

XENAKIS

His Life in Music

James Harley

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James Harley

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Preface

In 1982, I moved to London to focus on my compositional development and to taste the rich musical and cultural life of that city. I availed myself of the plentiful resources there, including the public library at Victoria. One of the books I checked out was *Formalized Music*. I had, of course, heard of Iannis Xenakis and had listened to a few recordings of his music, but this first attempt at working my way through his book was my initial prolonged exposure to the challenging ideas of this composer.

That same year, in November, I made the trek up to the Huddersfield International Festival of Contemporary Music, where Xenakis was a featured composer. My first experience of live performances of his music took place through the incredible, visceral presentations by the Arditti String Quartet, harpsichordist Elisabeth Chojnacka, and percussionist Sylvio Gualda. Further performances of Xenakis's music only enhanced my sense that this was a singular composer whose work projected an expressive force unlike any other.

From London, I moved on to Paris. Prior to that, in 1984, I had spent a few fortunate days with Xenakis at Kazimierz Dolny, Poland, as part of the Summer Course for Young Composers organized by the Polish Society for Contemporary Music. His lectures were fascinating, touching on a whole range of issues and techniques, and presenting compositions that I had not yet had a chance to hear. He also spoke of the Unité Polygogique Informatique de CEMAMu (UPIC), his computer music system based on a graphic-design approach to synthesis. When I learned that it was available for composers to use, I jumped at the chance. I was able to attend the 1985 Centre Acanthes summer course, that year focused on Xenakis. With the added bonus of working with the UPIC, I was able to immerse myself in his music. This is really when my study of Xenakis's music began. The two years I then spent in Paris were immensely helpful to me, for the opportunity to attend his weekly seminar at the Université de Paris and to carry out an extended residency at the Centre d'Etudes Mathématiques et Automatique Musicales (CEMAMu), where I completed two compositions using the UPIC.

In his lectures, Xenakis worked through the topics he had expounded in his book *Formalized Music* (1992). It was much easier to understand the mathematics of his techniques with the benefit of his examples and demonstrations, and with the chance to ask for clarification. He actually spoke very little about his own music directly, and analytical examples were invariably drawn from the book and other early articles. Newer works were occasionally mentioned, but it became apparent that Xenakis preferred to discuss the conceptual and theoretical basis for his music rather than the music itself.

Anyone wanting to study his music, then, would be working pretty much on their own. A daunting task, to be sure.

Still, over the years Xenakis was very helpful, not so much through answering specific questions as in making available all kinds of resources (often through the auspices of Radu Stan, his agent at Éditions Salabert), including scores, recordings, and sketches. It was quickly evident that there was a dearth of published material discussing Xenakis's music in an analytical way. And thus, what had arisen from composerly curiosity about his music developed into a fullscale attempt to present the music of this well-known but poorly understood figure.

This study is by necessity introductory and provisional. My aim has been to give an overview of Xenakis's complete output. While some pieces receive more detailed attention than others, no selected subset of pieces could satisfactorily convey the complex network of compositional concerns that carry through Xenakis's career. There are other publications that delve deeply into particular compositions or techniques. References are provided for those readers wanting to voyage further into the fascinating, peculiar world of this composer's music.

The book proceeds chronologically, for the most part, in order to present the scope of Xenakis's compositional concerns and to note the specific points at which new concepts and techniques are introduced. The descriptive discussion focuses primarily upon formal organization, which often derives from the deployment and development of "sonic entities." These can loosely be defined as textures or blocks of material characterized by particular features, be they timbre, rhythm, density, pitch, or what have you. Given the lack of reliance of this music on traditional elements such as melody or harmony, or even more modern techniques such as parameter rows or sets, more common analytical tools are not often of much use. This fact also goes some way to explaining the lack of attention Xenakis's music has received in the analytical community.

I offer this work as a bridge, a path by which interested listeners, musicians, students, and researchers may approach the music of Iannis Xenakis. I am hopeful that others will carry the study of this music further, as indeed many already are. There is no sense in pretending that the authorial stance taken is objective, though evaluation has not been my primary concern. It will be obvious that I am a great admirer of Xenakis's music; this mammoth task would have been torturous if I had been anything else. Preferences for certain pieces will also be apparent, as will be reservations for others. I know there are other listeners who don't share my opinions, but I hope that my discussion will enable readers to take some understanding of the piece to the score and recording. If weaknesses or flaws in my work are found, I hope that they will invite debate—all the better for extending the exegesis of this important repertoire. It goes without saying that any errors are my own, and they exist in spite of all the help I have received.

Throughout the book, there are numerous references to the scores, but few examples, for lack of space. Measure numbers are given so that anyone with access to the printed music may be able to follow the analyses and place the discussion into the context of the music. Diagrams charting the overall designs of selected pieces have been provided for reference. I would point the interested reader to the website related to this book for further such materials (www.mnstate.edu/harley/xenakis), and to the website of the Friends of Iannis Xenakis (<http://www.iannis-xenakis.org/>), where a comprehensive list of works, a current discography, an extensive bibliography, and much else, may be found.

Acknowledgments

It would not have been possible to complete the research and writing of this book without the support and assistance of a great number of people. The community of Xenakis scholars is small, but vital, and much important work has been done of immense help to me. Those with whom I have had direct contact and who have answered various questions along the way include Linda Arsenault, Ellen Rennie Flint, Rudolf Frisius, Benoît Gibson, Bengt Hambraeus (r.i.p.), Peter Hoffmann, Miha Iliescu, Serge Provost, Curtis Roads, Brigitte Robindoré, Ronald Squibbs, and Makis Solomos.

There are also a number of performers whose personal insights into the difficulties and rewards of this music have also been enlightening, as have been their dedicated performances. These include Irvine Arditti, Elisabeth Chojnacka, Marc Couroux, Claude Helffer, and Rohan de Saram.

Of the teams of people at the various institutes concerned with Xenakis in one way or another, including the Centre d'Études Mathématiques et Automatique Musicales (CEMAMu), Ateliers UPIC, and his publishers, I must thank the following people for helping me out through supplying materials, answering questions, and assisting in many other ways: Henrietta Brougham (UMP), Patrick Butin (Salabert), Cornelia Colyer (CEMAMu), Gerard Pape (Ateliers UPIC/CCMIX), Jean-Michel Raczinski (CEMAMu), Malcolm Smith (Boosey and Hawkes), and especially Radu Stan (Salabert), who has gone far beyond the call of duty to answer questions and place materials at my disposal.

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I have been welcomed as a researcher at the following institutions, where otherwise unobtainable materials have been accessed: the Getty Research Institute (Beth Ann Gynn), the National Arts Centre of Canada (Gerry Grace), and the National Ballet of Canada (Sharon Vanderlinde). In the quest to track down copies of all the scores and other publications—an extremely difficult task living far from Paris—the music libraries at the following institutions have been particularly useful for me: McGill University, Université de Montréal, University of California at Los Angeles, University of Southern California, and Wilfrid Laurier University.

Articles and reviews incorporating aspects of this research have appeared in various publications along the way. For providing a venue for my work, thanks are due to *All Classical Guide* (Gerry Brennan), *Canadian University Music Review* (Mary Cyr), *Computer Music Journal* (Thom Blum, Curtis Roads, and Doug Keislar), *Leonardo*

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Of course, the greatest acknowledgment must be accorded to Iannis Xenakis himself. He graciously provided assistance by making various crucial materials available, and was also willing to put up with questions and requests that would surely have been tedious given the pressures of innumerable such items pouring from all sides and, more important, his ongoing preoccupation with his own creative work. Thanks too, to Françoise Xenakis, for welcoming me into the lives of her and her husband on occasion. I have had the privilege to experience Xenakis as a teacher, as well as a composer and administrator (at CEMAMu). For all the harshness of his music, and the occasionally unsympathetic words in his writings, he was always patient and kind, even while challenging those surrounding him to be dedicated and uncompromising in their work. Perhaps most important to note is the inspiration his work and example have provided.

For their support and encouragement, for enabling me to pursue my dreams, I would like to dedicate this work to my parents, Audrey and Norman Harley. I would also like to dedicate it to my children, Ania and Ian, for helping me to live out those dreams.

1

The Outsider

Iannis and his two brothers, Cosmos and Jason, spent most of their childhood in Braila, Romania in the care of governesses. By all accounts, Iannis, the eldest, was nonetheless deeply devoted to his mother, who unfortunately died when he was five. He was, in Matossian's words, "deeply scarred by his mother's death. He clung to the few experiences he had shared with her: the gift of a flute whose sounds had astonished him, her wish that he should enjoy music" (1986, 13). After her death, however, he received little encouragement, and precious little affection. Xenakis has said he developed a "defense mechanism" against certain kinds of music associated with his childhood "because it awakens very sad memories in me." "I reacted against [this] music because I felt I was too sensitive. Music could even bring me to tears" (Varga 1996, 10, 8, 11).

Language was another element acting in a powerful way on Xenakis's early sense of alienation. While he was tutored in Greek, Iannis had his early schooling in Romanian, and was no doubt teased for being a "foreigner." In addition, the succession of governesses spoke their native tongues to their charges, giving the Xenakis boys exposure to other languages, including English, French, and German. While this would have been good for their intellectual and cultural development, it would also have made intimacy all the more difficult. At age ten Iannis was sent off to a Greek boarding school on the island of Spetse, where, belatedly, he discovered his own Greek culture, beginning a lifelong fascination and study. Mâche points out, though, that Xenakis may have endured derision because of his accent, coming as he did from another country. Paradoxically, it was this ostracism that drove him to the library; for solace in solitude, certainly, but also to a rich interior world filled with the poetry and philosophy of Greek history.

Matossian paints Xenakis's adolescent years as often troubled, and mostly solitary. After graduating from the school in Spetse, Iannis moved to Athens in order to prepare for the entrance exams to the Polytechnic Institute (Matossian 1986, 14–17). A growing interest in the sciences led him to study mathematics and physics, but he kept up his passion for ancient Greek philosophy and literature. In 1940, just as he passed the entrance requirements, the Italians invaded Greece and the Polytechnic Institute was closed. A "normal" route through the university to a career was not to be. The politics of Greece during that period were intricate, with the Italians supplanted by the Germans, who were then replaced by the British, leading to civil war.² Along with many others, Xenakis joined the Greek resistance, at first through student groups, then as part of the

Communist Party. Eventually, he was involved in armed resistance, as part of the EAM, the national liberation front.³ Although he was fighting against the succession of authorities in power, and was thus acting “outside” the law, this must also be seen as the period during which Xenakis was most closely involved in collective activity. Certainly this experience was crucial in shaping the aesthetic of the composer that was to come.

Xenakis was seriously wounded in December 1944. That he did not die is surely a miracle, but somehow he survived, scarred and minus his left eye. Eventually he recovered enough to return to his studies, graduating in the summer of 1946 with a degree in civil engineering. Unfortunately, the authorities began rooting out people formerly active in the Communist Party, rounding them up into what amounted to concentration camps. Fearing for his life, Xenakis, with the help of his father and others, fled the country, landing first in Italy, and then, after various maneuvers, arriving in Paris on 11 November 1947. Unattracted by Paris at first, in the throes of its own postwar difficulties, he had intended to continue on to the United States, where his brother Jason was already studying philosophy. Without proper papers, and with no money, this dream did not come true (although he later ended up teaching for a period of five years in the States). Xenakis soon landed a job in the architectural studio of Le Corbusier, a figure who would exercise a major influence on his creative development. In the midst of all these life-wrenching experiences and dislocations, Xenakis had decided that, if ever he got the chance, he would devote himself to music. He once explained, “In my loneliness and isolation I tried to hang on to something—after all, my old life and new circumstances, my old image of the world and the new experiences, all these were in conflict. I wanted to find out who I really was. In that process, traditional Greek folk music appeared to be a safe point...” (ibid, 26).

2

From the Personal to the Individual

While Xenakis would certainly have been an outsider to the new musical activities in Paris or Darmstadt, he had, during his student years, received enough training and musical acculturation to know that he loved music and could dream of devoting himself to it. His father was an opera fan, of Richard Wagner in particular, and his mother played the piano. Xenakis made a few short-lived attempts to study the piano over the years, and he sang in the boy's choir at the school on Spetse. He recalls "singing Palestrina and liking it very much" (Varga 1996, 12). He also learned notation and solfège, and became acquainted with Greek church music and traditional dances there. During his brief period in Athens before the outbreak of the war, he studied harmony and counterpoint with a Russian-trained musician, Aristotle Koundourov. Xenakis proudly recalls learning all the parts of Mozart's Requiem by heart (Varga 1996, 14).

Music held a special place for Xenakis, undoubtedly related to memories of his mother: "Music was more like a dream for me than anything else. I didn't think about it consciously" (Varga 1996, 12). It was also linked to his passion for ancient Greek culture, the world in which he often dwelt in the solitude of his imagination: "I felt I was born too late—I had missed two millennia.... But of course there was music and there were the natural sciences. They were the link between ancient times and the present, because both had been an organic part of ancient thinking" (Varga 1996, 15).

Xenakis's scientific training was much more rigorous, of course, leading him in the direction of a career in engineering. However, upon his arrival in Paris, with a job as an engineering assistant in Le Corbusier's architectural studio, his mind was filled with music. As Matossian recounts, "Xenakis compos[ed] far into the night.... Several notebooks from this period show that he must have worked long and hard at his studies of counterpoint and harmony" (1986, 37). He approached the difficult task of making up for his lack of training with great determination. According to his own account, he first approached Nadia Boulanger for lessons. Evidently she refused to take him on, but did offer encouragement. Arthur Honegger was less than supportive—"This is no music!" (Varga 1996, 27)—and Darius Milhaud only slightly more so. A suggestion from Boulanger, however, to contact Annette Dieudonné at the Conservatoire National Supérieur de Musique de Paris resulted in the advice to approach Olivier Messiaen. This would prove to be a seminal encounter, more for the open attitude and "free mind" Messiaen brought to his analysis of music of all kinds than for any specific suggestions he may have offered to the "naive" young composer (Matossian 1986, 48–49).

Xenakis audited Messiaen's class regularly between 1951 and 1953, gaining insight into a wide range of music, with particular attention given to the analysis of rhythm.¹ In terms of his own work, though, the elder composer advised him to work alone. Messiaen recalled, "I understood straight away that he was not someone like the others.... He is of superior intelligence.... I did something horrible which I should do with no other student... I said, "No, you are almost thirty, you have the good fortune of being Greek, of being an architect and having studied special mathematics. Take advantage of these things. Do them in your music"" (Matossian 1986, 48).

Messiaen had a special interest in Hellenic culture, and made use of rhythmic patterns derived from the classic meters of Greek poetry. It is certainly possible that his increasing use of these poetic feet in the 1950s and the formal modeling of the 1960 work *Chronochromie* (and a number of subsequent works) on Greek choral lyrics may have been stimulated by his contact with the young Xenakis.² In any case, Xenakis's compositional development over the next few years was meteoric; there can be no doubt that Messiaen helped him to gain confidence in his own ideas and abilities.

While there is little published record of Xenakis's early efforts, he has been generous in opening his archives. François-Bernard Mâche, who has made the most thorough study of the pre-*Metastaseis* period, notes a major shift in the compositions dating from 1952, reflecting "the first signs of a new awareness of the high standards which a European composer in the 1950s had to reach" (1993, 200). Sharing a classroom with the likes of Jean Barraqué, André Bourcourechliev, Michel Decoust, and Karlheinz Stockhausen would certainly have contributed to an intensified awareness of the concerns and achievements of the leading young composers of the new movement in music.³ Prior to that, Xenakis's music exhibits the conspicuous influence of Béla Bartók (considered modern at that time, if not *avant-garde*), along with the polytonal innovations of Milhaud.

Primarily, though, Xenakis was concerned to express the traditions of his Greek heritage, to write music for and of the people with whom he had fought and almost lost his life. He rounded out his boyhood knowledge through reference to scholarly collections of Greek music.⁴ Much of his music between 1949 and 1952 can be characterized either as settings of folk melodies, dance rhythms, and popular texts, or as attempting to convey the sonic characteristics of indigenous instruments such as the lyra. During this period, Xenakis wrote an article on the problems of the Greek composer in relation to national musical traditions.⁵ In it, he espouses the need to "find expressive and structural means in the folk and sacred music [of Greece] on the one hand and in the *avant-garde* discoveries of European music on the other" (Xenakis 1955, 188). This stance was in radical opposition to the dominant style of the time, which, according to Xenakis, "utilize[d] Greek melodies, but in such a harmonic, polyphonic and instrumental spirit that all Greek character is destroyed" (188). As he explains in the article, he was drawn to the "incomparable melodies" of this music, along with the distinctive two- or three-voiced Epirian polyphony (built from seconds and thirds), the parallel fourths of the lyra, the asymmetrical additive rhythms of the dances, and juxtapositional forms derived from antiphonal chants and related traditions (187–88).

Xenakis's music up to 1952 seems to have been focused on the development of these elements of Greek music within a European context not yet informed by the *avant-garde*. Most of the pieces are for piano, or for voice and piano. A duo for violin and cello from 1951, *Phipli Zyia*, which may have been broadcast on Belgian Radio in 1953 (Matossian

1986, 51),⁶ shows a concern for string sonority derived from Bartók and Maurice Ravel as well as the Greek lyra and lute. His next composition, *Tripli Zya*, trio for flute, soprano, and piano from 1952,⁷ displays the first explicit application of mathematical processes to music. The text, by Xenakis himself, is nationalistic, “extoll[ing] the painful birth of liberty” (Mâche 1993, 200). Set in juxtaposition to the Greek flavor of the music are rhythmic patterns built from the Fibonacci series (see fig. 1a) and melodies built from synthetic modes (see fig. 1b). Already, the influence of Messiaen can be discerned, even if the application of modal and rhythmic constructions is put to very different expressive ends.

This piece, highly ambitious even though incongruous in its strange mixture of stylistic elements, set the stage for an outburst of compositional activity that

(a)

The figure shows two staves of music. The top staff is for Flute and the bottom for Piano. The piano part has notes with durations 1, 1, 2, 3, 5, 8, 13, 21. The flute part has notes with durations 1, 1, 2, 3, 5, 8, 13, 21. The tempo is marked 'Allegretto'.

Figure 1a. *Zyla*: Opening Fibonacci pattern.

(b)

The figure shows a single staff of music for Flute. The notes have durations 1, 2, 3, 5, 8, 13, 21. The tempo is marked 'Allegretto'.

