

A Review of *Arts/Sciences: Alloys* by Iannis Xenakis

Larry Polansky

Any written addition to our understanding of the music and thought of composer and theorist Iannis Xenakis is highly welcome. Aside from his book *Formalized Music* and a handful of articles, Xenakis has, until now, said very little about his work, especially in 'nontechnical' terms [1]. His other book, *Musique Architecture*, has been translated from the French into Japanese, Italian and Catalan but not yet into English [2].

Arts/Sciences: Alloys is all the more important because of its essentially philosophical, conversational tone [3]. Xenakis and his colleagues candidly discuss aesthetics, the nature of the compositional process and, perhaps most interesting (especially to readers of this journal), the marriage of music and science, particularly mathematics. The latter topic is one of the primary thrusts of Xenakis's work. Many readers, fascinated by Xenakis's beautiful, visionary and demanding music but unable to navigate the somewhat difficult mathematical explanations in *Formalized Music*, may find in these conversations a kind of Rosetta stone for Xenakis's thought.

The very form of the book is intriguing: a transcription of a thesis defense for a 'Doctorat d'Etat' at the Sorbonne in 1976. In Xenakis's own words from the preface, "In France the 'Doctorat d'Etat' may be awarded on the basis of a 'file' consisting of previously published theoretical and creative works. This thesis file must then be defined before a jury whose members (not necessarily academic personalities) are suggested to the sponsoring university by the candidate. Once all the members have been agreed upon, a five-hour deliberation session is held between the candidate and the jury. At the end of this 'defense', the jury decides whether the degree should be awarded, and if so, with what honors" [4]. (Needless to say, Xenakis's doctorate was awarded, with 'Very Honorable' mention.)

One aspect that makes this book so interesting is that Xenakis himself chose those thinkers 'against' whom he wished to defend the voluminous material in his file (articles, books, scores, recordings, etc.). The five members of his jury—Olivier Revault d'Allones, Olivier Messiaen, Michel Ragon, Michel Serres and Bernard Teyssedre—adopt highly diverse, but usually admiring views of Xenakis's work and thought.

The book would be greatly improved by brief biographies or even one-sentence descriptions of these five. Non-French readers may not be familiar with these scholars (indeed, a quick canvas of some fairly literate musician friends showed this to be the case!). A cursory knowledge of their respective disciplines would, I think, greatly illuminate much of the

dialogue in the book, as well as supply the intellectual motivation for many of the questions.

Xenakis is unarguably one of the great visionaries of twentieth-century music. I have a habit of telling my composition students, when they first come to me, that there are perhaps five books with which they absolutely must be familiar if they are to consider themselves conversant with the musical ideas (especially American) of the second part of this century: Partch's *Genesis of a Music*, Tenney's *Meta + Hodos*, Cage's *Silence*, Ives's *Essays Before a Sonata* and Xenakis's *Formalized Music* [5]. Xenakis's work is a successful and forward-looking integration of the most profound ideas from science and music; and the sheer sonic integrity and fascination of his music has always made detailed study of his compositional processes and theories rewarding.

This book tends to focus on one of the most interesting realms of Xenakis: the integration of art and science. Xenakis and his colleagues are not interested in simply applying scientific principles to artistic activity (in fact, they point out that the converse has been surprisingly overlooked). Rather, they initiate an investigation of what Xenakis calls 'global morphology'—a search for deep forms that motivate human thought processes and concrete manifestations (art, science, technology, architecture and even the evolution and perception of biological forms). Xenakis's statistical and group-theoretical musical constructs are the beginnings of a search for a unitary theory of thought and of perception, which includes as a necessary subset his musical and architectural creations.

In *Arts/Sciences: Alloys* Xenakis presents for the first time (at least in English) some of the most fundamental philosophical motivations for his work. Often these ideas are surprisingly simple (he likes what he likes), but more often they evidence a critical facility of almost overwhelming integrity and what one might call 'persistence of vision'.

