation is absolutely indispensable. It is one of man's crutches. He has two crutches: revelation and inference. And in the artistic realm, both are valid. In the scientific domain, there is one which takes precedence over the other, and that is inference" [15: 33].

CONCLUSIONS

We see that Xenakis and Cage use chance as a means to realize a musical action. We could say that they are both, in a way, "obliged" to use chance in their music, for a different reason each. Cage because only in this way he may leave himself out of the composition and Xenakis because the constitution of sound masses he uses, is conditioned by chance.

We see that these two approaches of chance, western and eastern, are not absolute, neither in Xenakis' nor in Cage's music. Their theoretical outlook is the base on which they have created their work, and that mainly characterizes it. Nevertheless, both permit themselves to deviate from their theoretical positions when they consider it "musically" necessary.

Terminating, let us pose a question that is latent during our presentation. Could we, making maybe a hazardous generalization, consider these two approaches complementary? Could we, paraphrasing Xenakis, talk about *East/West: Allies?*

POSTSCRIPT: In this paper, we insisted essentially to the musical consequences of the "eastern" and "western" approach of chance by Cage and Xenakis. However, this subject has a tendency to generalization and it has interesting extensions; esthetic-philosophical (modernism-postmodernism, determinism-free will...), and also socio-political (multicultural societies, globalization...), which are not touched here, therefore we have to mention them.

Furthermore, these extensions link directly to Cage and Xenakis. We can mention, for the esthetic-philosophical, Daniel Charles' reflections on Cage's empiricism [3], and for the socio-political, the "anarchic" *circus* in the sixties and Cage's references to Buckminster Fuller and Herbert Marshall McLuhan for the "global village". On the other hand, we have in Xenakis esthetic-philosophical parallels (Epicurean clinamen-free will-"écarts") and socio-political ones in the conception of the sound masses as an "analogon" to the massive public demonstrations, images that refer to his traumatic youth years in Greece.

In addition, the xenakian conception of the sound masses has a naturalistic aspect (as "clouds" or "song of cicadas"...) that completes the mathematical abstraction [12]. It will be interesting to notice the proximity of sound masses' stochastic treatment in the compositional process, with the caegian eastern conception of art (borrowing from Ananda Coomaraswamy [4]) as "the imitation of nature in her manner of operation" [5].

REFERENCES

- [1] Bayer F. *De Schönberg à Cage*, Editions Klincksieck, Paris, 1987
- [2] Cage J. *Silence*, Middletown, CT: Wesleyan University Press, 1961
- [3] Charles D. *Gloses sur John Cage*, Desclée de Brouwer, 2002
- [4] Coomaraswamy A. *The transformation of Nature in Art*, the Harvard University Press, 1943
- [5] Di Scipio A. "Métaphore, formalisation et intuition dans *Analogique A et B* de Xenakis", M. Solomos (ed.), *Xenakis-Grisey. La métaphore lumineuse*, L' Harmattan 2003, p. 181-192
- [6] Gibson B. "La théorie et l'oeuvre chez Xenakis: éléments pour une réflexion", *Circuit* 5(2), 1994, p. 41-54
- [7] Helffer C. "Sur *Herma* et autres" in *Regards sur Iannis Xenakis*, ouvrage collectif, Editions Stock, Paris, 1981 p. 195-205
- [8] Kostelanetz R. ed., *Conversing with Cage*, Omnibus, London, 1989
- [9] Pritchett J. *The music of John Cage*, Cambridge University Press, Cambridge, 1995
- [10] Solomos M. *A propos des premières oeuvres (1953-1969) de Iannis Xenakis*, Thèse de doctorat, Université de Paris IV, Sorbonne, 1993
- [11] Solomos M. *Iannis Xenakis*. Mercuès, P.O. Editions, 1996
- [12] Solomos M. "Xenakis et la nature? Entre les mathématiques et les sciences de la nature", in *Musicalia* 1. 2004, p. 133-145
- [13] Suzuki D. T. *Essais sur le bouddhisme Zen*, Editions Albin Michel, Paris, 2003
- [14] Varga B. A. *Conversations with Iannis Xenakis*, Faber and Faber, London, 1996
- [15] Xenakis I. *Arts/Sciences-Alloys*, Pendragon Press New York, 1985
- [16] Xenakis I. *Formalized Music*, Pendragon Press, Stuyvesant (NY), 1992
- [17] Xenakis I. *Musique Architecture*, coll. Mutations-Orientations, Casterman, Tournai, 1971