Figure 1b. *Zyla*: Synthetic scale (Fibonacci), mm. 57–59.

led, in just two years, to the completion of *Metastaseis*, widely considered (by himself as well) to be Xenakis’s first mature opus. In between are two major works of a planned triptych for choir and orchestra entitled *Anastenaria*.⁸ This largescale work is based upon a Dionysian ritual perpetuated “under a thin Christian veneer” (Mâche 1993, 201) in the Thracian region of Greece and Bulgaria. The first piece, *La Procession vers les eaux claires*, is for mixed choir, men’s choir, and orchestra. It is derived from the Greek elements Xenakis had been working with previously, although he admits to no obligation of authenticity.

The second work of the triptych, *Le Sacrifice*, for orchestra alone, moves much further in the direction of musical abstraction. Whereas in the first piece Xenakis draws freely on

elements derived from traditional Greek practice, here he constructs an edifice worthy of the European avant-garde of the 1950s. In the manner of Messiaen's "modal" serialism, as exemplified by the *Mode de valeurs et d'intensités* (1949), Xenakis bases his composition on a series of eight registally fixed pitches, each linked to a duration derived from the Fibonacci series (see fig. 2). These pitches are elaborated by neighboring notes and glissandi in between, characteristic features of later pieces, along with the exclusion of vibrato. The deployment and repetition of the associated durations follows a mathematical process, its completion signaling the music's conclusion (see Solomos 2001, 7–8).

The projected third section, which became *Metastaseis*, detaches itself completely from the source, the original design being thus abandoned. Xenakis has left no trace of how he views the relationship between the abstract serial structure of *Le Sacrifice* (or the sonic architecture of *Metastaseis*) and his original inspiration from the Dionysian sacrifice of the bulls.⁹ That the text had been dropped from the music is certainly of some significance. It is possible, too, that the intensity of the ritual could find no true expression in music except through abstraction. This position would have reflected the influence of Le Corbusier, who honed his modernist architectural vision from a whole range of historical and cultural models and influences.



Figure 2. *Le Sacrifice*: Pitch series with associated durations.

Xenakis, in any case, had decidedly moved on from folklore, and from his dreams of becoming a "Greek Bartók." However, he would return to his cultural roots in numerous creations, and would revisit the Dionysian ritual in *The Bacchaie* (1993). But in 1953, Xenakis was poised to challenge and surpass—some would say obliterate—the abstractions of the musical avant-garde.

3

From Architecture to Algorithm

Along with Olivier Messiaen, the other major force helping to shape Xenakis's rapidly evolving compositional aesthetic was Le Corbusier. Their relationship was difficult, and Xenakis has since emphasized his independence from the elder architect. When the Greek refugee began working in his studio in 1948, Le Corbusier had become obsessed with his "Modulor" approach to form and proportion (Le Corbusier 1980). Taking the human figure as the unit of reference, Le Corbusier worked out a numerical series built from additions and subtractions of the Golden Mean. He was then able to project large-scale architectural volumes and forms from this "universal" series based on the proportions of the human body. Xenakis, with a passion for ancient Greek architecture, found his creative interest in modern design awakened, stimulated by Le Corbusier's ability to draw mathematical connections between edifices from not only antiquity but from other historical periods and cultures. He was also impressed by the architect's "spiritual force" and his "constant questioning of things normally taken for granted" (Bois 1967, 5). Le Corbusier encouraged collaboration within his studio, and discussions were wide-ranging. Xenakis eventually found himself drawn into this ferment. Quite naturally, though, with most of his ambition directed toward his compositional activities, Xenakis began to consider ways in which similar processes to those developed by Le Corbusier could be applied to music.¹

Employed at first as an engineering assistant, Xenakis soon took a more active role in architectural design, collaborating extensively on two major projects: the Monastery of La Tourette (1954–60), and the Philips Pavilion (1956–58).² The most well-known, and perhaps most fanciful, application of the Modulor is found in the "musical" or "undulatory" glazed panels that adorn one facade of the Monastery at La Tourette. Xenakis created a spectacular counterpoint over three levels of windows (certain drawings from the design show four) by varying the widths of the window panels according to the proportions of the Fibonacci series.

Metastaseis

Xenakis had already begun work on a new orchestral score, one in which "the role of architecture is direct and fundamental" (Le Corbusier 1980, 326).³ *Metastaseis* (1954) is the work through which the composer's own "spiritual force" carried him past the culturally based ritual of the *Anastenaria*, as well as the strictures of serialism and most other compositional conventions of sonority and form. At that time, composers were

grappling with the problem of how to create a new music. The serialist solution, derived from Arnold Schoenberg via Anton von Webern, was to design the shape of the composition from a generative cell, or series. This “organic” approach—rather traditional from today’s perspective, despite all the avant-garde fervor and proselytizing of the time—can be contrasted with the principle of juxtaposition, which Xenakis adapted from the architectural model of Le Corbusier. In this approach, materials and forms are assembled according to relations established by the Modulor principle.⁴ At the same time, Xenakis was interested in dynamic processes or transformations. The title, *Meta* (“after, beyond”) -*stasis* (“immobility”), refers to the contrast—or dialectic relationship—between movement, or change, and nondirectionality, or standstill. There is also a sense in which the title refers to the composer’s own evolution, moving on from the arid formalization of *Le Sacrifice* (and serialism in general) and the constraints of the classical tradition (which would also include the traditional music of his native Greek culture). In the forward to the score, Xenakis states that “the *Metastaseis* are a hinge between classical music (which includes serial music) and ‘formalized’ music which the composer was obliged to inculcate into composition” (Xenakis 1967).⁵

The piece itself is utterly original. Xenakis’s conception of originality supposes that creation must start from nothingness (Xenakis 1994a, 110). The music begins on a sustained single note, as much out of nothing as is possible. The full complement of strings sound this note, filling it with acoustic energy. There is, however, nothing to mark time or meter.⁶ Gradually, individual strings begin to pull away, sliding outward by means of slow glissandi, increasing the dynamic intensity at the same time, arriving at a massive cluster covering the full range of the orchestra, each instrument sustaining its own note. The impact of this opening passage cannot be overstated; nothing like it had ever been heard before. For the audience at its 1955 premiere in Donaueschingen, it was as if they were hearing “atomic music” from “the first traveller in space” (Matossian 1986, 65).⁷

Glissandi were nothing new, of course. The portamento had been commonly used to add a certain sentimental expression, as in the work of Gustav Mahler, one of the first to notate the effect explicitly. Béla Bartók abstracted the technique much further (see, e.g., the fourth movement of his String Quartet No. 5, 1934), and was no doubt an influence, along with Edgard Varèse’s sirens in *Ionisation* (1931), perhaps.⁸ Xenakis treats the glissando as an independent sonic entity, creating a musical space in which the transition from a single pitch to a forty-six-note cluster is achieved by means of a continuous evolution of sound. The treatment of what had hitherto been a peripheral sound effect as a fundamental building block upon which to create a musical edifice became a cornerstone of Xenakis’s compositional style throughout much of his career.

Metastaseis is built from four distinct sections, each further delineated by clearly identifiable subsections (see fig. 3).⁹ The first, as noted, opens out into a large cluster, which is treated as a sonic unit articulating the passage of time (durational values being derived from the Fibonacci/Modulor series) by means of dynamic and timbral changes. The surface of this extended sonority is broken by percussion, brass (treated percussively, for the most part), and isolated pizzicato strings. A reverse glissando in the strings closes out the passage, narrowing into a four-note chord—*E-G#-D#-A*—voiced over a five-octave range and strongly consonant with the major tenth interval in the bass.

The second section is surprising in its own way, being completely different from the opening. A sextet of solo strings begins an angular, Weberian passage that, after *Le Sacrifice* (1953), is the most serial music Xenakis ever wrote. A ten-note set (or series) is partitioned between the violins (four notes) and cellos (six notes). All twelve transpositions of the set are displayed in succession, though in the fifth and twelfth the cellos are absent. Xenakis developed his own method of permutating the intervals within each presentation of the set, a precursor of methods he would implement in the 1960s based on group theory. The rarified texture of this passage is colored by the occasional use of tremolo, *sul ponticello*, and mutes.

The succeeding passage adds more instruments and expands the register through the prominent use of harmonics, balanced by the low basses. The pitch structure breaks off from the rigorous organization of the ten-note sets, but the surface is similarly contrapuntal. A more strongly rhythmic element is introduced in the second half of this passage with a continuous layer of *col legno* and *pizzicato*, and a gradually accelerating pattern in the percussion. Throughout, Xenakis spreads the material across three layers of rhythmic subdivisions of the beat: triplets, sixteenths, and quintuplets. The result is that, in spite of the strict organization of the music, there is a certain “statistical” quality that nudges the contrapuntal nature of the music toward a more textural character. Xenakis may have been thinking of this passage, at least in part, when formulating his critique of serialism soon after completing the score (see Xenakis 1994b).

The third section of *Metastaseis* returns to the sonority of the glissando, but treated here as a small cell (or “brush,” as Xenakis calls it) to be developed. Each

A	B	A'	C	C'	D	A(retro)	B'
Massed glissando from unison	Cluster chord	Glissando	Serial	Quasi-serial (development)	Fragmented glissandi (development)	Massed glissando to unison	Sustained unison to end
34	52	18	23–23	24–28	115	16	13
104(30%)			98(28.25%)		115(33.25%)	29(8.5%)	

Figure 3. *Metastaseis*: Chart of formal outline.

unit begins with a central pitch that then opens out to a cluster by means of glissandi. These brushes are layered and varied in register and dynamics. The succession of entries is governed by values drawn again from the Fibonacci series, and the duration of each is at first fixed to three beats, but is then reduced toward the end of the section to two, then one. In counterpoint to these sonorities, a more percussive texture is gradually built up in the winds, percussion, and *pizzicato* strings. The wind instruments are usually paired in close proximity, often in neighboring quarter tones, to enhance the stridency of their attacks. In contrast to the sophisticated treatment of the strings, the writing for winds is quite limited, and would not be much developed until *Eonta* (1963) and *Terretektorh* (1966). The gradual increase in density in both the glissandi and the punctual sounds is

masterful, and points the way to the masses and textural transformations in *Pithoprakta* (1956).

A release from the mounting intensity of the third section leads to the short concluding gesture, a slightly more elaborate glissando for the full strings that leads from a wide cluster into a single pitch, the *G#3* just above the opening *G*.¹⁰ The quasi-cadential return to the opening sonority has become a standard ploy in the postonal world of contemporary composition. At the time of *Metastaseis*, however, the effect was more striking, and, given the ontological, existential impetus for the piece, certainly appropriate. Xenakis had succeeded in creating something new, original; the architecture was bold and sophisticated, but not difficult to follow. The sonic energy was powerful, and immediately provoked a strong response in those listeners—particularly young people—willing to leave behind, as the composer had, a reliance on tradition.

In the fall of 1954, Xenakis met Hermann Scherchen, renowned conductor and activist (publisher, organizer, researcher, etc.), who was in Paris to direct the premiere of Varèse's *Deserts*, his seminal work for ensemble and tape. Xenakis had just been accepted into the Groupe de Recherches de Musique Concrète through the support of Messiaen, and his score for *Le Sacrifice* had been given to the conductor by Pierre Henry, Varèse's studio assistant for the creation of the tape part. Scherchen was interested enough in the score to want to meet the composer, though not enough to want to perform it. Xenakis showed him *Metastaseis* instead, which captured his attention, thus beginning what would become a relationship of vital importance for the young composer (see Matossian 1986, 77–79; Varga 1996, 33–34). It turned out to be Hans Rosbaud who premiered *Metastaseis* at Donaueschingen, but Scherchen immediately offered his support, and, through his invitations to attend the annual conferences held at his home in Gravesano, Switzerland (published in the short-lived *Gravesaner Blätter*), encouraged Xenakis to formulate and articulate his ideas.

Metastaseis had introduced the notion of architectural or global sonorities, where massed glissandi, for example, create a sonic entity that can only be perceived as a whole and not as a product of smaller elements. Even the quasi-serial passages were complex enough to be heard as texture rather than counterpoint. In his attempts to formulate new ways to deal with such sounds and transformations from one to another (as in the third section of *Metastaseis*), Xenakis was led to a statistical conception of complex sonorities, resulting in what he would eventually call “stochastic” music. Of course, similar techniques would have been second nature to an engineer used to consulting tables of averages and probabilities to calculate loads, stresses, and so forth. In the domain of human perception, an influential theory had been put forward by Claude Shannon, elegantly formulating the problems of communication in informational terms, expressed by probabilities (Shannon and Weaver 1949). Information theory, as it came to be known, was a central paradigm in many fields throughout the 1950s, and was adapted to the realm of aesthetics and music by such figures as Werner Meyer-Eppler in Germany (whom Xenakis met through Scherchen at Gravesano, and who exerted a major influence on Karlheinz Stockhausen), Abraham Moles in Paris, and Leonard Meyer in the United States.¹¹ It was a formidable conceptual shift, however, to move from essentially analytical techniques to generative, or creative, ones.

Nouritsa Matossian draws many parallels between Xenakis's work as an engineer and architectural assistant for Le Corbusier and his development as a composer. In moving

from technical analysis to creative application, Le Corbusier's study of the load-bearing potential of reinforced concrete led to further innovations of design, and eventually to the radical architecture of the Philips Pavilion. In music, having grasped that human perceptual capacity could only grasp the global outlines of complex sonorities, Xenakis sought to apply processes such as those used by Shannon to describe the passage of information through communication channels. He also saw parallels in scientific thought, in which the classical principles of causality were being supplanted by the statistical conceptions of quantum mechanics and relativity (see Xenakis 1992, 1, 4). Transposing the discussion to music, Xenakis notes, "[I]f, thanks to complexity, the strict, deterministic causality which the neo-serialists postulated was lost, then it was necessary to replace it by a more general causality, by a probabilistic logic which would contain strict serial causality as a particular case.... 'Stochastics' studies and formulates the law of large numbers,...the laws of rare events, the different aleatory procedures, etc.... They are the laws of the passage from complete order to total disorder in a continuous or explosive manner" (Xenakis 1992, 8–9).

In his next piece, Xenakis would tackle directly the problems of composing complex textures and continuous transformations between them, drawing on mathematical procedures used in mechanical engineering, Information Theory, quantum physics, and so on.

Pithoprakta

Pithoprakta (it translates as "actions through probability") was composed for the same number of string instruments (forty-six) as *Metastaseis*, with the rest of the orchestra reduced to two trombones, xylophone, and woodblock (and the xylophone and trombones each make but a single appearance). The focus on global sonic entity as primary compositional material is evident right from the start; the music begins with no precise pitches at all, eliminating traditional expectations. The string players are asked to strike the backs of their instruments to produce a wooden knocking sound. These percussive sounds are treated statistically, such that an array of attacks are distributed within a fixed unit of time—in this case the half measure—with the number of sounds being governed by a mean density. Surprisingly, the opening is very sparse, apart from an initial flurry. For ease of performance, the rhythmic values are limited to divisions of three, four, and five, as in *Metastaseis*. The result is that these rhythmic layers produce ten unique attack points in each half measure. Each point can then be "orchestrated" by assigning different numbers of instruments, producing a texture that varies in "weight" as well as density.¹² The first two attacks, for example, are performed by five and eight violins, respectively. The progression is unpredictable, but the overall shape is clear, with the opening jolt serving to capture the listener's attention, followed by a long, sparse section, increasing in activity in preparation for the introduction of the second sonic entity, the pitched pizzicato. A third entity, a percussive "au talon" or "à la pointe," bowing action, is brought in soon after (m. 47), there following a long passage in which these three layers of sonority unfold in a play of fluctuating densities.

Over the course of the whole piece, twenty-one different sonic entities make their appearance.¹³ While an account of other elements such as pitch, rhythm, density, dynamics, and instrumentation would be beneficial to a full analysis, a diagram of the

successions and superpositions of the textural elements is sufficient for describing the basic formal architecture of *Pithoprakta* (see fig. 4). Pitch, with a few striking exceptions such as the entry of the xylophone and the high unison harmonics at the end, is important only in the global sense of conveying registral boundaries (e.g., high versus low register, wide versus narrow range, fixed versus evolving placement). Similarly, rhythm is almost always treated in a statistical way, though the tutti figure of five even attacks at mm. 193–96 is the one striking exception. Dynamics and density are the most important parameters in helping to delineate the different sonorities, particularly when presented simultaneously. Density is treated in a sophisticated manner, and the dynamics are characteristically extreme, being predominantly loud or soft, with little in between. As for instrumentation, Xenakis was clearly attracted to the homogeneity of the strings, although he does make some play of the contrasting timbral qualities of the different instruments—often linked, of course, with registral contrasts. The woodblock, as in *Metastaseis*, is treated independently, offering, with its sporadic punctuations of the ongoing music, a Noh-inspired commentary on the passage of time.