Before dealing with the specifics of the dialogues, a few words about the book itself are in order. Sharon E. Kanach, the translator (and also a composer), must be congratulated for bringing this work to press, and for her deep sensitivity to the ideas expressed and the often thorny style of conversation. In general, the conversations read fluidly and intelligi-

ABSTRACT

The author reviews a transcription of Xenakis's 'thesis defense' for the 'Doctorat d'Etat' at the Sorbonne in 1976 and finds it a welcome and essential addition to the literature documenting the composer's ideas. Each dialogue transcribed introduces a different thinker and colleague of Xenakis, and each focuses on a different realm of Xenakis's compositional and aesthetic philosophy. The informality and interdisciplinary nature of the discussions contributes new and valuable insights into Xenakis's work. Xenakis's dialogue with Messiaen is of particular interest, because of Xenakis's extraordinary rapport with his former teacher, and because of the unusual candor with which these two composers spoke.

Larry Polansky (composer, educator, programmer), Box A36, Hanover, NH 03755, U.S.A.

Received 7 November 1988.

bly. What occasionally sound like awkward paragraphs must surely be attributed to the problems inherent in translating the spontaneous language of five French philosophers! For example, consider this sentence (from Revault d'Allones): "Speaking of pedagogy, it seems clear to me that neither innocently nor by chance, pedagogy, such as it is practiced in our society, creates literati on the one hand, and on the other hand, scientists, as you were saying" [6]. This type of English occurs several times in the book, and perhaps the only thing the translator can be accused of is not requesting that the participants speak readily translatable French! Xenakis's own (English) titles have always seemed to me to be rather awkward, possibly because they are too literal translations from the French (e.g. *Formalized Music* from *Musiques Formelles*). To me, this current title has gained a kind of rigidity in the move from French to English.

The structure of the book itself is of interest. It begins with a brief introductory statement by Xenakis, with its two sections subtitled "Subtended Philosophy" and "Coagulations". This introduction attempts to give a broad philosophical overview of his work as it relates to such general notions as intelligence, creativity, talent ("talent, then, is a kind of qualification, a grading of the vigor and richness of intelligence" [7]), causality, inference, connectedness and existentiality.

The introduction is followed by five 'dialogues' (with welcome interjections), in which each participant attempts to investigate and probe another area of Xenakis's work. After the dialogues are five appendices. The first three are theoretical (and excerpted from *Formalized Music*). Appendix 4 is a catalogue of Xenakis's work, and appendix 5 is a very brief bibliography. Lastly, there is a brief postface by (I assume) Sharon E. Kanach.

The first dialogue, with Olivier Revault d'Allones, begins with an insightful and seminal question regarding the coevolution of music and mathematics. Revault d'Allones finds them currently to be 'unequal' partners. Specifically referring to Xenakis's use of abelian groups to generate scales, he ponders why

musical thinking has not sufficiently utilized all the mathematical resources it could. . . . When Xenakis realized that for a musician, pitch scales constitute a well-ordered group, and abelian

scale, (a trivial definition for a mathematician's mind), this put the 'bug in his ear', as they say. There are well-ordered groups; therefore, perhaps there are groups that are not orderly. Here's an abelian scale, can't there be a scale which is not? We understand very well how musical thought can thereby be fertilized by mathematics, but given the relatively elementary level of mathematics in these concepts, I would say that the interest is null for mathematics [8].

One of the great disappointments for me is that Revault d'Allones's question is never really answered in the book, and the importance of the friendly accusation he makes to those of us who work in this field is never fully dealt with. When he says that "today, the benefits which the arts and sciences could share seem to me to be quite unequally divided" [9], I hoped for an answer that would give us a possible direction to the solution to this fundamental problem. Should science look more deeply at the extraordinary logic of art and creativity for help in understanding its own roadblocks? Are there significant problems in the arts (like aspects of similarity theory in perception, information reduction in computer-generated images and sounds, or the mathematics of the creative process itself) that might perhaps motivate scientific progress in the same way that the problems of applied physics and chemistry often motivate advances in pure mathematics?

In addition, what of the work of mathematicians/theorists like David Rothenberg and John Myhill, whose search for musical constructs has often motivated mathematical approaches that might not occur but for the 'fuzziness' of the musical issues? It is true that in the areas of musical artificial intelligence, digital synthesis, image generation and so on, artistic creations and ideas have largely been fabricated from the debris of science and technology motivated by other applications (sadly, usually for military defense). Perhaps this is a problem not with the fundamental interest and complexity of artistic issues but rather with the social and economic motivations for investigating these problems. Given similar human, technological and economic resources, it seems plausible to me that artists (and their unsolved problems) could generate technological and conceptual advances at least comparable to those produced by military-minded personnel. The answer to Revault d'Allones's question, then, may have

nothing to do with art itself but instead with societal allocation of essential resources.

Unfortunately, these issues are avoided in this dialogue (and in those that follow), which does not go unnoticed by Revault d'Allones. Michel Serres attempts to answer him, primarily with unqualified praise of Xenakis's work (e.g. "Xenakis's music is a step ahead" and he "presents a general idea of scientific thinking" [10]). Revault d'Allones agrees with Serres's assessment of Xenakis's work but contends (correctly, I think) that his fundamental question has still not been answered. Later, in the dialogue with Olivier Messiaen, after Messiaen congratulates Revault d'Allones for the ideas he raised earlier about Xenakis's technique, Revault d'Allones responds with wonderful candor: "Personally, I failed. He, Xenakis, didn't speak!" [11].

In this first dialogue Xenakis is quite eloquent on other aspects of the relationship between music and mathematics.

What is indeed curious . . . is that music is much closer to mathematics than any of the other arts. Why? I can say that the eye is quicker, much more immediate and in direct contact with reality, than the ear, which is less agile and more recessed, demanding reflective thinking. Consequently, the ear must be more abstract and therefore create bases which also are more abstract, bringing them closer to mathematics [12].

The second dialogue, with Olivier Messiaen, more strictly addresses musical questions, like the evolution of musical syntax, the teaching and role of 'musical technique', the use of permutations and even the subject of tetrachords [13]. I found this dialogue to be the most poetic, and perhaps the most interesting of the five. I attribute this to a deep communality of spirit between Xenakis and Messiaen (who was the former's teacher). Xenakis speaks here with an obvious reverence for the older composer and thus assumes a kind of passion and an almost revelatory tone that is absent from the other dialogues. In fact, he and Messiaen speak directly of the nature of musical revelation, as the following remarks by Xenakis indicate: "I said earlier, (or maybe I didn't) that in the artistic realm there is revelation. In philosophy, in knowledge, it's the same thing. Yes, revelation is absolutely indispensable. It's 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" [14]. Here, Xenakis 'takes sides' in favor of the mode of art as opposed to the mode of science; perhaps it is the (revelatory) nature of Messiaen's own work that inspires him to do this.

Xenakis and Messiaen also speak unabashedly of love, of the necessity of that emotion when the arts utilize highly formal process of technology. Messiaen asks, "In your case, a machine will give you the millions of permutations within a few minutes: it's a cold and unexplicit list. How can and do you choose directly from within this immense world of possibilities without intimate knowledge or love?" [15]. The two composers seem to be in agreement about love—that it is a way of interpreting knowledge or, as Xenakis calls it, the "epiphenomenon of knowledge". Xenakis adds that "when I look at the starry sky, I love it in a certain way because I know it in a certain way; but if I must know the successive stages of astrophysics, well, that may happen without love" [16]. It seems to me that this short dialogue may be the real answer, as Messiaen suggests, to Revault d'Allones's original question.