Pithoprakta falls clearly into three main sections, each one quite elaborate in design.¹⁴ The first, after leading from the unpitched knocking sounds into an interplay of knocks, plucks, and short bowed attacks, shifts abruptly into a *fff* outburst of the bowed entity alone. This is followed, after a short break, by a return to the pizzicato sonority, varied here by the addition of glissandi (whereby the finger slides quickly up or down the string after it is plucked). Xenakis (1956) has discussed this passage in some detail, using it as an example of probabilities applied to music, modeled on the kinetic theory of gases. In his examination of the relationship

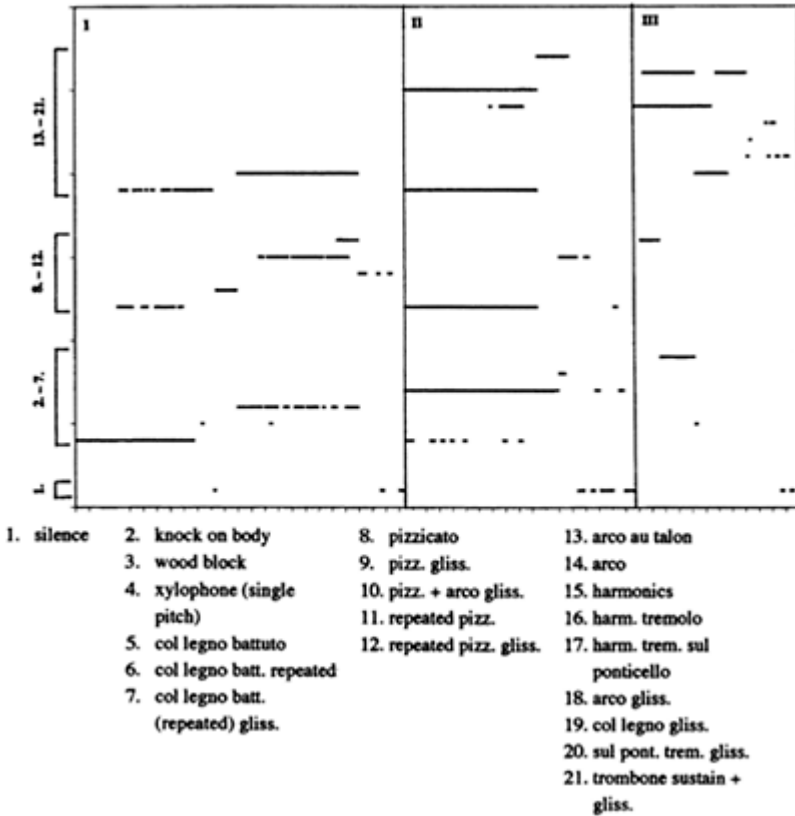


Figure 4. *Pithoprakta*: Chart of formal outline with listing of sonic entities.

between theory and practice, Benoît Gibson notes that the rapid decay of the pizzicati renders the texture less a mass of glissandi traveling at “1148 speeds” than a cloud of plucked attacks (1994, 43). The discrepancy between intent and result aside (the issue will come up again), this complex, statistical passage leads directly into the first stable sonority of the piece, a large, sustained cluster in which each string instrument holds a distinct pitch. Repeated striking of the highest *A* of the xylophone sets up a transition whereby isolated strings begin to perturb the otherwise smooth surface of the sonority by plucking their note in repeated fashion, in imitation of the xylophone. As more instruments join in, the pizzicato pulsations turn into glissandi and lead to a dispersal of the accumulated energy of this section with increasingly sporadic pizzicato notes each setting off a bowed glissando as a kind of resonance of the plucked attack.

While the first section is pieced together from a number of different passages, some overlapping, some shifting abruptly, the second section is more continuous. The logistics are impressive: first five, and then six distinct sonic entities combine to form an almost opaquely thick texture. Individual instruments switch back and forth between one mode

of playing and another as each entity pursues its own trajectory of evolving densities and registers. Xenakis sculpts perceptual signposts out of this complex sonority, giving prominence to a single entity for a short period by boosting its dynamic level. In this way, the listener is guided from one sonority to the next, allowing each to be set into relief without relinquishing the intensity of the overall sweep of this extraordinary passage. A sudden outburst of frenzied clouds of *col legno battuto* at m. 172 scatters the other sonorities to the wind, leaving in their place the pair of trombones sustaining a low *G2*, intensified by one instrument slowly sliding up to a neighboring note and then back again. A “beating” effect is created, whereby two pitches in close proximity seem to vibrate against one another, a phenomenon Xenakis first explored in *Le Sacrifice* and would make much of in subsequent pieces. As the trombones finish up, the strings settle into a more stable sonority, with each instrument sticking to a single pitch, switching one by one to pizzicato and then dropping out. A few brief, isolated gestures of alternating *battuto* and *pizzicato* close the middle section. This passage includes the striking moment where sixteen instruments tap out a unison pattern of five attacks of equal duration.

A long silence of 3–1/2 measures (approximately eight seconds) serves as preparation for the final section. Three distinct layers are quietly introduced (the *sul ponticello-tremolo-giassando* is a new element here), each tracing undulating patterns rather than statistical clouds. A dramatic crescendo leads the return to the sustained cluster heard in the first section, this moment of relative repose soon dissolving into a teeming mass of *sul ponticello-tremolo-giassandi*. As the lower instruments drop out, the register climbs higher and higher, narrowing onto a single pitch, *D8*, one note above the highest key of the piano. A final passage of brief alternations on this pitch between different playing modes (harmonics, tremolo, and *sul ponticello-tremolo*), separated by increasingly lengthy breaks, serves as an epilogue, leaving off with a silence that is filled with resonances of the sonic adventure just passed. Some twenty years later, Xenakis would end *Jonchaies* (1997), another major orchestral sonic adventure, in almost exactly the same way.

Although perhaps not immediately obvious given the immense sonic density of much of the piece, *Pithoprakta* contains a great deal of variation and formal shaping, providing for moments of relative repose where listeners can gather their bearings (silences, sustained notes, thinner textures). At the premiere, however, which took place in Munich with Hermann Scherchen conducting the Bayerischer Rundfunk Symphony Orchestra, the audience (and the orchestra!) found little in the music to reassure their traditional sensibilities. As did *Metastaseis*, the score caused an uproar, and the reaction was similar when Scherchen conducted it in Darmstadt the following year. At the same time, though, exposure to these shocking new scores was spreading, primarily through broadcasts on German radio. (*Metastaseis* was also performed and broadcast in Sweden in 1958.) Stockhausen included certain quasi-statistical textures in *Gruppen* (1957); György Ligeti featured his large masses and intricate sonic weaves in *Apparitions* (1959); and Polish composers began their striking sonic explorations soon thereafter.¹⁵ In the meantime, the instigator would move on.

The Philips Pavilion

In the period following the completion of *Pithoprakta*, Xenakis was involved in three different pursuits: architecture, musique concrète, and the formulation of a theory of stochastic music. For Le Corbusier, he worked intensively on the design and construction of the Philips Pavilion, commissioned for the 1958 World Exposition in Brussels.

Philips, the only corporation to be included in the display of pavilions, sought to highlight its commitment to creativity and to modern technology. Le Corbusier, controversial, but by that time accepted as a central force in the prevailing modernist trend in architecture, was an evident choice for the commission. It was his idea to create a multimedia *Poème électronique*, with Edgard Varèse as collaborator for the sounds,¹⁶ and, later, filmmaker Philippe Agostini for the visual elements. Le Corbusier—preoccupied throughout that period with another project—was often absent, and placed much responsibility for the Brussels commission upon his young Greek assistant. Working from an initial conception sketched by Le Corbusier, Xenakis designed a remarkable building, bending geometrical outlines into curvilinear shapes known as hyperbolic paraboloids. What has proven particularly inspirational to succeeding architects is the liberation of the vertical dimension from the floor plan (see Oswalt 1994). A bold dynamism is achieved through the tensions arising from the juxtaposition of continuously evolving surfaces and sharp intersections, from the melding of one dimension into another. Xenakis completed the design in 1956, and he has acknowledged the ruled-surface glissandi of *Metastaseis* as an influence on the architectural conception of the Pavilion (Xenakis 1958; Xenakis 1992, 6–7, 10–11). Also of vital practical importance for his future multimedia creations (his “polytopes”) was the direct involvement in many of the technical aspects of the project, from the construction of the concrete shell to the distribution of loudspeakers, lighting, and projections.¹⁷

The experience of working on the Philips Pavilion, alongside his blossoming relationship with Scherchen, appears to have increased Xenakis’s self-confidence. The virtually unknown young composer found himself defending Varèse, reassuring Philips of the ultimate value of its investment in the radical *Poème électronique* in a letter, “Have no fears about the music of Varèse; this is the music and the composer that you need. Your pavilion must attract attention by its avantgarde ‘strangeness’ and even cause a scandal. The desired goal can only be attained in this fashion.... Truly artistic strangeness, that which you qualify as ‘abstract,’ is one characteristic of a work which will survive. Long after the end of the exposition, people will talk about your Pavilion as a coup, striking the public imagination in a powerful way.”¹⁸

Indeed, while the Philips Pavilion holds a relatively minor place in the career of Le Corbusier,¹⁹ it holds an important place in the creative work of Xenakis, who went on to achieve renown both as an architect and as a composer.

Musique Concrète

In his spare time, Xenakis was also beginning his initiation into the world of musique concrète and tape composition techniques. Having been accepted into Pierre Schaeffer's Groupe de Recherches de Musique concrète in 1954,²⁰ he began working in the studio in the winter of 1955. To begin with, he wanted to "understand the direction and the medium besides the new possibilities open to the imagination" (Matossian 1986, 80). In the same way that he had studied the properties of building materials (e.g. reinforced concrete), Xenakis was able to study the components of sound in the studio. He was drawn right away toward the exploration of complex sounds and rhythmic textures: "to arrive at a body of sound like white noise; to study the evolution of timbres, dynamics and register...to make chromosomes of attacks" (Matossian 1986, 125).

Xenakis's first tape composition, completed in its original version in 1957,²¹ was *Diamorphoses* ("continuity—discontinuity," "two aspects of being"), and was just under seven minutes long. He combined noisy, primarily low-frequency sounds—an earthquake, a jet engine, train sounds—with more sharply defined high-register bell sounds. The natural glissando effect of the plane taking off is combined with the glissandi of other sounds, produced in the studio by means of tape-speed manipulations. Outer sections of more- or less-sustained sounds are contrasted with a central, more discontinuous passage, filled with many shifts of sonority (focusing at first on the bell sounds, then adding others). Xenakis has spoken of his exploration of the phenomenon of density through his work on this piece (Delalande 1997, 39), achieving shifts and continuities of this parameter through layered variations of sound objects. For the discrete sonorities, he used probabilities to calculate attack points, layering the tracks to achieve a range of activity levels.

In his next tape composition, *Concret PH* (1958), the study of density would constitute the main focus of the work. This 2–1/2 minute miniature was produced as an introduction to the *Poème électronique* for the Philips Pavilion in Brussels. Le Corbusier would not allow Xenakis to work on it at the Philips studio in Eindhoven established for Varèse, where special equipment for the spatialized projection of sounds over multiple loudspeakers had been developed (the pavilion housed over four hundred loudspeakers). As a result, he was forced to work in the rather primitive facilities of the Philips offices in Paris, and the monophonic tape he produced there in 1958 was later completely redone in a stereo version at GRM in 1961, and then for four channels in 1969 (Delalande 1997, 36). The only sound source used is the crackling and hissing of burning charcoal. Transpositions and numerous overdubs produced a dry, but sparkling study, with the texture evolving in a continuous fashion, much like the central portion of *Pithopraktra*. The mobile sound trajectories throughout the Philips Pavilion would have no doubt been astonishing, and to this day *Concret PH* remains a miniature gem of the electroacoustic genre.

In 1959, Xenakis produced another tape work, *Analogique B*, first in a monophonic version at Scherchen's studio in Gravesano, where the premiere took place, and then in a stereo version at GRM in Paris. This, his first to employ electronically synthesized

sounds, is a companion piece to *Analogique A* (1958), for nine string instruments, and we will return to it in the next section.

The following year came a commission for a soundtrack to a documentary film by Enrico Fulchignoni for the United Nations Educational, Scientific, and Cultural Organization (UNESCO). *Orient-Occident* (1960) is an attempt to portray in film the relations and resonances of artistic relics from a whole range of ancient cultures, from prehistoric times to the Hellenic era of Alexander the Great. The point of departure was an exhibition at the Cernuschi Museum in Paris, which Fulchignoni spent three months filming. Xenakis was not brought into the project until the shooting was complete (Fulchignoni 1981, 259). According to the director, he intentionally gave no instructions or “interpretation” to the composer, preferring to allow the musician to work from his own reactions and analysis. The film links disparate eras and cultures primarily through visual means rather than any sort of chronological or cultural narrative. In effect, this enabled Xenakis to construct his own “narrative,” or sonic “atmosphere” parallel to the images (Delalande 1997, 133–34). While his general compositional approach had become more abstract and theoretical, this project provided him with concrete images to set his music against, without imposing a strongly linear extramusical structure. While the original twenty-two-minute soundtrack is little known, the concert version of half that length has been widely disseminated.²²

The sound sources are unusual, but are often much clearer (i.e., less noisy) than in his other tape works. A bow drawn over various objects is the source of much of the sustained sonorities. The short, percussive sounds are often presented as regular pulsations or perceptible patterns rather than statistical “clouds.” The burning charcoal of *Concret PH* makes an appearance in the latter part of the work, mixed with water droplets and other sounds, and commentators note the use of slowed down passages from a recording of *Pithoprakta*.

Paradoxically, the formal outline of *Orient-Occident* is less sharply defined than is usually the case in Xenakis’s music, perhaps due to its origination as a soundtrack. The music proceeds from one section to another by shifts of sonority, effected at times by gradual transition and at other times by sharp divisions. It is possible to distinguish eleven sections, of durations varying between fifteen and ninety seconds.²³ In drawing upon a relatively wide range of sonorities, none recognizably linked to any particular culture but related to each other by various means of transition or juxtaposition, Xenakis enables the viewers/listeners to create their own associations between the images and the sounds.

Xenakis composed two more short soundtracks around this time: *Vasarely* (1960), for a film by Peter Kassovitz and E. Szabo of an exhibition of paintings by the well-known op art personality Viktor Vasarely (whom Xenakis would work in 1968–1969, on the ballet *Kraanerg*), and *Formes rouges* (1961), an animated film by Piotr Kamler. Both these works, however, have been withdrawn from his catalog, and Xenakis never again collaborated in this way, although he would go on to compose music for theater and for his own multimedia creations. As a newly declared freelance composer (having left the employ of Le Corbusier just about this time), these projects may well have served utilitarian purposes. In any case, his development as a composer was diverging from the prevailing direction at GRM, and the *succès du scandale* of *Bohor* (1962), his final work to be created at the studios of GRM, sealed the parting.²⁴

Pierre Schaeffer, GRM's director, was primarily concerned with the classification and study of *objets sonores*, or "sound objects" (Schaeffer 1966). In his view, composition came *after* the materials were gathered and selected, and should be "studies, not works" (Delalande 1997, 38). Xenakis, on the other hand, was preoccupied with the architectural conception of the music, and with the creative application of mathematical principles to music. The stance of Schaeffer was that of an analyst, while Xenakis's was that of an artist. Xenakis was uninterested in pursuing the research agenda of the director. His aim in working with concrete sounds was to pursue his compositional ideas unencumbered by the need for a score, parts, musicians, rehearsals, and so on. He was particularly interested in the exploration of scales of transitions between different timbres and degrees of sonic activity.

Bohor, originally for eight channels, is a radical exposition of these issues, being in effect a single, slowly evolving gesture lasting close to twenty-two minutes. It is, as Xenakis states, "'monistic with internal plurality, converging and contracting finally into the piercing angle of the end'" (Brody 1970). There are two basic textures:

- A concentrated, teeming sonority, constantly in motion, ranging in timbre from bell-like sounds (filtered to muffle the resonance) to metallic rattlings, finer-grained metallic sounds closely resembling the charcoal crackles of *Concret PH*, and noisy clashings and crashings;
- A low, sustained sound adapted from recordings of a Laotian mouth organ, the characteristic crescendo-decrescendo and breaking off for breath being preserved.

The low sounds are heard twice (aside from the opening sonority, lasting just ten seconds, and a few other occasions at very soft dynamic levels), beginning at the 5'30" mark, and lasting about 8 minutes, reappearing after the 17'00" mark to last just 1–1/2 minutes. The other sonority continues throughout, adding layers, one by one, until there are several sounding simultaneously. The density of each one builds and subsides independently, producing an incredibly thick, constantly evolving texture that seems to have no linear trajectory. When the sustained sound drops out the first time, there is a noticeable drop in intensity and tension, but the metallic sounds build up again, leading at the end to a sublimation of all the other layers to the noisiest, crashing sonority, which sharply boosts its mass and dynamic level over the final three minutes.²⁵

Bohor is dedicated to Pierre Schaeffer, but for Schaeffer, who believed that the composer must, above all, "respect the physical quality of any sound" (Delalande 1997, 40), this study in the transition from perceptible (bell-like) sounds to outright noise could only have been an affront. He also reacted, as did many in the audience, to the extremely loud playback levels Xenakis employed for the diffusion of the composition. The intensity would have been heightened by surrounding the audience with eight loudspeakers (a novelty in those days). In a later, rather poetic, reflection on the piece, Schaeffer wrote: "*Bohor*,...this was no longer tiny embers, each with its own allure [*tilt*], this was an enormous burst of explosions [*une enorme pétarade*], an offensive accumulation of lancet jabs to the ear at maximum volume level" (Schaeffer 1981, 85; my translation).

Thus ended the musique concrete phase of Xenakis's electroacoustic work. He would not create another tape until 1967, and by that time he would be concentrating primarily upon manipulations of orchestral, instrumental sounds. In the meantime, Xenakis had

become convinced that computers could, and should, be usefully applied to the creation of music. To his chagrin, Paris was not to develop a facility dedicated to computer-music research for several years (notably his own *Equipe de Mathématique et Automatique Musicales/Centre d'Etudes de Mathématique et Automatique Musicales* [EMAMu/CEMAMu], and then *Institut de Recherche et de Coordination Acoustique Musique* [IRCAM]), long after such facilities had been established elsewhere, particularly in the United States (Delalande 1997, 37). It is ironic, too, that the computer has become an integral tool in the interdisciplinary study of music forwarded by Schaeffer in his *Traité*.

Stochastic Music

Having launched a new approach to music with *Metastaseis* and *Pithoprakta*—based on sonic entities and compositional procedures adapted from probability functions—Xenakis set about defining and exploring the realm of stochastic music in earnest. In a series of articles published in *Gravesaner Blätter*, eventually collected and published in French as *Musiques formelles* (1963), he rigorously defined his ideas in highly scientific, mathematical style. Xenakis also embarked on a series of instrumental pieces, each strictly conforming to a theoretical framework.

The first of these was *Achorripsis* (1957), for a chamber orchestra of twenty-one musicians. The title, Greek for “jets of sound,” would seem to indicate music of exhilarating, scintillating sonorities along the lines of *Pithoprakta*, but this turns out not to be the case. *Achorripsis* is an extremely formal, abstract piece; the jets of sound may derive, metaphorically, from the creative force produced by the collision of eruptive sonic impulses and rigid grids of constraining processes.²⁶ At the time he embarked upon this composition (1956), Xenakis set himself the task of defining what he called the “fundamental phases of a musical work,” based upon a profound musical question: “What is the minimum of logical constraints necessary for the construction of a musical process?” (Xenakis 1992, 22, 16).²⁷ At the same time, a search for the “greatest possible asymmetry,” in order to escape from “traditionally inherited behavioural frameworks” (Xenakis 1992, 23, 25), led to the use of probability functions as primary agents for the generation and control of the various procedures outlined in table 1.