Another interesting, and perhaps autobiographical (a tone rare in Xenakis's writings), exchange between Xenakis and Messiaen occurs when the subject of teaching composition and technique arises [17]. Revault d'Allones points out that Xenakis adopts a kind of 'hermetic' approach to certain areas of his compositional process when he (Xenakis) says, "Listen, I have nothing to add. Listen, and if you don't understand, listen again. And then, like it, if you like it" [18]. Messiaen and Xenakis make this kind of discourse less apocryphal when they attempt to define, mainly for themselves, what each of them considers to be within and beyond the realm of technique. Messiaen describes his own teaching process as one where only technique is discussed. "Outside of purely musical fact, of course, I would not allow myself to reconcile intentions, because I would certainly be incapable of doing so" [19]. For Xenakis, Messiaen's use of durations, harmonies, modes and colors are all outside of the realm of technique! When Messiaen adds that "orchestration is also a question of technique," Xenakis very cryptically (but, I think, tellingly) responds, "Which means one can speak of these things" [20].

The third dialogue, with Michael Ragon, focuses primarily on Xenakis's architectural ideas (Xenakis remains a well-known and visionary architect). Ragon questions Xenakis on his utopian and far-reaching sociopolitical designs, like the 'vertical city' ("a city like this would simply be like stretching a garment" [21]). This dialogue will be of great interest to those, like myself, less familiar with Xenakis the architect than Xenakis the musician. In addition, Xenakis the utopianist emerges from this dialogue—not surprisingly—for many of the most visionary composers feel it necessary to develop cosmological and societal visions that are equal in depth to their perception of the possibilities of the worlds of form and sound. Xenakis proves, in this dialogue, that he is no exception.

The fourth dialogue, with Michel Serres, ostensibly deals with mathematics but seems rather to be about more general ideas of time and form. Here Xenakis very clearly elucidates his notions of 'local' and 'general' morphology. On global morphology, Xenakis's thought resonates with a great deal of modern 'synergistic' thought, from Rene Thom to Rupert Sheldrake:

Well, in every domain of human activity, form exists as a sort of froth. I have noticed some figures, some forms, which belong to either the domain of abstract speculation (such as mathematics, logic), or to more concrete speculation (such as physics, treating either atomic or subatomic phenomena), or to geometrical expressions of genetics (such as chemical molecular reactions). Yet these figures, these forms which belong to so many dissimilar domains also have fascinating similarities and diversifications and can enlighten other domains such as artistic activities [22].

Xenakis is less clear on the subject of 'local morphology', which I think he means as a more direct application of one realm to another. For example, "when the idea of proportion was first applied to architecture on man-made forms" is cited as a case of local morphology [23].

Later in the dialogue with Serres, the discussion centers on the concept of time. Xenakis briefly adopts a wonderfully cosmological perspective, in a statement that makes one wish that one of the five respondents here was the British physicist Stephen Hawking: "Time is not reversible; it's time's movement which is reversible. Time itself (to my knowledge, it's a kind of postulate) or the temporal flow never goes back-

wards" [24]. He also speaks clearly of the important musical idea of 'orders outside of time', a concept with which many music theorists seem to have difficulty. Here, Xenakis is referring to statistical functions that have no necessary temporal order, or even to the way that the amplitude envelope of an instrument (like a flute or oboe) might relate to its register. Xenakis's own music, with its sophisticated use of probability functions, makes these theoretical concepts quite clear: "There can be order in non-temporal things. That's why it's absolutely indispensable to distinguish between what is *in* and what is *outside* of time. For example, I'll take a group of keys on a piano (an elementary case). I then have intervals which repeat themselves, but they are never repeated in time; they're there, fixed. The piano keys are on a piano which doesn't move" [25].

The final dialogue, with Bernard Teyssedre, deals with the principles underlying Xenakis's compositional philosophy. Of the five, it is the most direct discussion of Xenakis as a composer. Teyssedre engages Xenakis with questions about the use of probabilistic and, in particular, ergodic forms and goes into some depth in discussing *Formalized Music*. Students of this book (what young composer today isn't?) will be particularly interested in this section.

An unusual thing happens in this dialogue—Teyssedre questions Xenakis about the work of other composers. Xenakis has usually been either silent or, at best, oblique about this topic, preferring to concentrate his public statements on the explication of his own music. Of course, this explication has been most important, since the fecundity of his music absolutely demands an articulate linguistic concordance, and Xenakis has always been more than capable of providing this. However, as is always the case with a musical intelligence of this stature, one wonders what he thinks of the music of other important composers.