Achorripsis is simply structured as a succession of twenty-eight short sections, each of an equal duration of fifteen seconds. Seven sonic entities are established, forming a kind of “orchestra,” and five levels of density are generated according to a Poisson function, to be distributed across the matrix of temporal and sonic units. The microcomposition of events within each section is also derived from probability distributions, including pitches, durations, successions, dynamics, glissando direction and speed, and so on. In his discussion of this piece, Xenakis makes a significant statement regarding the incorporation of probabilities, or chance, into his music (Xenakis 1992, 37):

In fact, the data will appear aleatory only at the first hearing. Then, during successive rehearsals the relations between the events of the sample ordained by “chance” will form a network, which will take on a definite meaning in the mind of the listener and will initiate a special “logic,” a

new cohesion capable of satisfying his intellect as well as his aesthetic sense—that is, if the artist has a certain flair.

The “definite meaning” that the music will take on for the listener as the music becomes familiar is “satisfying” not because of the inherent characteristics of the stochastic functions and distributions, but because of the “flair” of the composer. Xenakis has endured much criticism over his application of mathematical procedures to music composition; in fact, his intent has always been to enhance artistic expression.

It is certainly true that *Achorripsis*, with its utter lack of hierarchical structure or long-range relationships beyond the projection of timbral resemblance and similarity of density, is rather impoverished in terms of musical signification. The

Table 1. Fundamental Phases of a Musical Work.

-
1. Initial conceptions
 2. Definition of the sonic entities
 3. Definitions of the transformations
 4. Microcomposition (choice and detailed fixing of the functional or stochastic relations of the elements of 2)
 5. Sequential programming of 3 and 4 (the schema and pattern of the work)
 6. Implementation of calculations, verifications, feedbacks, and modifications of 5
 7. Final symbolic result (traditional notation, etc.)
 8. Sonic realization (performance, playback, etc.)
-

decisions as to regularity of sectional duration, random pitch succession, and relatively thin texture (compared to *Pithoprakta*), while obviously not arbitrary, seem shortsighted; the music does not wear particularly well. It is important to remember, though, that the block-like form and the heightened emphasis on sonority were bold for that time. Interestingly, the premiere by Scherchen in Buenos Aires in 1958 was much better received than in Paris, where Xenakis had his local debut to great controversy with *Achorripsis* in November 1959. This music, which sounds so alien from the concerns of mainstream music, both traditional and modern, seemed to appeal to listeners in more distant lands, no doubt in part because of its removal from the cultural colonialism of Western Europe.

In 1957, Xenakis received his first composition award, from the European Cultural Foundation, a great encouragement to the fledgling composer. Soon after, in 1958, followed a commission from the Service de Recherche of Radio-France (the administrative unit overseeing GRM). *Analogique A*, for nine string instruments, extends the concerns of *Achorripsis* into new realms of musical organization. Xenakis developed the concept of “screen,” a temporal unit within which the parameters of pitch region, dynamic intensity, and density are specified. The progression from one screen to the next is governed by a Markov process, whereby the settings for the first screen exert an influence on the calculations for the next, building “memory” into the temporal organization of the music (Xenakis 1992, 98–109). Xenakis had also become interested in

what became later known as granular synthesis, with sonic events being represented as “grains,” or “quanta,” rather than lines or waveforms. To that end, *Analogique A* contains only short notes, either arco, pizzicato, or col legno battuto; there are no glissandi and no sustained notes. The music is even more austere than *Achorripsis*, the “ordered clouds of elementary grains” (Xenakis 1992, 103) being often of even lower density. Nonetheless, the attempt to implement a form of Markovian memory upon a limited range of parameters, and particularly upon pitch (in a rudimentary way), would have important consequences for Xenakis’s later conception of musical form.

Analogique B, completed in 1959 and premiered at Gravesano in the summer of that year, replaces the grains of string sounds with sinusoidal ones, produced electronically. The constructive principle, linked successions of screens, remains the same, though of course studio techniques allow for much higher densities and a wider range of frequencies than are possible with instruments. In fact, Xenakis worked out a linked structure by which the two pieces can be played together (see fig. 5), and this has remained the preferred option, the distinctions of timbre, register, and activity nicely balancing the similarities of structural organization.

The premiere of *Analogique A+B* took place in June 1960 at the Festival de Recherche in Paris, along with Scherchen’s French premiere of *Pithoprakta* with the Orchestre Nationale de Paris. The critical reception of Xenakis’s music in Paris began to turn. Maurice Le Roux, conductor of the Orchestre Nationale de l’ORTF (Radio-France), was sufficiently impressed with the composer’s artistic control of new sounds (Matossian 1986, 142) that he programmed the French premiere of *Metastaseis* for December that same year, and recorded it at that time (along with *Pithoprakta*) for release on vinyl a few years later.²⁸

<i>Analogique A</i>	E		P ⁰ _A		P ¹ _A			E	P ¹ _C	P ⁰ _C	P ⁰ _B		P ¹ _B		E	P ¹ _A
Strings	36"		36"		36"			40"	35"	36"	36"		36"		36"	36"
<i>Analogique B</i>		I	II		III		IV			V		VI		VII		
Tape		21"	(24")12"		(6")4"(26")		7"			36"		22"		15"		
Slience					2"		3"									

Figure 5. *Analogique A+B*: Chart of formal outline.

As Matossian reports, Scherchen disliked *Analogique*, but conceded its necessity in the path Xenakis was pursuing toward an integrated conception of music based on stochastics (Matossian 1986, 135). Perhaps in response to that reservation, Xenakis wrote another work, *Syrmos* (1959), meaning “traces,” or “trails,” for eighteen string instruments (or double that number), which he dedicated to Scherchen. This piece, structured according to principles similar to *Analogique*, is much more engaging to listen to. The screens, here treated more flexibly, are built from eight sonic entities:

1. Parallel horizontal bowed notes
2. Parallel ascending bowed glissandi

3. Parallel descending bowed glissandi
4. Crossed (ascending and descending) parallel bowed notes
5. Pizzicato clouds
6. Atmospheres of col legno struck notes with short col legno glissandi
7. Geomatic configurations of convergent or divergent glissandi
8. Glissando configurations treated as undevelopable ruled surfaces

These building blocks are more sharply defined, morphologically, than the timbral classes in *Achorripsis*. In addition, the screen duration is variable, and entities are allowed to overlap, producing a more supple temporal structure. The activity of events, together with the more memorable identity of the basic sonic entities, results in music of striking architectural outline and great coherence. *Syrmos*, though, waited six years to be premiered (by Constantin Simonovitch, not Scherchen), an indication of its fate since.²⁹

Game Theory

At the same time as he was completing *Syrmos*, Xenakis had become interested in games. This corner of probability theory is, in fact, the historical foundation of the discipline: it was a question concerning gambling that first led Blaise Pascal to turn his attention to the problem of probabilities in 1654. Game theory concerns itself with strategy and the overcoming of odds. It was the idea of incorporating an “external conflict” into the musical performance that captured Xenakis’s imagination. By dividing the musicians into teams, each is able to influence the other by their choice of what material to play next, assigned a value according to a table of probabilities. The process is set up so that one team can “triumph” over the other.

His first effort to create a musical game was *Duel* (1959), in which an orchestra of fifty-six musicians is divided into two groups, each with its own conductor. Xenakis composed six musical modules, or blocks of material: three for strings (one of short sounds, one sustained, and one of glissandi), and one each for percussion, winds, and silence. Each conductor is free to choose which module, or “tactic,” to deploy at any given time (along with the possible combinations: a string module with percussion or winds, etc.), constrained only by the points assigned to each “coupling” of tactics between the two ensembles. For example, if conductor X begins with tactic A (any of the string modules), and conductor Y responds with tactic IV (percussion), conductor Y wins one point. If, then, conductor X responds with tactic B (a combination module), conductor X wins three points. And so on. Each module may be stopped at any point, and can be reprised from the stopping point or from the beginning. The logistics for communicating the conductors’ decisions to the musicians, and for keeping score, are formidable, which may explain why *Duel* was not performed until 1971. In the score, Xenakis takes pains to reassure potential conductors that no artistic value is assigned to winners or losers: “The losing conductor must absolutely not be considered less good than the winner.... The winner has won simply because he has better followed the rules imposed by the composer, who, by consequence, claims all responsibility for the ‘beauty’ or ‘ugliness’ of the music” (Xenakis 1972, v).³⁰

In *Stratégie* (1962), Xenakis created a similar “duel” for larger forces (eighty-two players), using six different modules of musical material and a set of nineteen tactics

(including various combinations of modules). Other refinements served to ameliorate the logistics of performance. This score was performed at the Venice Biennale in 1963, with Bruno Maderna and Constantin Simonovitch battling it out, marshalling the forces of the Festival Orchestra. Maderna won, although Xenakis was not happy with his cavalier approach to the score (Matossian 1986, 164–165). *Stratégie* has received a number of performances, including a scandalous performance in Paris after the Venice premiere with the same conductors (Varga 1996, 41). While many other composers, following the example of John Cage, were exploring various means of indeterminacy and ways of granting degrees of freedom to the performers, Xenakis took his own mathematical approach to “choice.” He has been highly critical of these trends toward chance, dismissing them as banal improvisation and resignation of compositional responsibility. As he states in no uncertain terms, “chance needs to be calculated” (Xenakis 1992, 38). Xenakis has, however, pragmatically employed limited degrees of chance in certain scores, where various kinds of graphic notation are used to convey textures or effects that need not be precisely defined.

The excitement of games waned, in any case, perhaps due to difficulties in organizing the performances (having to separate the two ensembles, provide cueing mechanisms for the conductors, score-keeping equipment to keep the audience informed, etc.). The other problem, only partially overcome, is that “each strategy should be genuinely interesting...but it can’t differ basically from the others because I have to retain the continuity of the music” (Varga 1996, 109).

One further gaming effort on a smaller scale resulted in *Linaia-Agon*, a piece for horn, trombone, and tuba, completed for the London Bach Festival in 1972. This time, the music has a poetic basis, the contest of Linos, the celebrated musician, and Apollo, the god of music. In effect, the duel is between the trombone (Linos) and the tuba (Apollo), the horn siding with the tuba. The programmatic aspect of the music is emphasized by the inclusion of a passage where the “characters” are introduced and the challenge put forward by Linos to be accepted by Apollo, a *Suspens du Destin* section, to be played while the referee totals the score, and a final *Chant de Victoire et Requiem*. *Linaia-Agon* is certainly the most improvisatory of Xenakis’s scores, showing traces of Stockhausen’s “intuitive” music, where the performers are guided both by the directions in the score as well as the choices of the other performers.³¹

Symbolic Music

In 1961, Xenakis was invited to participate in the International Congress of East and West in Japan. This visit was profoundly inspiring for his contact with Japan’s traditional music, theater, architecture, and way of life. He lectured on *Metastaseis*, which was also performed, and presented a concert of tape music from GRM. Along with making contact with more established musicians such as Yoritsune Matsudaira, Seiji Ozawa, and Toru Takemitsu, Xenakis struck up a close relationship with a talented young pianist and composer, Yuji Takahashi. Upon his return to Paris, Xenakis composed his first published solo work, *Herma*, for piano, which Takahashi premiered in Tokyo in February 1962. Much has been made of the rigorous compositional procedure implemented for this piece,³² but it also launched Xenakis’s direct engagement with the performance process

as manifested in music for a single performer. In effect, Xenakis composed what are often extremely active clouds of stochastic textures, scored for the ten fingers and two hands of a pianist. While many other piano works from that era are virtuosic in innovative ways, the energy required of the performer for this score is quite new, and of amazing intensity. Takahashi called it “extraordinary, intense, radical and passionate music” and reported after the premiere, “it made some excited and wonder, others feel painful, totally I think” (Matossian 1986, 151, 154).

Herma (meaning both “bond” or “foundation” and “germ” or “embryo”) represents a new approach to musical structure in which the form is built from successions and combinations of large pitch sets. This is really the first time, since his early works, that Xenakis gave prominence to the organization of pitch. Through his ongoing mathematical studies, Xenakis came across a fascinating formulation of the algebraic equations of Boolean, or symbolic, logic. The elegant visual representation of all the combinations of three elements can be expressed algebraically in two ways. Xenakis decided to create a form based on a “comparison” of these two functions, sharing pitch sets, but distinguished by dynamic markings.

Stochastic procedures are used to select the order and rhythmic placement of notes within each set, and there are two types of textures employed: “linear,” and “cloud.” The chief distinction between these two is mass, along with dynamic marking and pedaling. These sets are spread over the full range of the piano. Repeated hearings may develop an aural awareness of the distinctiveness of each, although it is debatable that it could ever be possible to hear the unfolding of the logical functions explicitly (by means of conjunctions and intersections of sets and their complements).³³ However, to the extent that the listener is able to build up successively more accurate approximations of the formal logic of the music, the composer has succeeded. The contrasts of dynamics and density (reaching as high as twenty notes per second, and, in one spot, thirty-one), along with elaborate pedal markings, help to convey the compositional intent. The numerous silences, too, serve to punctuate the logic of the form, and add dramatic intensity to the expressive power of the music. The impact of *Herma* is found in the sparks of energy released by the collision of the “cold,” rational architecture and the volcanic physical and mental effort required of the performer.

The *ST* Algorithm

The particular approach to piano writing launched with *Herma* would be carried on, and even intensified, in *Eonta* (1963), for piano and brass. In the meantime, Xenakis returned to the stochastic approach introduced in *Achorripsis*, this time with the aim of programming it to run on a computer. In compositional terms, he was taking a step backward, having already explored more elaborate means of organizing his music, but the attraction of producing music by means of a computer was irresistible. By 1962, Xenakis had completed his algorithm, written in the Fortran computer language, and had succeeded in persuading IBM-France to grant him time on their 7090 computer to run his program. (In those days computers were large, expensive machines, not at all widely available.) The algorithm (see table 2) is an elaboration of the “fundamental phases of a musical work” used for the composition of *Achorripsis*.

Probability functions are used throughout, with various constraints being programmed to account for the particularities of each phase (instrumentation, range, dynamics, etc.). There are advances on *Achorripsis*—the variability of section length, for example—but basically the process is the same. Once the program is run through the computer, the numerical output must be transcribed into music, allowing Xenakis to apply his own judgment to the results, changing details, or reordering events, as he saw fit.

The *ST* algorithm engendered a whole family of compositions (see table 3). Changing the input data obviously affects the results, though the basic premise underlying the formal conception remains unchanged in each piece. Xenakis has compared the *ST* algorithm to forms such as the fugue, which consist of sets of rules giving rise to any number of compositions. Not all fugues make for interesting music, however, and neither would the automatic application of an algorithm. Xenakis has been criticized both for his indiscriminate use of mathematical

Table 2. General Description of the *ST* Algorithm for Stochastic Composition.

1. The work consists of a succession of sequences or movements each a_i seconds long.
2. Definition of the mean density of the sounds during a_i .
3. Composition Q of the orchestra (from r classes of timbres) during sequence a_i .
4. Definition of the moment of occurrence of the sound N within the sequence a_i .
5. Attribution to the above sound of an instrument belonging to orchestra Q .
6. Attribution of a pitch as a function of the instrument.
7. Attribution of a glissando speed if class r is characterized as a glissando.
8. Attribution of a duration x to the sounds emitted.
9. Attribution of dynamic forms to the sounds emitted.
10. The same operations are begun again for each sound of the cluster $N a_i$.
11. Recalculations of the same sort are made for the other sequences.

Table 3. The *ST* Family of Compositions.

Title	Date	Instrumentation (of computer run)	No. of Sections (from algorithm)	Premiere
<i>ST/48-1</i>	24 January 1962	Orchestra: 2222/2220/2perc/8864	7	1968, Paris
<i>ST/10-1</i>	8 February 1962	Ensemble: cl.bcl.2cor. hp.perc.2vn.vl.vc	15	May 1962, Paris
<i>Amorsima-Morsima (ST/10-2)</i>	8 February 1962	Ensemble: cl.bcl.2cor. hp.perc.2vn.vl.vc	5 (complement of <i>ST/10</i>)	16 December 1962, Athens (withdrawn)
<i>ST/4-1</i>	8 February	String quartet	15 (from <i>ST/10</i>)	December 1962??

	1962			Paris
<i>Morsima-Amorsima</i>	3 July 1962	Mixed quartet: vn.vc.cb.pf	17	16 December 1962, Athens
<i>Atrées (ST/10–3)</i>	6 September 1962	Ensemble: fl.cl.bcl.cor. tp.tb.3perc.vn.vc	27 (5 movements)	December 1962? Paris

functions in music (see Griffiths 1975) and for sullyng by intuition the purity of his algorithms (see Vriend 1981).

In terms of formal outline, each piece is distinct. The sonic material, though, is similar for every one, in spite of differences in instrumentation. Single notes—short, held, or treated as glissando—form the basic units of sound, intensified by dynamic forms (a limited set of dynamic markings and crescendo-decrescendo gestures) and playing modes (tremolo/flutter-tongue, col legno, etc.). There is no attempt to create any larger-scale organization of pitch or any other parameter (such as ensemble dynamics or register) beyond considerations of range and playability (e.g., disallowing huge leaps). The mean density of events within each section is fixed, so that perception of the piece proceeds primarily by reference to the changes from one section to the next. A wide range is used for the selection of section duration and activity, resulting in a more strongly delineated formal outline than *Achorripsis*. Lengthier, sparser passages, for example, have time to establish a sense of identity, and can contrast dramatically with sudden shifts to shorter ones of much higher density. Nonetheless, the lack of a hierarchical organization is a definite shortcoming: it is perceived as a lack of depth. Such music, however, challenges preconceived notions of musical coherence.

In examining the *ST* works, a few anomalies should be noted. *Amorsima-Morsima* (later withdrawn from the catalog) was put together from the sections of the computer output not used in *ST/10*. In choosing to leave JW4 (JW is a section designation from the algorithm) out of the first piece, one can only assume that Xenakis was concerned about creating a lengthy passage of very low density (four sections), having already decided to reverse JW2 and JW3 to obtain a graduated descent from the extremely active opening section. With the exception of *Morsima-Amorsima*, the other scores (*ST/48* and *Atrées*) also contain reorderings of sections, no doubt for a variety of reasons. *Atrées*, the piece most freely adapted by the composer from the original data, challenges most dramatically the need to respect the output of the program. Xenakis divides the form into five movements, and allows them to be played in any order. The notion of a mobile form, of course, had already been put forward by John Cage and Earle Brown, and applied by Karlheinz Stockhausen and Pierre Boulez, among other European composers.

ST/4, perhaps the best known of the set, is not, in fact, an independent composition. Rather, it is a transcription/reduction of *ST/10*.³⁴ The music consists of the string parts of the larger piece, with additions whenever possible of material from the other instruments. This transcription makes for fascinating study, as Xenakis went far beyond a mere reduction of the original. Certain elements of the transcription point to the active creative impulse of the composer.³⁵ Perhaps most striking is the treatment of the harp part. The original data allowed for glissandi in the harp part. To create this effect, the harpist must sweep across the strings to achieve a kind of scale or arpeggio, whereas the string

instruments slide continuously along one string. In transferring the harp part to strings, Xenakis could have allowed the harp glissandi to revert to the characteristic sliding sound. Instead, he chose to preserve the discrete nature of the harp part, transcribing them as chromatic scales. At one point (mm. 224–48), the harp plays a very slow “glissando,” a chromatic scale descending four octaves to the lowest note of the instrument. Xenakis preserves this gesture in *ST/4*, passing the pizzicato scale off from the viola to the cello. The latter instrument, however, reaches its lowest note an octave higher than the harp. Undeterred, the composer asks the player to detune the lowest string with each note in order to descend through the final octave. This is an audacious gesture, to say the least. It is, of course, extremely treacherous to have to retune in the middle of a concert. Nonetheless, the effect is rivetingly theatrical.

Likewise, *Atrées* shows a concern for sonority and performance issues that go beyond the premise of the compositional algorithm. There are passages, such as the JW32 section of the third movement, where the sustained pitches are varied by the periodic intrusion of tremolo or flutter-tongue, or shifts between *sul ponticello* and *sul tasto*. The tradeoffs of timbral or dynamic shifts from one instrument to another creates a kind of hocketing dialogue as the spotlight of attention shifts back and forth. These passages were not programmed, but added by Xenakis in the process of transcribing and evaluating the computer data. *Atrées*, commissioned by the ORTF, signifies “the inflexible laws of Necessity” (Xenakis 1968, i), and the piece is dedicated to Pascal. The title is ironic, considering the degree to which Xenakis intuitively reworked the original material, although it could also be taken to refer to creative necessity rather than rationality.

Clearly, Xenakis was moving on, content neither with the output of his computer program nor with the assumptions about musical form underlying it. While the novelty of using the computer to make music added to his notoriety, and attracted a great deal of attention (he was awarded first prize in the Manos Hadzidakis Competition in Athens for *Morsima-Amorsima*, and was later awarded a prize at the 1968 Computer-Composed Music Competition of the International Federation for Informatic Processing), Xenakis began to focus on other concerns, including a return to his Greek heritage.

4

The Voice, the Stage, and a New Conception of Time

For the whole period from *Metastaseis* to the *ST* pieces, during which he was creating his compositional identity and establishing his reputation, Xenakis wrote only instrumental and electroacoustic music. Beginning in 1962, however, he began writing for the voice, following two streams of development over the course of different compositions: in one he returned explicitly to his Greek identity; in the other he integrated the voice into his explorations of extended performance techniques and new manifestations of solo and ensemble virtuosity.

Polla ta dhina

Polla ta dhina, a commission from Hermann Scherchen for the 1962 Stuttgart Festival of Light Music, straddles these two strands of Xenakis's compositional concerns. The festival organizers were looking for "light music...less in the sense of an operetta by Lehar than a divertimento by Mozart" (Matossian 1986, 198). Xenakis took this to mean "optimistic," and therefore selected for a text the second ode from Sophocles' *Antigone*, often called "Hymn to Man."¹ Xenakis translates the title as "many are the wonders of the world," the continuation being "but none more wonderful than man." (There are, it should be noted, significant differences of nuance from one translation to another.) Xenakis calls this text "an oasis in this formidable tragedy" (Bois 1967, 19), and it is significant that he did not include the concluding lines of the ode, which point toward a moral, religious sense. Instead, he wanted to show "the continuity of conscious rational optimism of man without religious overtones" (Matossian 1986, 198).

The text is intoned by a children's choir on a single pitch, inspired by the chanting of the hours by the Dominican monks at the Monastery at La Tourette, heard by the composer during his visits there while working with Le Corbusier (Matossian 1986, 198). The material for the orchestra is anything but traditional, though, being a rather freely constructed succession of sonorities like those introduced in *Metastaseis* and *Pithoprakta*. In following a text rather than an algorithm, Xenakis was able to concentrate on achieving suppleness of formal design (building on *Syrmos*, and perhaps on *Orient-Occident*).

The music of *Polla ta dhina* has been little discussed.² The vivid, profound imagery of Sophocles' words must have been a powerful inspiration for Xenakis, but with a few

notable exceptions: there is little direct word painting, and the musical structure follows the lyrical form in only a general way. There are two basic sonic entities that alternate, roughly mimicking the strophe/antistrophe pattern of the ode. The first entity is built primarily from sustained textures, while the second is based on glissandi. The block-like appearance of the formal outline is mitigated in the music by a great deal of overlapping and transitional material.

The opening section is the most static, consisting of a high, five-note sonority in the woodwinds, enriched by a counterpoint of dynamic fluctuations and punctuated by short tremolo attacks in the low strings and tom-toms. The text, while anchoring the composition through the constant chanting on *A4*, is not generally treated as if it is to be understood directly. Indeed, the opening phrase, “*Polla ta dhina*,” is broken up by a rest—and needlessly, from the point of view of scansion. The second section of music is launched by the next phrase of the first strophe, and leads to a lengthy passage of string glissandi. In terms of word painting, it is possible to connect the contours of the strings with the waves of the sea mentioned in the ode. Significantly, the first four measures contain only rising glissandi, followed by a moment of high, sustained tremolos, then two measures of falling contours. This evocation of a wave is enhanced by the swirling sound of the maracas.

From m. 23 on, the glissando contours are mixed, with the texture being enhanced by brief clouds of pizzicati together with percussion. A gradual incursion of sustained sounds, rising from low notes in the double basses and contrabassoon to a thick, wide-register chord in the strings, leads to the next section through a dramatic crescendo. This return to the sustained entity, loosely coinciding with the shift in the text from the sea to the earth, features the strings primarily, in contrast to the opening, with chordal interjections by the winds. The continuously evolving string sonority contains more linear motion within the parts and numerous changes of dynamics and timbre (tremolo, *sul ponticello*, muted). As the texture thins, the glissando entity returns, this time in conjunction with the start of the ode’s first antistrophe. The intensity of the glissando sonority is lighter, gradually building up the dynamic level at the same time as the length of the individual lines increases.

The music remains relatively consistent into the beginning of the second strophe, with sustained tones in the winds again entering to build momentum toward the shift to the next section. Xenakis chooses, in setting the words “*thought swift as wind*,” to stretch out the intoning of the phrase far beyond any other moment, drawing attention to the significance of the text (“*anemoen*” means “*high-soaring*” as well as “*swift-soaring*”). For this passage, the quiet glissandi of the high strings are ordered in quasi-canonic fashion, creating a form of spatialized resonance, perhaps in evocation of “*swift-wind, high-soaring thought*.” This dramatic passage is quickly succeeded by the winds, whose sustained harmonies are varied by dynamic and registral shifts, and staccato repetitions (pulsations) of held tones.

At m. 122, the texture evolves into a passage of greater melodic motion within individual lines, exhibiting a contrapuntal richness not found in Xenakis’s music since *Metastaseis*. The winds build to a climax, quickly echoed by a second, this time enhanced by a thick cloud of pizzicati in the strings, silent throughout the entire section to that point. The strings take over with an immense glissando sonority, fading to silence, the choir carrying the passage forward to a dramatic statement of the line referring to the

inevitability of death. This moment is surely the most striking of the piece; the winds blast a snarling outburst of flutter-tongue glissandi (Xenakis's boldest writing yet for winds), the shocking silence thereafter being colored by a resonating chord struck on the vibraphone (rarely used by him in any other orchestral score) as the choir finishes the strophe. The final passage, set in tandem with the second antistrophe, is surprisingly harmonious,³ as a quiet texture of sustained string harmonics unfolds, enhanced at the end by a crescendo supported by pulsating horns. The dichotomy of the text, stating man's capacity for both good and evil, finds emphasis in the music as Xenakis sets off "kakon" ("to evil") with a sudden *sfff* tremolo, subsiding only to crescendo to the finish.

In returning to a Greek theme after years of working intensively to develop a new, original compositional voice, Xenakis was able to adopt a highly individual approach, something he had aspired to achieve earlier without success (Xenakis 1955). As François-Bernard Mâche has noted, Xenakis needed to undergo a "distancing" from the specific details and influences of Greek music (and culture, generally), in order to develop a personal, creative response to this powerful force in his own character (1993, 207–10). *Polla ta dhina* has not been often performed, but in signaling a return to his cultural roots, along with a step, begun with *Atrées* (1962), toward greater freedom in his compositional approach, it is a score of some importance.

Eonta

The writing of *Polla ta dhina* signaled a new stage in Xenakis's faith in his own musical abilities, strengthened by intensive studies and theoretical thinking. The success his music began to achieve around the world no doubt helped to bolster his confidence. He was received like a hero at the 1962 Warsaw Autumn Festival, where *Pithoprakta* was performed. György Ligeti included *Metastaseis* in his lectures at Darmstadt that year, and Xenakis was invited to lecture at Tanglewood the following summer, and was shortly thereafter awarded a Ford Foundation residency in Berlin. Significantly, his algorithmic piece *Morsima-Amorsima*, premiered in Athens in December 1962, was awarded the Manos Hadjidakis Prize. Although he was not yet allowed to set foot in Greece, on pain of sure imprisonment and possible death, this prize resulted in a commission to compose the music for a 1964 production of Aeschylus's *Hiketides* (*The Suppliants*) at the ancient theater in Epidaurus.

In the meantime, Xenakis had received a commission from the Domaine Musicale in Paris (marking a definitive entry into the upper echelons of contemporary musical life in France). *Eonta* ("being(s)"—present participle verb and noun plural form), composed in 1963 for piano solo and a brass quintet of two trumpets and three trombones, draws upon certain elements of *Herma* and the *ST* series, but is much more freely composed. Following the advances in achieving a more distinctive treatment of the wind instruments in *Polla ta dhina*, this score makes a quantum leap in the brass writing, so much so that Pierre Boulez, who conducted the premiere in 1964, deemed it impossible to play as written. For that performance, he incorporated a second set of brass players to spell the first group. In spite of Boulez's misgivings (the score was performed with the proper number of players by Constantin Simonovitch in 1965), *Eonta* has become one of Xenakis's most popular works.

Nouritsa Matossian uncovered some written notes Xenakis made for *Eonta* during that visit to Tanglewood in the summer of 1963 (Matossian 1986, 177). What is extraordinary are the references to “type-phrases of Mozart” and “alternate delicate and brutal suites as in Mozart, Beethoven,” because there is little in this music reminiscent of classical music. Still, that Xenakis was musing thus, rather than via stochastic functions, is indicative of his evolving frame of mind. *Eonta* opens with a long piano solo, strongly reminiscent of *Herma* in its “statistical” textures. Unlike the solo piece, this passage, lasting close to 2–1/2 minutes, is based on the entire chromatic compass of the piano. While the composer includes symbols throughout the score of *Eonta* to indicate the succession of pitch sets and their various combinations and complements (there are two primary sets used, as opposed to three in *Herma*), study of the music reveals many inconsistencies, diffusing any sense that the “symbolic operations” are meant to be perceived. Pitch is not ignored, however, even if it is not treated as a parameter of primary importance. Most noticeable in the piano part are changes of density, dynamics, register, and pedaling.⁴ The evolution of these parameters becomes clearer upon repeated listenings, but the moments of dynamic shifts (m. 10—*ppp*, m. 15—*fff*, m. 22—*ppp*, m. 29—*fff*, m. 32—*ppp/fff*) and registral compression (m. 28—mid, m. 32—mid) immediately stand out. The most dramatic passage occurs at mm. 32–40, where the dynamic marking jumps from *ppp* to *fff*, the register narrows into the mid-high range, and the activity level drops to a much lower rate than had been deployed thus far. As a result, this moment is strongly imprinted on the listener’s memory, preparing for the entry at m. 40 of the brass, who sneak in holding a chord voiced in the same range. While it appears that the piano part goes its own way throughout much of the piece, there are a number of moments of synchronicity that serve to unify the disparate character of the solo and the brass ensemble.

The brass are introduced with three long chords, each containing dynamic elements that become increasingly elaborate. The range expands outward with each chord, and the intervallic character is different for each, the first two being complementary (the third does not complete the chromatic set, as might be expected, but is nonetheless inversionally related to the second chord; see fig. 6a). The first projects a gradual crescendo over nine measures, with the players emphasizing the entrance by gradually raising their bells from a downward vertical direction to the normal, horizontal playing position. There are numerous such “stage” directions in *Eonta*, requiring the brass to move to different sitting positions onstage, to blow into the open body of the piano, or to play while freely circulating within a set area. This aspect of Xenakis’s thinking had been more implicit in earlier works, although the distribution of glissandi and clouds of sounds across the orchestral strings certainly enhances the “spatial” character of the music.

After a break, during which the piano continues its high-voltage, full-range stochastic music, the second brass chord enters, again quietly, this time with independent dynamic fluctuations for each instrument, the contours generally rising to a high-point over six measures, falling back again over six more, then rising again over thirteen. The internal activity of the otherwise static chord serves to spatialize the music in a different way, as attention is drawn first to one pitch/instrument and then another as the individual dynamic contours peak. Throughout these measures the piano continues, its texture being distinguished by dynamic shifts, from *fff* to *ppp*, then gradually rising back up to *fff*, only to stop suddenly, leaving the damper pedal to resonate with the ongoing sound of the brass. A much sparser passage serves to link the end of the second brass chord with the

third, which adds layered staccato articulations of the held pitches to the dynamic fluctuations. In this passage, the piano avoids the middle registers, articulating the regions above and below the brass. Again, the piano drops out before the end of the brass chord, leaving the damper pedal to resonate the lengthy silence that follows the abrupt termination of the brass sonority.

After the registral and articulatory expansion of the brass material, a passage follows in which the register is again restricted, this time to a narrow band in the mid-low range (see fig. 6b), in which a stochastically conceived succession of notes teems with strong dynamic shifts and quarter-tone alterations. The piano again concentrates on the high and low registers, gradually centering in on the same range as the brass in time for a cadential crescendo and break. The process starts up again in m. 123, varied by a gradual expansion of the brass range. This music gives way to a stark, rather beautiful, passage in which the piano and brass resonate two chords in alternation, the long moments of sustained sonority being disturbed only by two sharply articulated dyads in the piano (see fig. 6c). Xenakis includes here a series of Boolean markings showing the rapid succession of pitch sets, an amusing gesture considering the extremely limited nature of the material at this point. At m. 166, the brass are restricted to the second chord, sustaining it through several measures, dynamic pulsations and staccato *fff* outbursts gradually giving way to rising scales, eventually petering out by m. 202.

A series of short, jerky tradeoffs between the piano and the brass lead into more sustained scalar contours, alternating in the brass with sustained notes increasingly elaborated by means of near-unison “beating,” slow glissandi, exaggerated vibrato, and, eventually, tremolo glissandi (a trombone technique involving rapid back- and-forth motions with the slide). The piano begins by playing similar scalar phrases, the contours thickened by close-voiced chords, but soon jumps into a more fractured style, different materials being contrasted through dynamics, register, density, and degree of contour linearity. This long section continues until m. 299, after which the brass take a break in order to gather around the piano, while the piano continues on its own. After a silence, again resonated by the held damper pedal, the piano leads into a two-chord, short-long gesture that is treacherously difficult to perform; it is repeated sixteen times in succession, linked intervallically with the brass chord introduced at m. 310 (see fig. 6d). As the piano breaks out of its stuck-needle repetitions, the brass move smoothly into a contrapuntal passage that is then alternated and layered with faster, scale-like contours. During all this, the players are instructed to promenade freely (randomly) around the central area of the stage (presumably without bumping into each other!).

The figure displays six systems of musical notation (a-f) for the piece *Eonta*. Each system consists of a grand staff (treble and bass clefs) with notes and rests. System a) shows three measures: mm. 40-48, mm. 55-79, and mm. 82-91. Below the staff are interval vectors: [123121], [122131], and [122131] (Inversion of Chord II, normalized). System b) shows mm. 100-121 with a long melodic line in the bass clef. System c) shows mm. 144-189 with two measures, each containing a piano chord marked 'pf' and an interval vector: [222220] and [431242]. System d) shows mm. 310-322 with a piano chord marked 'pf' and an interval vector: [032140]. System e) shows mm. 450-454 and mm. 460-466 with two measures and interval vectors: [322210] and [132130]. System f) shows m. 469 and m. 479 with two measures.

Figure 6. *Eonta*: Key structural harmonies and voice leading.

Opening three brass chords, mm. 40–91.

Expanding register, mm. 100–21, with culmination at mm. 127–37.

Brass chords, with registrally complementary piano chords, mm. 144–89.

Sustained brass chord with two-chord rhythmic gesture in piano, mm. 310–22.

Registral contraction in final five-note chords, mm. 450–66.

Cadential voice-leading motion in bass, concluding measures.

The piano, at last, is silent through mm. 331–90, with one brief staccato flurry at mm. 365–68. In the passage of mm. 375–93, Xenakis attempts a dialectical deployment of pitch-set derivatives, but, given the mutually exclusive ranges of the material and the lack of any clear exposition of the sets earlier, the argument is more truly between instrument groupings (trumpets versus trombones) and register (high versus low). The materials do converge, however, enabling the piano to enter with a short phrase filling in the extreme high and low register as it had done before. A remarkable nine-measure passage follows in which the brass play in a staccato, pointillistic fashion, imitating the stochastic texture of the piano, heard here with no damper pedal, emphasizing the brittle character of the music. An outburst in the piano, dying away over four measures (403–6), leads into the final section in which broad, undulating contours, independently shaped for each instrument, including the piano, lead, after numerous dynamic fluctuations both layered and for the ensemble, to a five-note brass harmony more widely spread than any of the preceding pivotal chords (see fig. 6e). Dramatic dynamic swells, juxtaposed with a full-out, full-range stochastic sonority in the piano, lead to a final staccato passage, paralleling the sonority at m. 393, finishing on a blaring, brassy diatonic chord, closely voiced in the middle register. The brief coda, heard after a short silence, is puzzling; it consists of four dynamically and articulationally varied statements of a widespread dyad, with the bottom note descending a half-step at the close (see fig. 6f). That Xenakis would end his most ambitious work to date (in terms of duration, staging, and instrumental technique) with a simple cadential progression underscores his growing concern with the organization and perception of pitch. The deployment of five-note chords throughout *Eonta* certainly enhances the sense of pitch structure, although the nonrigorous use of declared pitch sets does not.