Anecdotaly, I recall when Xenakis taught at my home institution, Mills College, for one week. Though highly articulate and open about his own music and theory, he showed a real reluctance to consider student work. When asked about this, he replied quite frankly that if he did not like the work, he would have to say so, and why. As a rather brief guest, he did not want to be put in that position. At the time, I greatly admired the complexity of his concern for the feelings of the composi-

tion students, who would certainly have been deeply affected if someone of Xenakis's obvious integrity and intelligence disliked one of their formative pieces!

However, in this dialogue, he is quite blunt. When Teysseire says that the music of Cage "brings up another musical principle, different than yours", Xenakis answers, "Fine, and I'll tell you why. Very simply because we all have fortuitous sounds in our daily life. They are completely banal and boring. I'm not interested in reproducing banalities." When Teysseire later asks, "In summary, you don't like silence?" Xenakis is less than oblique: "Silence is banal" [26].

Some conclusions. The book is tantalizingly short, and it is not clear if the entire five hours of the 'defense' are included in these pages. Since Xenakis's writings are rare, the important questions touched on could have been explored in greater depth. The discussion moves rapidly, and ideas shift and are transmogrified rather quickly. Digressions from which there is no return are frequent. Of course, this is to be expected given the nature of such informal conversation, but the loose ends can be frustrating for the reader. Also,

the dialogues themselves are a little too polite and full of mutual admiration. Even Revault d'Allones's justified frustration is couched in so much respect for Xenakis that a good healthy argument never ensues (although one is clearly merited, and certainly would have been fun!).

Xenakis is clearly not the 'petitioner' here; this is precluded by his own personality and stature. The reader gets a lasting impression of the profundity of his inner surety in his own historical contribution. Indeed, he makes this quite clear in appendix I, "Correspondences between Certain Developments in Music and Mathematics", where the only names he mentions after the year 1950 are himself and Lejaren Hiller!

This is a rich and important work that sheds welcome light on one of the most inspired and profound composers of this century.

References and Notes

1. Iannis Xenakis, *Formalized Music* (Bloomington: Indiana Univ. Press, 1971); "Xenakis on Xenakis", *Perspectives of New Music* 25, Nos. 1 and 2, 16-63 (Winter 1987, Summer 1987).
2. Iannis Xenakis, *Musique Architecture* (Tournai, Belgium: Casterman, 1971).
3. Iannis Xenakis, *Arts/Sciences: Alloys, Aesthetics in*

Music, No. 2, Sharon E. Kanach, trans. (New York: Pendragon, 1985).

4. Xenakis [3] p. vii.

5. Harry Partch, *Genesis of a Music* (New York: Da Capo Press, 1961); James Tenney, *Meta + Hodot* (Oakland: Frog Peak Music, 1988); John Cage, *Silence* (Middletown, CT: Wesleyan Univ. Press, 1961); Charles Ives, *Essays before a Sonata and Other Writings*, Howard Boatwright, ed. (New York: Norton, 1962); Xenakis [3].

6. Xenakis [3] p. 24.

7. Xenakis [3] p. 2.

8. Xenakis [3] p. 15.

9. Xenakis [3] p. 14.

10. Xenakis [3] pp. 23-24.

11. Xenakis [3] p. 38.

12. Xenakis [3] p. 21.

13. Xenakis [3] p. 30.

14. Xenakis [3] p. 33.

15. Xenakis [3] p. 31.

16. Xenakis [3] p. 32.

17. Xenakis [3] pp. 40-41.

18. Xenakis [3] p. 39.

19. Xenakis [3] p. 41.

20. Xenakis [3] p. 41.

21. Xenakis [3] p. 53.

22. Xenakis [3] pp. 63-64.

23. Xenakis [3] p. 64.

24. Xenakis [3] p. 68.

25. Xenakis [3] p. 70.

26. Xenakis [3] pp. 94-95.