Regardless of any inconsistency in pitch organization, *Eonta* is a strong, wideranging work, drawing on many, if not most, of Xenakis's compositional concerns of that time. The bold treatment of the instruments and the concerns for staging would become major components of several works in the years following. The architecture of the work is intricate, with many subtle details and interconnections. At the same time, the outline is very clear, with dramatic textural contrasts and dynamic articulations providing strong points of engagement for the listener, and intensely visceral, with its outpouring of energy drawn from the maximally challenged performers. This approach to musical form and expression would become central in many subsequent works. In addition, the disparate attempts at organizing pitch would lead to new formulations of this important aspect of music, both in the harmonic and temporal domains. In the meantime, though, Xenakis turned his attention back to Greece.

Hiketides

While Xenakis had worked at setting Greek texts before, *Hiketides* (*The Suppliants*, 1964) was his first work intended for the dramatic stage. Even though he knew he could not attend, the presentation in the ancient amphitheater at Epidaurus must have been a powerful inspiration for a personality steeped in the literature and culture of that time. For the production of Aeschylus's drama, Xenakis adopted an approach to setting the choruses that included dancing and the playing of small percussion instruments. The vocal parts, following the rhythm of the text closely, are more elaborate than in *Polla ta dhina*, outlining narrow modal melodies in simple two-part counterpoint, but are far removed from the composer's normally modernist style.⁵ The instrumental interludes, though, resemble others of his scores from the same period. Xenakis pits the brass against the strings, drawing upon seven types of material, varying them with each appearance. The "archaic" character of the vocal parts makes reconciliation with the instrumental parts difficult. In *Polla ta dhina*, the chanting on a single pitch neutralizes the problem, enabling the vocal part to contribute a timbral, rhythmic element to the ongoing orchestral textures. In *Hiketides*, Xenakis attempts to bridge the two worlds by means of the unison sonority, with the instrumental material narrowing in—over a very long span outweighing any of the other sections—to a single pitch, from which grows the melodies of the chorus.

While *Hiketides* has not stood the test of time too well, the original music languishing and the instrumental suite little played (perhaps due to its overobvious cut-and-paste nature), it did serve to break the ground for more ambitious stage projects such as *Oresteia* (1966) and *The Bacchae* (1993), and multimedia spectacles such as those mounted at Persepolis (1971) and Mycenae (1978). The attempt to engage the chorus in a "total theater" involving recitation, singing, dancing, and percussion would also have repercussions in Xenakis's instrumental work. In addition, he was soon to be drawn into the world of ballet, as choreographers began setting his scores to movement.

Outside Time

The period 1963–65 was not the most productive for Xenakis in terms of scores completed. During his tenure in Berlin, he spent much of his time writing texts, first of all to prepare for the publication of *Musiques formelles* (1963), and then to pursue research into additional matters pertaining to the historical foundation of his work and new ways to conceive of time and space in music.

In what became the first chapter of *Musique formelles*, later the expanded *Formalized Music* (chapter 7: "Towards a Metamusic"), Xenakis examined the Greek theoretical writings of Pythagoras and Aristoxenos, also looking into the structure of Byzantine music (Xenakis 1992, 183–91). Xenakis drew two important conclusions from his studies:

1. An approach to formal construction based on the transformational and combinatorial techniques of group theory;
2. An extension of symbolic logic he called "sieve theory," enabling ordered collections of intervals to be constructed and permuted.

According to Xenakis, the complex structure of Greek and Byzantine music, built from a layered network of tones, tetrachords, systems (combinations of tones and tetrachords), and tropes or modes, is far richer than the “smoothed out” Gregorian tradition, from which developed the fixed modes and then tonality. The materials from which Byzantine music was built constitute what Xenakis calls the “outsidetime” category. By this he means that the systems resulting from the various combinations of tones and tetrachords are not altered by any particular manifestation “inside time,” as, for example, the identity of a mode is not affected by its presentation as a melody. The Byzantine system, though, comprising a greater wealth of elements on each level, offers a wider range of possibilities than the relatively simple modal/tonal system. In seeking his own mathematical formulation of such an “outside-time” system, without wanting to re-create or imitate the earlier, mostly lost, Byzantine theory, Xenakis came up with a logical, algebraic conception based on the relations between sonic events, characterized by basic parametrical values (of pitch, duration, and intensity). “What will count will be the abstract relations within the event or between several events, and the logical operations which may be imposed on them,” he wrote. “Every sonic event is perceived as a set of qualities that is modified during its life. On a primary level we perceive pitch, duration, timbre, attack, rugosity, etc. On another level we may distinguish complexities, degrees of order, variabilities, densities, homogeneities, fluctuations, thicknesses, etc.” (Xenakis 1992, 156, 157).

Xenakis then outlined the intervallic nature of the qualities of sound (such that values can be ordered numerically), and the abstract relational properties that can be conceived “outside time” (158–60). A separate, though in many ways similar, set of properties are also described for the temporal characteristics of a set of events (based on comparison of metric values between events),⁶ with the correspondences between the outside-time and temporal structures comprising the “inside-time” structure (which would normally be the score or piece).

According to Xenakis, Western polyphony accords too much weight to the temporal aspects of music, with a resulting impoverishment of the outside-time aspects so rich in the monodic music of the Byzantine era and much non-Western music (191). His stochastic sound masses had rendered the perception of detailed temporal structures absurd (as had, according to his argument, the complex serial constructions of the Darmstadt composers), but the conceptual foundation for a new approach balancing the temporal and outside-time properties of music was a long time in coming. With time in Berlin to study the historical precedents, Xenakis was able to clarify the theoretical aspects of his thinking and to implement compositional procedures taking this tripartite notion of musical structure—outside time, temporal, inside time—into account.

Akrata

Xenakis was very well-received in the United States upon his first visit in 1963. Soon after, he received a commission from the Koussevitzky Foundation for an ensemble score featuring winds. *Akrata* (“pure,” “unbounded”), completed in 1965 and premiered in June 1966 at the English Bach Festival in Oxford (where Xenakis would become a regular guest), is scored for sixteen winds. The instrumentation is unusual for the concentration of the woodwinds on the extremes of high and low, with piccolo, contrabass clarinet, and

two contrabassoons. Stylistically, the music is distant from the exuberant virtuosity and intuitive architecture of *Eonta*, being built entirely from an extremely restricted premise: held, or repeated, tones. This unremarkable material (perhaps paralleling the use of concrete in the architecture of Le Corbusier) is subject to a kaleidoscope of variations in which the different parameters are treated quasi-independently.

According to the composer, *Akrata* “is of an extra-temporal architecture, based on the theory of groups of transformations. Use is made in it of the theory of Sieves” (Bois 1967, 34). These theories are discussed by the composer in great detail in reference to *Nomos alpha*, his next piece, but *Akrata* is not even mentioned in *Formalized Music*. Makis Solomos attempts, not entirely successfully, to determine specific applications in the score (1993, 179), but it seems likely that these theories are here applied in embryonic form. In later recollections, Xenakis discusses only the group-theory aspects of *Akrata*. This theory provides the means for limiting, and ordering, the combinations of parametrical values. If, for example, there are two sets of eight elements each, they can be combined in over forty thousand ways. If, however, one imagines that these two sets of elements are each assigned to the eight vertices of a cube, one of which fits inside the other, then there are just twentyfour ways the inner cube can be rotated and fit back inside the other.⁷ Xenakis maintains that he used the tetrahedron, which is limited to just twelve symmetrical rotations, for *Akrata* (Varga 1997, 88).

The great advance in this approach over the earlier stochastically based algorithm is the ability to generalize the process from individual events to larger segments of the music. In other words, the group elements subjected to transformational processes can be sonic entities (such as clouds of pizzicati, or massed glissandi), or pointers to collections of parametrical values. Xenakis was attracted to the three-dimensional geometrical models precisely because the dimensions could be represented as the three basic parameters of sound: pitch (sometimes density), duration, and intensity. Thus, a sequence of transformations could point to a succession of musical events rather than an ordering of individual notes. In *Akrata*, the music proceeds as a series of moments—collections of notes—separated by silences. The prominence given to the pauses between the sounds adds to the austerity of the music, but also contributes to its expressive force.

Turning to the score, there is a strong sonic identity established right away, with a uniform dynamic level (*mp*), playing mode (repeated staccato articulations of a single pitch), and overall timbre (brass). Both the note durations and lengths of time between entries proceed irregularly, though each is limited to a fixed range, adding a degree of homogeneity never present in the stochastic pieces. The density of events is too low to determine if the pitches belong to a particular set or sieve, but they are limited to two midrange octaves (*D3–D5*) throughout the opening brass section (mm. 1–57). All (except three) pitches in that range are stated over the course of the passage, but the distribution is complex, particularly if doublings and dynamics, elements that strongly affect the listener’s perception of the music, are taken into account. In fact, Xenakis makes much of the orchestrational effect of highlighting certain notes, doubling some, and adding octaves to others. This concern recalls the “interventions” of the composer in *ST/4*, where certain notes are treated in a similar way, pointing an acoustic spotlight on these moments in an otherwise generically stochastic distribution of pitches. The effect in *Akrata* is to color brief strands in the ongoing flow of the music. This is altogether different from

Eonta, where the long stretches of sustained five-note chords enable a strong harmonic-intervallic identity to become established.

In examining the sequence of events in the opening passage, it is apparent that the organization is complex, with little repetition or consistent association of one element with another. The durations of events vary within a range of 11 to 26.25 beats, and the number of notes in each varies between three and eight, with a similarly proportional range of event activity. The dynamics, too, after remaining consistent into the first shift of entity from staccato repetitions to sustained notes, range between *ff* and *ppp*. The flutter-tongue sonority is presented at a *ff* marking each time, but the staccato and sustained entities vary a great deal, although the former is more often loud while the latter is more often quiet.

By comparison, the passage for woodwinds alone, separated from the opening brass section by a sustained passage for the full ensemble, holds certain elements consistent in order to draw more focused attention to those that vary. The staccato entity is heard throughout, and the number of notes in each event is always eight.⁸ The dynamics hold to a uniform *fff* for over half the passage, at which point the markings decrease incrementally to *ppp*. The linearity of this trajectory, including the cadential shift to *fff* and back again at the end, indicates the direct involvement of the composer rather than the output of a permutational process. While the length of each event remains fairly uniform (between 6.75 and 9.5 beats), the segment length (comprising the sonic event and succeeding silence) varies considerably, the only linearity occurring with the gradually decreasing lengths of silences from the tenth through seventeenth segments (in tandem with the decrescendo from *fff* to *ppp*). The temporal and registral distribution of notes within each event varies greatly, of course, even as the number of notes in each remains the same. Unlike the restricted ambitus of the opening brass section, though, the range is quite wide.

In the second half, the extremes are more prominent. The music proceeds in fragmentary fashion, briefly spotlighting the low instruments, the high ones, the full ensemble, and so forth. The basic variants of the held-pitch entity—staccato repetitions, sustained note, flutter-tongue—are joined by a number of others, although none are as extensively presented as the original three. These additional sonic entities include: accented rearticulations; dynamic fluctuations (crescendo and decrescendo); *fff* accents immediately muted to *ppp*; layered rhythmic variants of the staccato repetitions; slight glissandi to obtain “detuned unison” beatings; and quarter-tone alterations. While the pitch organization appears to be statistical (in spite of what the composer has stated), the density is not high (there are often, particularly in the sections where note durations are extended, isolated pitches or intervals), and the registers are often restricted. These factors, together with the added weight of unison and octave doublings, lend a more nuanced perspective to the pitch presentation.

In its almost faltering energy, with moments of activity separated by silences, *Akrata* is a strange piece. But the purity of the “subject,” the held note, imbues the music with a stark, radical expression that is appealing to many. And, while the formal construction may have resulted from an only partially rationalized process, the imprints of a new, deterministic approach are clearly present in this score.

Nomos alpha

While it is possible that Xenakis drew upon ordered pitch or duration collections in *Akrata*, his theory of “sieves” was fully developed soon after, and forms an integral part of his compositional arsenal for the solo cello work *Nomos alpha* (1966). Sieves are, in a sense, Xenakis’s answer to the tones, tetrachords, and systems of Byzantine theory. What he achieves is a method by which ordered structures (pitches, durations, etc.) of any degree of regularity or irregularity can be constructed and then subjected to a regulated sequence of permutations.⁹

By treating the smallest intervallic unit (normally a semitone, but smaller or larger units are possible) as equivalent to a numerical series of integers, cyclical rotations and transpositions of selected intervals can be combined to form a “scale,” or specific succession of intervals. Xenakis limited the material by selecting an interval of periodicity (such as the octave, which would be expressed as 12, if the smallest unit is the semitone), and constructing intervals using multiples derived from the periodic unit (e.g., 12 can be resolved into moduli elements 3 and 4). The major scale, for example, can be described numerically in such a fashion, the various cycles being combined by means of the logical operations of union, disjunction, and complementation (see table 4). *Nomos alpha* uses sieves built from quarter tones and three-quarter tones.

Xenakis next formulated a method for organizing permutations of sieves on the basis of systematic rotations of the moduli units used in the sieves (e.g., 3 and 4). He called these processes “metabolae” (Xenakis 1992, 199). In *Nomos alpha*, given a unit of periodicity of 18, Xenakis creates sieves from moduli derived from the prime numbers less than 18 (5, 7, 11, 13, 17), creating metabolae from rotations of a set of sieves built from different pairings of these five moduli (ibid, 231). The primary sieve, built from moduli 11 and 13, is essentially nonperiodic, the cycles realigning only after $11 \times 13 = 143$ steps. The other sieves in the metabola, built from the different pairings of prime numbers, have their own cyclical ranges and intervallic content. Obviously, the possibilities for creating ordered pitch collections are vast, encompassing, as Xenakis has commented, “[a]ll the scales used, both in the past and in other cultures, as well as the ordered sets of the future” (Varga 1996, 96).

In addition to the sieves, *Nomos alpha* exemplifies an elaborate group structure based on the twenty-four rotations of a cube. Xenakis describes this piece’s theoretical and compositional basis in great detail, the only time he has ever been so forthcoming (Xenakis 1992, 218–36). This exegesis has attracted a number of scholars, approaching the work in different ways.¹⁰ However, as Jan Vriend in particular has discovered, Xenakis did not always follow his own rules. Rather, he considered his procedures to be aids rather than ends in themselves. He has, however, written analytical signposts into the score, as in *Herma*, for anyone who might like to study it, or perhaps match aural experience with formal organization. He also produced a detailed analysis of the opening page, where each section is subdivided into eight segments, with the pitch metabola shifting to a new sieve every three sections. Density is treated as a secondary factor relating to segment duration. Given that the score is for a solo instrument, this approach is understandable. The process by which the sequences of density values are selected is

easily adaptable to other contexts where this parameter would be significant, as in *Nomos gamma* for orchestra, completed two years later.

Table 4. The Sieve Method for Deriving a Major Scale.

period (12)	0	1	2	3	4	5	6	7	8	9	10	11	12(0)
modulus 3(tr2)			×			×			×			×	
complement 3(tr2)	×	×		×	×		×	×		×	×		×
mod 4(tr0)	×				×				×				×
intersectionA	×				×								×
mod 3(tr1)		×			×			×			×		
comp 3(tr1)	×		×	×		×	×		×	×		×	×
mod 4(tr1)		×				×				×			
intersectionB						×				×			
union: A, B	×				×	×				×			
mod 3(tr2)			×			×			×			×	
mod 4(tr2)			×				×				×		
intersectionC			×										
union A, B, C	×		×		×	×				×			
mod 3(tr0)	×			×			×			×			×
comp 3(tr0)		×	×		×	×		×	×		×	×	
mod 4(tr3)				×				×				×	
intersectionD								×				×	
union A, B, C, D	×		×		×	×		×		×		×	×
pitches (example)	C		D		E	F		G		A		B	C

Nomos alpha (“rules/laws” but also “particular melody,” or “mode”) is Xenakis’s second composition for a solo instrument, written for Siegfried Palm, leading newmusic cellist of the time, on a commission from Bremen Radio. In honor of the theoretical foundation of the new procedures worked out for this piece, the composer dedicated it to Aristoxenes, the ancient Greek theoretician, and Evariste Galois and Felix Klein, mathematicians important for the theory of groups. At seventeen minutes in length,¹¹ *Nomos alpha* is a substantial score, and, given the fragmented nature of the music and the extreme technical demands placed upon the player, the perception of scope is intensified.

While the formal processes by which this score was constructed are complex and to some extent mechanistic or algorithmic, Xenakis also succeeded in creating room for a more spontaneous, intuitive engagement with the material. The cyclical, nonlinear architecture is disjointed at times, but the composer shapes the musical gestures within

segments to flow from one to another and sculpts basic dynamic levels into more dramatic dynamic contours. The music certainly catalogues an extended range of technical possibilities for the cello, including double-stop glissandi, rapid col legno battuto, registral extremes both high and low (including de-tuning the C string, as in *ST/4*), triple-stops, quarter-tones, and so on. One of the most extraordinary passages comes just before the end, where the cellist plays two scales at once, each going in the opposite direction, one sounding ordinary notes, the other harmonics. When the descending scale reaches the bottom, the two sounds, to be played quasi-simultaneously, are more than six octaves apart! Few cellists after Palm have taken the piece on, but those who have are very dedicated. Rohan de Saram, of the Arditti String Quartet, maintains that working on *Nomos alpha* over several years has forced him to search for new technical solutions to the musical problems posed, becoming a better cellist as a result.¹²

With *Nomos alpha*, Xenakis had arrived at a new approach to composition, one that could draw upon the stochastic techniques he had developed earlier, but also offer a much more sophisticated treatment of musical form. A complex, though cyclical and deterministic, web of outside-time structures, values, and relations are linked with temporal trajectories of the various elements and parameters. The succession of events is put into relief by means of hierarchical groupings, such as segments, sections, and *metabolae*. At the same time, there is a careful definition of sonic entities of the solo instrument, articulated through a systematic treatment of playing modes, dynamics, register, and so forth. The result is a unique melding of compositional and instrumental concerns, creating a musical experience of great power. It is clear that Xenakis was working toward this goal in *Eonta* and *Akrata*, but it was the beloved cello, favored instrument of his mother, that sparked the creative energy necessary to the task. He would carry on his application of these new techniques in succeeding pieces, and the nonlinear form based on limited combinations of outside-time and temporal structures would become basic to his style.

Oresteia

Alexis Solomos, head of the Greek National Theater, had directed the staging of *Hiketides* for which Xenakis had supplied the music. When Ypsilanti, Michigan, decided to mount a festival of Greek drama in the summer of 1966 in celebration of the origin of the town's name's, they invited Solomos, then in New York, to mount productions of Aristophanes' comedy *The Birds* and Aeschylus's great tragedy *Oresteia*. The director turned once more to his compatriot for the incidental music to the latter, and Xenakis responded with a score of some one hundred minutes in length.

Little is known about the original music, because Xenakis quickly produced a suite of much more modest length (approximately forty-five minutes) that has since been recorded and widely performed. He was not content, though, to merely provide background music for the drama; the chorus parts were often sung, and the singers were required to play a variety of percussion instruments while moving about the stage according to a choreography by Helen McGhee. The original production was in English, although Xenakis based much of the chanting rhythms upon the syllabic flow of the original language (even if little is truly known about the rhythms and syllabic stresses of the ancient verse). The choral parts of the suite were later reset in Greek, and that is how

the work has been presented since. Study of the translation used by Solomos for the Ypsilanti production shows that, in addition to editing, updating, and assigning text, he also noted cues for the music, with indications as to function (song, dance, etc.), timing, and links to the choreography and staging.¹³ Altogether, there are thirty music cues indicated in the director's notes, with some intended to be repeated at later points.

The suite, obviously intending to be more continuous, still attempts to preserve some sense of the plot and dramatic scope of the original. The text is mainly taken from the choruses, although two later additions, *Kassandra* (1987), and *La Déesse Athéna* (1992), incorporate solo voices. These enhance the dramatic impact of subsequent staged versions of what has become Xenakis's own take on the ancient trilogy. *Les Choéphores* sets dialogue between Orestes and Elektra, alternating between the male and female choruses, and the interaction between Athena and the chorus toward the end of *Les Euménides* is similar. The vocal settings range from speech-like chanting to modal monodies (sometimes incorporating microtones in homage to the Greek and Byzantine theorists), two-part counterpoint, parallel quartal harmonies, and chaotic yelling and howling. The singers also play small percussion instruments, creating stochastic clouds of unusual sonorities, particularly in *Les Euménides* (and to a lesser extent in *Les Choéphores*). The instrumental parts, scored for an ensemble of thirteen players (winds, percussion, and one cello), are surprisingly unrestrained, with much use of microtonal harmonies, glissandi, and timbral-registral interplay.

In terms of instrumental writing for winds, *Oresteïa* follows on from *Eonta*. The range of styles, both vocal and instrumental, creates a broad scope; this enables the disparate materials to be integrated into the flow of the music without overpowering each other. This synthesis of modern and traditional materials signals a solution to the speculations Xenakis had put forward back in the early 1950s about the revitalization of Greek musical culture (see Mâche 1993, 208).

Terrektorh

Building on his experiences with the multispeaker sound projection for the Philips Pavilion (see chapter 3), Xenakis had become increasingly interested in staging and spatialization. With *Hiketides*, and carrying on in *Oresteïa*, Xenakis generated stochastic textures by means of percussion instruments spread throughout the chorus, a simple but effective means to spatialize these sonorities. In *Eonta*, the brass players are required to move to different positions and to play while promenading around a central area of the stage. Brass instruments are highly directional, so changes in position directly affect the perceived tone quality, along with dynamics and spatial location. In *Oresteïa*, too, Xenakis achieved a synthesis of sound, text, and movement.¹⁴ Given the vagaries of modern knowledge about the staging of the ancient dramas, Xenakis was free to invent his own "total theater," drawing upon what is known of the Greek tradition but also upon Japanese Noh and Kabuki theater, and modern "spectacles" such as the *Poème électronique* (1958) of Le Corbusier and Edgard Varèse.

In 1965, Xenakis received a commission for an orchestral work, to be premiered by Hermann Scherchen and the Orchestre Philharmonique de l'ORTF at the 1966 Royan Festival. According to the composer, he was given just a few months, and was also busy working on the incidental music for *Oresteïa* (and writing *Nomos alpha*, premiered one

month after *Terretektorh*). The title, meaning “construction by action,” refers to the radical conception of the kinetics of orchestral sonority. For this piece, Xenakis distributes the eighty-eight musicians in quasi-stochastic fashion in a circular space around the conductor, with the audience being seated amid the musicians (see fig. 7). Obviously, this performance experience is completely different from a standard one in which the audience is separated from the compactly seated, onstage orchestra.

The kinetic aspect of the sound in *Terretektorh* is to some extent imaginary, as the composer conceives of the listening experience being different for each listener as if it were possible to move from one position to another. In reality, being seated next to one instrument has the effect of amplifying that part, to the detriment of others. For the premiere, Xenakis did specify that audience members be given camp stools, to be free to move around during the performance. The effect would be something like that of an electroacoustic concert, with eighty-eight sound sources rather than two, four, or eight loudspeakers.¹⁵ About the piece, Xenakis has written, “*Terretektorh* is thus a ‘Sonotron’: an accelerator of sonorous particles, a disintegrator of sonorous masses, a synthesiser [*sic*]. It puts the sound and the music □ around the listener and close up to him. It tears down the psychological and auditive curtain that separates him from the players when positioned far off on a pedestal...” (1992, 237).

Xenakis created a score of great textural richness, though also of formal simplicity. Following his experiences in *Hiketides* and *Oresteia*, he expanded the orchestral palette by assigning a number of small percussion instruments to each player: woodblock, whip, maracas, and siren-whistle. Stochastic textures of percussive sounds are thus easily obtained, and Xenakis makes great use of them. These sounds are more easily spatialized than complex melodies or harmonies, and to underscore this, the pitch content of *Terretektorh* is relatively static.

The music begins with a long passage, lasting over three minutes, in which a single pitch, *E4*, is swirled about the orchestra at varying speeds and according to various spiral patterns.¹⁶ The strings finally break away, sliding outward to an enormous chord spread over their full range, recalling the arrival sonority of the opening passage of *Metastaseis*. This chord soon dies away, giving way to the cracking sound of the whips played by the rest of the orchestra. Much of the remainder of the piece focuses on the extreme registers. The high winds come in on an eight-note closely spaced chord, sustaining it from approximately the 4'00" to 7'00" marks, varying the sonority by means of dynamic fluctuations rotating around the field of instruments. Narrow melodic undulations in the low winds begin after the 5'00" mark and continue for five minutes, gradually expanding the ambitus and speed of the undulations. This thick rumbling in the low register, together with the high wind sonority, is filled in with various percussive textures and brief glissando contours in the strings.

being answered by string glissandi. A shift to woodblocks played by most of the orchestra at m. 305 is joined by a band of undulating contours in the high winds, a response to the low-register entity heard earlier. Strands of glissandi or quasi-glissandi fill out this section until the siren-whistles obliterate all other sounds (with the exception of some woodblock strikes) in an extraordinary passage in which short “flames” of rising sounds are repeated in layers of regular rhythms, fours against fives against sixes. This play with cross-rhythmic pulsations would become a common element in subsequent pieces, given extreme expression in *Persephassa* (1969). At m. 356, a high, sustained sonority returns, together with a low band of relatively static sounds. Various individual instruments in the middle register are spotlighted with isolated attacks or short scale contours, until everything but the high string harmonics drops away at m. 414. While the high winds take over this sonority, the strings shift to imposing glissandi that spread out to a full-range chord. This is sustained, with tutti dynamic fluctuations, right to the end.

Terretektorh contains very little clearly perceived melodic material, and the harmonic content is generally limited to compactly voiced sonorities in specific ranges. There is a great deal of movement, though—both directional and stochastic—in dynamics, range, density, timbre, and spatial location. While there is a certain resemblance to the orchestral scores of Ligeti from the period (*Apparitions* [1959], *Atmosphères* [1961], *Requiem* [1965]), the percussive textures—a vast expansion of the knocking and plucking sounds first exploited in *Pithoprakta*—constitute a remarkable and original addition to the orchestral canvas. In this score, Xenakis also attempted an evocation of one of his strongest inspirations, the sounds of nature, writing, “[A] shower of hail or even a murmuring of pine-forests can encompass each listener, or in fact any other atmosphere or linear concept either static or in motion. Finally the listener, each one individually, will find himself either perched on top of a mountain in the middle of a storm which attacks him from all sides, or in a frail barque tossing on the open sea, or again in a universe dotted about with little stars of sound, moving in compact nebulae or isolated” (1992, 237).

The premiere at Royan, the first time anyone had really heard an orchestra from “within” (including the musicians themselves, who are used to playing in sections), was wildly successful, and led to a series of commissions for Royan. The performance of *Terretektorh* was also a poignant last encounter between Xenakis and his mentor, Hermann Scherchen, who died soon after.

Medea

The year 1966 was an eventful one for Xenakis. Along with the premieres of *Terretektorh*, *Nomos alpha*, and *Oresteïa*, he began his first fruitful relationship with a publisher, Boosey and Hawkes (to be succeeded a few years later by Éditions Salabert, better placed to serve his needs, with its headquarters in Paris). He was increasingly invited to lecture and present concerts, and that year he traveled to Argentina, Brazil, the United States, Germany, Sweden, the Philippines, and Japan (Gerhards 1981b, 368–69). In France he had certainly achieved renown, particularly with the Festival Xenakis, organized by Constantin Simonovitch, and the Grand Prix du disque, awarded to the first-ever recording devoted to his music (including *Metastaseis*, *Pithoprakta*, and *Eonta*). He

also received another commission for incidental music, from Jean-Louis Barrault and the Théâtre de France.

Medea is a Greek story, but the version used was by Seneca, in Latin. According to Xenakis, “I hesitated because I knew Seneca as a pseudo-philosopher, an imperial courtier, and above all a Roman who sought, like all the Romans of that period, to emulate the ancient Greek masterpieces.” However, Xenakis was “seduced by its violent sonority, its barbarity” (Matossian 1998, 8), so he agreed to take the commission. It is unclear how much music Xenakis originally provided for the production, but what remains in the published score is a suite primarily taken from the section describing the maritime journey of the Argonauts as they returned with Medea and the Golden Fleece.

There are just five instruments used: E♭ clarinet, contrabassoon, trombone, percussion, and cello. The male chorus sings throughout in a chantlike syllabic style, and their only added percussion are struck pebbles (here in a rhythmic, rather than stochastic, fashion). The vocal parts are mostly in two, often in close harmony, including quarter tones and third tones. The only other sonic extensions in the voice parts are a few moments of unsynchronized spoken and whispered text. The text in that particular passage reaches its most powerful imagery, a significant moment of word-painting:

groaned as if with the sound of thunder;
the trapped sea soaked their peaks
and even the clouds.
Brave Tiphys paled and all
the tiller ropes he let slip from his faltering hand...

The other striking vocal passage comes toward the end. The final two lines of text (“Now, gods, you have avenged the sea enough / spare the man acting under orders”) are set in a faltering way, with each repetition of the initial phrase adding a few more words or syllables until the lines are completed. Xenakis then asks the voices to repeat the whole passage with each voice singing at its own speed, creating a fascinating sonic weave of great rhythmic complexity and raucousness. That this is also the fastest, most rhythmic section, with the drums pounding out the patterns along with the chorus, contributes to its climactic sense.

The wind instruments are treated much as they were in *Terretektorh*, playing sustained tones, often in the extremes of their registers, usually as unstable “quilisma” (sliding in an irregular fashion around the given note, or from one to another) or glissandi, serrated with sudden shifts to flutter-tongue, new dynamics, or contrasting registers. The cello has the additional role of accompanying the chorus throughout the lengthy middle section. The rhythmic, chanting lines of the voices are sporadically doubled or thickened by the cello, requiring quick changes from pizzicato to arco, along with difficult double stops and microtones. The percussion, primarily playing detuned tom-toms, adds a primitive tone to the score, punctuating the texture rather than keeping time.

The music is sectional, but there is a great deal of continuity that heightens the dramatic impact of the work. The voice parts are difficult (particularly the microtones) and the instrumental parts are very challenging as well, making it a piece not easily

undertaken by choirs or theater companies. According to Maurice Fleuret, the original version of *Medea* was not premiered in Paris as intended, but at the Royan Festival (1988, 162). The suite prepared for concert performances was premiered in 1969. Regardless of the problems of presentation, *Medea* is a powerful work.

Polytope de Montréal

In 1966, Xenakis received a prestigious commission to compose music for the French pavilion at the 1967 World Exposition (EXPO 67) in Montreal. He was not invited to design the pavilion itself (the architect was Jean Faugeron, who won the Grand Prix de Rome for it), but Xenakis did construct an installation of cables and lights to extend his music into the visual and architectural realms.¹⁷ This was his first *polytope*, a Greek term derived from *polys* (“many, numerous”) and *topos* (“place, space, territory, location”).¹⁸ Clearly inspired by Le Corbusier’s multimedia presentation *Le poème électronique*, Xenakis was also interested in “repeating on a lower level what Nature carries out on a grand scale” (Varga 1996, 112) in such phenomena as storms, with their dramatic sounds of thunder, wind, and rain together with flashes of lightning. He had been thinking again of architecture in his writings, perhaps touched off by the death of Le Corbusier in 1965, and had given free rein to his imagination in extending designs based on reinforced concrete to unheard of, cosmic proportions (see Xenakis 1976b). Dissatisfied with the rather cavalier approach exhibited by Le Corbusier, Xenakis instead sought “to develop a new form of art with light and sound” (Varga 1996, 112) in which all the elements would be conceived together.

For the French Pavilion in Montreal, Xenakis got the chance to put his dream into practice. Faugeron’s design was several stories high, with an open interior space accessible on all levels. In this central area, Xenakis constructed five networks of intersecting steel cables, each outlining curved geometrical shapes. Onto these cables were attached twelve hundred flashbulbs (eight hundred white, four hundred colored) that could be independently triggered by an ingenious control system of perforated tape and photosensitive cells. Xenakis’s *poème de lumière* comprised a succession of visual configurations such as “arabesques, spirals, layered patches, nebulae, cascades, galaxies, explosions, streams and constellations of stars” (M.A. Harley 1998, 57). The aim was to “create a luminous flow analogous to that of music” (Fleuret 1988, 175), requiring the flashbulbs to be triggered twenty-five times per second to achieve the necessary sense of continuity. Xenakis used interconnected techniques to compose the music and the “poem of lights,” but for him, “the link is not between them but beyond or behind them” (Varga 1996, 144).

The music for *Polytope de Montréal* is scored for four identical ensembles, comprising piccolo, E♭ clarinet, contrabass clarinet, contrabassoon, trumpet, trombone, percussion, violins, and cellos (emphasizing, like *Medea*, registral extremes in the woodwinds and the strident timbre of the cylindrical brass). Although Xenakis specifies a seating plan for the live presentation of the music, placing the ensembles along the four cardinal directions with the audience placed in the intervening quadrants, the music was presented at EXPO 67 by means of loudspeakers, the ensemble parts having been prerecorded in Paris by Marius Constant and the Ensemble Ars Nova.

Like *Terrektorh*, the emphasis is on relatively static sonorities, with dynamic fluctuations swinging the spotlight around from one ensemble to another. In the opening passage, based on long quilismas in the winds, crescendos and accents in the high winds are passed along in one direction (3–4–1–2), at the rate of every four beats (decreasing to three at m. 16), while the low winds pass their crescendo-toaccents along in the opposite direction (3–2–1–4), at the rate of every eight beats (the rate shifts to six beats at m. 11, becoming erratic thereafter). The gongs, punctuating the sonority together with *sfp* trumpet attacks, are also spatialized, rotating according to a different pattern (4–2–1–3, 1–2–4–3, 3–4–2–1). The strings take over in the second section, projecting a high, concentrated, sustained sonority built from quarter tones with the crescendo and decrescendo again being used to emulate the movement of sound from one group to another. Xenakis carves holes in the texture, dropping the strings after each gesture to enable the shifting spotlight to be better perceived. At the same time, a grinding string sonority also starts to be passed around, along with the gong-trumpet sonority and the piercing Japanese woodblock. A fifth sonic layer is added in m. 71 as the four piccolo-E \flat clarinet pairs contribute relatively short quilisma-glissandi of interlaced dynamics contours (when one crescendos, the other drops off). The spatial distribution and rate of succession of these elements is irregular.

The third section, beginning at m. 117, suddenly unites all of the strings on a unison E4, breaking slowly away by means of very gradual glissandi. This large-scale linear motion is broken up by accented ponticello tremolos passed from one ensemble to another at a fairly regular, although generally decreasing, rate. Added to this are interjections of pizzicato clouds (along with the tom-toms); unusually, this sonority is created from members of all the ensembles together. As the violins and cellos reach the upper and lower limits of their glissandi, the sound is thickened by the addition of glissandi in the winds (in the upper and lower registral extremes, for added intensity). As the strings settle on fixed pitches, passing dynamic accents around at a constant rate (3–2–1–4, every eight beats), low attacks are added by the contrabass clarinet and contrabassoon (irregular distribution and rate), the drums (also irregular, though increasing in density), and crescendo-decrescendo gestures in the middle register by the trumpets. The piece ends abruptly, as if torn off rather than concluded.

The overall architecture of the music is clear: there are three contrasting sections, each containing a number of distinct sonic elements that are spatialized according to different patterns and rates. While the music is intense, concentrating on registral extremes and filled with dramatic accents and dynamic gestures, it is not particularly complex. Xenakis had learned, perhaps from his stage music, to leave perceptual space for the visual elements: “We are capable of speaking two languages at the same time. One is addressed to the eyes, the other to the ears. The content of the communication is different but sometimes there’s a link between the two” (Varga 1996, 114).

While his incidental music is usually considered irrelevant to the main concerns of his work, Xenakis surely gained valuable experience from those projects. After all, if we are able to understand two languages at once, they each must not be overloaded with information. Thus, while the succession of visual images for the *Polytope de Montréal* was relatively clear, paralleling the simple outline of the music, the experience of many hundreds of bright lights flashing twenty-five times a second would have been very intense, as would have been the no doubt high-volume diffusion of the music out of

loudspeakers placed around the pavilion. According to Canadian composer Micheline Coulombe-Saint Marcoux, Xenakis's multimedia presentation was a "perfect symbiosis of architectural space and musical structures" (Kendergi 1981, 304). It was also a wonderful exemplar of the confluence of artistic aesthetics and technological innovation celebrated at the EXPO 67. Xenakis would soon return to Canada with a new multimedia work, this time including dancers.

Nuits

First, though, Xenakis returned to the voice, composing his first mature a cappella work, *Nuits* (1968), for a mixed choir of at least twelve voices, uses phonemes derived from the Sumerian and Persian languages and is not connected with any stage work. It is, however, explicitly enjoined to a political statement, dedicated "to you, unknown political prisoners...and thousands of forgotten ones whose very names are lost" (Xenakis 1969). The prisoners named are from Spain, Greece, and Portugal, countries that were all under military rule at that time.¹⁹ Xenakis rarely ties his work to extramusical concerns, but this particular gesture could have been provoked by the rising unrest and activism throughout the world. In the fall of 1967 he had taken a teaching position at Indiana University, a relatively isolated environment, and he may have wanted to make a gesture of solidarity as he watched from afar as the situation developed, particularly in Paris, where student riots erupted in the spring of 1968 (see Matossian 1986, 193–95).

While *Nuits* is not as intricately constructed as *Nomos alpha*, its architecture is certainly elaborate and represents a return to formal musical concerns after his excursions into the outlying territories of stage, movement, and multimedia. At the same time, the voice is certainly the most directly expressive of instruments, and this music projects a raw emotional intensity, particularly in live performance, that derives from the primal quality of the voices themselves. In terms of writing techniques for voices, Xenakis went far beyond anything he had previously attempted. In addition, he made greater use of the materials, honing his developmental skills through controlled changes of selected parameters.

Makis Solomos has studied *Nuits* in detail, and identified ten distinct sonic entities (Solomos 1985). Some are closely related, though, and one may identify others not listed in his analysis. It is clear that entity similarity is important for the articulation of the form. It is helpful, then, to identify four classes of materials, each with a number of variants. An outline of the temporal structure on the basis of these entities shows seven large formal divisions (see fig. 8). There are a number of entity changes within these, serving as transitions (such as the gradual shift from pulsations to vowel sweeps in the second section) or short contrasts (as in the fourth or fifth sections). The class of vertically active material is predominant, being present almost half the time. The main contrasting elements are the sustained sonorities, as might be expected in a choral work. The punctual sonorities—rhythmicized pulsations and percussive glissandi—are even more differentiated, of course, and serve to delineate the form on a larger scale, with sections 2 and 3 functioning as a traditional contrasting B region between two A sections.

Within sections, shifts in register, dynamics, contour range/intervallic scope, degrees of rhythmic independence, and phoneme distribution provide the basis for development, along with the coarser changes of entity. The opening soprano phrase, for example,

unfurls three intertwining glissando contours within a range of a fifth (*D#5-A#5*). Later in the same section, the soprano phrase at mm. 38–43, the range is doubled. Other changes include the shift from phoneme synchronization to inde-

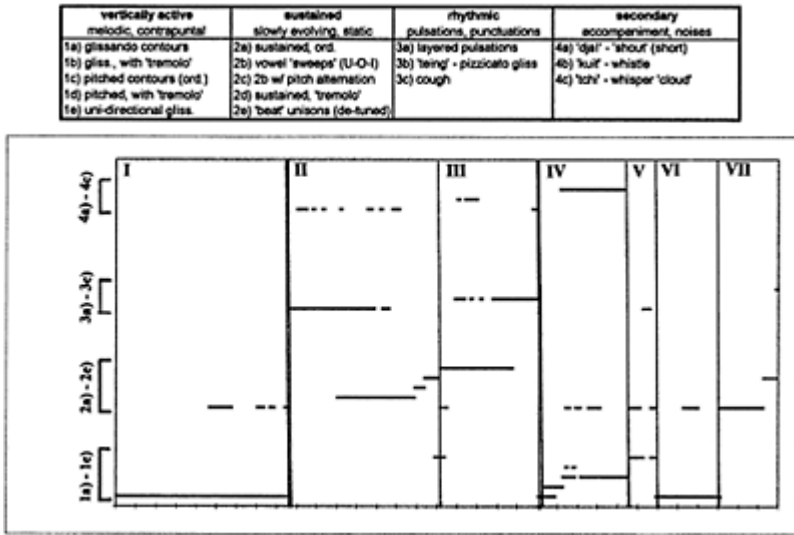


Figure 8. *Nuits*: Table of sonic entities and chart of temporal succession of sonic entities.

pendence (with one coordinated phoneme change at m. 40), and the addition of accents and dynamic shading.

The layered pulsations featured in section 2 strongly resemble Balinese *ketjak* chanting, replete with punctuating shouts. The call-and-response between the choir’s female and male members gives way to tutti chanting, shifting from quarternote triplets to eighths to quintuplet eighths, each set off by shouts. This section culminates in a longer passage of layered pulsations, creating a rhythmic field of great complexity and energy. The pitch organization through this section is fascinating, the chanting beginning on a single central pitch and gradually fanning out with the female voices ascending by quarter tones and the male voices descending in like fashion. This motion is almost imperceptible, because the pitch changes overlap between the different voices, shifting no faster than a quarter tone per two bars in each voice. The resulting cluster-like harmonic sonority is taken over by the sustained entity, featuring continual transformations from one vowel sonority to another (sweeps), as one voice after another begins to sustain the same pitch it had been chanting on. The harmonic process reaches its apex at m. 120, where the voices sound a twelve-note chord spread over three octaves, alternating with a second twelve-note chord. The second aggregate continues through to the next entity, a sustained chord “roughened” by an unusual staccato-tremolo effect, eventually narrowing back in again to the single pitch that carries into the next section.

The overall pitch organization of *Nuits* is not governed by sieves or their permutations. While there are moments in which pitch structures are meant to be clearly perceived, pitch actually plays a relatively minor role in the whole work; and this is in a work that is almost entirely sung (in contrast to vocal works by other composers from the period—Luciano Berio, György Ligeti, and Dieter Schnebel—in which the sonic explorations are more radical)! The passage of relatively traditional melodic counterpoint in section 4 should be noteworthy, but in fact, this passage is difficult to perceive, given the ubiquitous use of quarter tones and the intertwining lines. Xenakis is most careful in his treatment of register, however, and this helps to render complex passages more intelligible. The alternation of viscous passages with others of static or articulatory rhythmic gestures also helps to orient the listener.

Section 6, which appears to be a return to the opening material, is in fact quite different. Whereas the opening section overlaps clearly defined blocks of material in each voice group, the latter section is continuous, with glissando contours flowing seamlessly, twice filling out to include all 12 voices in independent counterpoint. The final passage of sustained notes closes off the piece, ending with a short “cough,” an enigmatic conclusion given the programmatic resonances of the music. (Is it the giving up of a life, that of the prisoners to whom the work is dedicated?)

Whatever interpretations may be attached to *Nuits*, it exhibits remarkable writing for voices, and has been widely performed. With it, Xenakis returned to considerations of melding distinctive performance techniques and sonic entities to a rich architectural form. While his solution here may have been less formalized than earlier instrumental scores, it prepared the way, along with *Nomos alpha*, for the remarkable series of large-scale works he would produce over the next year or two.

Nomos gamma

Nuits premiered at the 1968 Royan Festival. Xenakis received, for the following year, another festival commission, this time for an orchestral work to follow the success of *Terretektorh*. His response was *Nomos gamma* (1969), for an even larger ensemble, again distributed among the audience.

The main difference in instrumentation from *Terretektorh* is the expansion of the percussion section, with eight drummers encircling the orchestra and public. (The brass section, too, is beefed up.) And, whereas the earlier piece winds itself up at the beginning by rotating a single pitch around the orchestra, *Nomos gamma* finishes off by passing short drumrolls around from one percussionist to the next in a dizzying climax that presages Xenakis’s *Persephassa*, for six percussionists, completed a year later. In most other ways, *Nomos gamma* is very different from *Terretektorh*. As the title suggests, Xenakis returned to concerns manifested in *Nomos alpha*, constructing what he claimed to be an even more wide-ranging structure of interlocking combinations of various groups of elements and parametrical sets.²⁰ According to the composer, “the thesis of *Nomos gamma* is a combinatorial organization of correspondences, finite and outside the time of the sets of sound characteristics. Various groups are exploited; their inner structure and their interdependency are put in relief musically.... The isomorphisms are established in many ways,...thus a vast sonic tapestry of non-temporal essence is formed (which incidentally includes the organization of time and durations).” (Xenakis 1992, 237).

In his technical discussion, Xenakis focuses on two sections, the opening melodic passage for oboes and clarinets (mm. 1–15, 15–24; the book gives mm. 1–16, 16–22 instead), and a complex “sound tapestry” for strings from much later (mm. 404–42). In the woodwind passage, the generative elements are “product sets” built from limited collections of pitches, durations, and dynamic levels. It is possible to trace the in-time ordering of the dynamics, which change for almost every note, but the durations and pitches come with built-in ranges (variations), making any such derivation almost impossible without being given details of the “translations and homothetic transformations” (Xenakis 1992, 238). The second part of this passage adds “playing mode” to the equation, with the three elements—normal, fluttertongue, quilisma—being distributed and rotated among the three oboes and three clarinets and linked to the ever-changing dynamic levels. The sonic result of this opening melodic passage is a folk-like heterophony of reed instruments unfolding intricate phrases within a narrow range replete with exotic-sounding quartertones²¹ and intensified by the addition of flutter-tonguing and quilisma. Xenakis does not mention the *ffff* outburst of the drums in mm. 3–5, and the interjection of the strings in m. 11: these moments, particularly the percussion sounds, reappear throughout, and serve to fracture otherwise linear, continuous textures.

In *Nomos gamma*, for the first time, Xenakis treats the four instrumental families of the orchestra as equals. Each has its own characteristic material, although there are moments of synchronicity when the material transcends the typecasting. The horns are treated as belonging both to the brass and to the woodwinds (a traditional strategy). At m. 20, a horn enters in its low register with similar melodic material to the higher woodwinds, carrying on the in-time unfolding of this compositional element. The three phrases are each played with a different playing mode, before all six horns enter at m. 34 on a sustained cluster combining all three entities. This switch from a melodic orientation to a harmonic or textural one highlights the intricacy and richness of Xenakis’s group-derived combinatorial approach. As the woodwinds and horns are spinning their phrases, the rest of the brass enter (from m. 21), aggressively pulsating a single pitch, *C4*, intensified by the inclusion of a quarter-tone neighbor. This supporting (or challenging?) sonority lasts until the second percussion outbreak at m. 26, which is followed by the second string interjection (mm. 28–30). When the horns shift to the cluster at m. 34, this gesture is heard as an outcome both of the melodic woodwind material (same range, same playing modes) and of the previous brass entrance. Then, out of the horn cluster comes a trumpet solo, fixed in a very narrow range around *C4*, which carries on the melodic impetus of the previous section, transforming the music’s character through faster rhythmic units and staccato articulations.

As the horns pass off to the trumpets, the timbral emphasis of the music shifts definitively from the woodwinds to the brass, who remain prominent right through to m. 131, when the attention shifts back to the woodwinds. Indeed, the piece is clearly designed with these emphases in mind (see table 5),²² though of course there are many juxtapositions and interjections by the other instrumental families.

The drums, which take over the main spotlight in the final section, are heard almost half of the time. The degrees of density vary, naturally, but this powerful presence is a dominant force in shaping the overall character of the music. The impact live, with the performers spread out and the percussionists placed around the perimeter of the performance space, would be dramatic.

There are two additional points in the score marked by fermatas, which are strong indicators of formal divisions, normally. Both of these occur in section 2, where the brass predominate. The first occurs at m. 80, after a passage of clusters involving all the low-pitched instruments of the orchestra. This sonority was foreshadowed in mm. 37–40 as an additional element signaling the shift from horns

Table 5. Formal Outline of Timbral Emphasis in
Nomos gamma.

Section 1: mm. 1–24 (0:48)—woodwinds

Section 2: mm. 25–130 (6:45)—brass

Section 3: mm. 131–229 (4:12)—woodwinds

Section 4: mm. 230–441 (7:02)—strings

Section 5: mm. 442–559 (3:10)—percussion

to trumpets. It reappears in mm. 56–61 and at a number of other points. The passage at mm. 71–80 halves the tempo and ruptures the flow of the music, introducing the first moments of silence. The brass music carries on, regardless, featuring the tuba as melodic soloist at m. 81, again limited to the narrow range around *C4*, its material being a complex mixture of shifting articulations, dynamics, and playing modes. The strings interject as before in mm. 84–86 and 90–94. The tuba is joined briefly by trumpets and trombones before the music breaks off again with another fermata at m. 100. Following this, the entire brass section enters, projecting a cluster in the same central register, elaborated by means of layered dynamics, playing modes, articulations, and narrow melodic phrases in individual instruments. The percussion drops out at m. 103, leaving the brass in the first significant passage without any other instrumental group.

At m. 114, having concentrated much of the focus of the music up to this point on this narrow central pitch range, Xenakis opens out the ambitus in an extraordinary passage of slow brass glissandi (the trumpets and horns are expected to approximate as best they can by means of alternate and half-valve fingerings, embouchure changes, etc.).²³ The waves of glissandi slowly unfold, expanding and then contracting again, finally leaping up to a unison *A4*, intensified by rapid dynamic fluctuations (creating a sort of amplitude modulation effect) and quarter-tone oscillations. The focal pitch is scored very high for the trombones and tuba, contributing to the intensity of the sound. Xenakis would include similar moments in other works, notably *Kraanerg* (1969) and the extraordinary opening of *Aïs* (1980).

At last, the music shifts back to the woodwinds, where it focuses on the registral extremes, first in the high instruments, with a bassoon adding the strained tone of its highest range. The contrabassoons (there are *three!*) enter soon after, filling in the low register. The music proceeds as a mixture of melodic figures, again held to narrow ranges, and sustained pitches. As before, there is a rotation of playing modes, here expanded to include flutter-tongue along with staccato tonguing, quilisma quavering, and normal sound. The strings are more active at the start of this section, contributing three closely spaced interjections. Later in the passage, the horns join the woodwinds, providing a timbral transition to the closing passage of this section, featuring long

sustained notes in the extreme high and low registers distributed over the full orchestra, ending with a fermata. This passage is very similar to the earlier one (mm. 71–80) that featured the low instruments exclusively.

There follows the longest section of the piece, featuring—at last—the strings. The string interjections to this point were built from the complex “sound tapestry” Xenakis describes in *Formalized Music* (1992, 239–41). Eight playing modes are distributed and rotated among the sixty instruments spread across the full register, each with independent dynamics and rhythmic phrasing (see table 6).

Xenakis divides the strings into six groups using a group rotation process to assign playing modes to each. In the score, there are generally two or three instruments assigned to each line, but with the players distributed throughout the performance space perfect accuracy is rendered virtually impossible, producing an even more complex texture than the notation indicates. This lengthy section for strings (with different wind instruments joining in on occasion, and with numerous

Table 6. *Nomos gamma*: String Section Playing Modes.

bridge, tremolo
 bridge, tremolo/trill
 sul ponticello, arco
 sul ponticello, tremolo
 natural harmonics
 col legno, irregular/dense
 arco ordinario, tremolo
 pizzicato—glissando

percussion perturbations) is built from an alternation of these highly complex, “dispersed” passages with single or dual sonorities, “compacts,” as Xenakis describes them. The in-time structure is built from the interlocking successions of textural blocks (dispersed or compact) and the reassignment of playing modes, each structural unit being of a relatively short duration. Larger segments are formed from groups of “compact” units having identical or related playing modes, such as the first two (playing modes 5 and 1), the next three (playing mode 6), the next two (playing mode 8), and the next three (playing modes 3 and 4, both sul ponticello effects). Within the “dispersed” passages, the two large divisions of the strings (each comprising three groups) are often treated independently in terms of succession and rotation of material. There is a noteworthy passage (mm. 362–65) in which the second set of strings directly imitates the first, one measure later. However, given the complexity of the overall sonority, this relationship would hardly be apparent to the listener.

This long section featuring the strings is highly organized but at the same time quite static in terms of teleological orientation. At its end, the strings are swept away by a loud unison roll on the drums, leading to the final dizzying passage in which the sound is swirled around the perimeter of the orchestra at a relentlessly fast pace. These rotations

are articulated by a complex distribution of accents, rendering the repetitive circling of drumrolls more engaging intellectually. In addition, the drums break out of their spatorhythmic ritual on six occasions, each time after a different interval of time. They break out again one final time to end on a sustained unison roll. The winds and strings periodically enter with tight clusters in the middle register. Each sonority descends almost imperceptibly, a quarter tone at a time, creating a disorienting effect, particularly when coupled with the vertiginous effect of the drums.

Nomos gamma is not a particularly linear or goal-oriented work. The grouptheory approach enabled Xenakis to build up large, unified sections by combining smaller units in turn built from successions of particular sets of parameters (dynamics, pitches, etc.). For the largest-scale organization, Xenakis relied on his intuition, choosing to group the material according to timbral and registral considerations. Thus, the new compositional techniques developed for *Nomos alpha* and extended in *Nomos gamma* reinforce Xenakis's predilection for creating music on the basis of sonic entities. He would refine his approach to large-scale form by further exploring outside-time structures and temporal proportioning.

Kraanerg

As it turns out, Xenakis soon received a fortuitous opportunity to apply himself to a large-scale work: a full-length ballet. The well-known French choreographer, Roland Petit, had accepted a commission for the launching of the National Arts Centre in Ottawa, Ontario, and he was promised his choice of soloists, set designer, and composer.²⁴ French composer-conductor Marius Constant, who wrote the music for Petit's previous work *Paradise Lost* (1967) was a natural choice, but he was unable to take on the project. In the meantime, Xenakis had become known in the dance world thanks to Paul Taylor's 1967 choreography for *Atrées*, and an acclaimed setting of *Metastaseis* and *Pithoprakta* by George Balanchine and the New York City Ballet in 1968. Whether it was Constant's recommendation that influenced Petit's decision, or the favorable reviews from New York, Petit invited Xenakis to collaborate on the project. Xenakis had approximately six months to complete seventy-five minutes of music and to have it recorded by the time rehearsals were to begin in April 1969.

Unlike his earlier incidental music, Xenakis was given no text or story line for the ballet. He had complete freedom, the only limits being the duration (not *less* than seventy-five minutes!) and the size of the orchestra (chamber rather than symphonic). However, the National Arts Centre was decidedly interested in a modernist creation, given its architecture (tiered concrete honeycombs) and the progressive spirit prevailing in cultural circles in Canada, fresh from the success of EXPO 67 in Montreal (where Xenakis himself had made a strong impact). In addition, the administration was anxious to display its state-of-the-art facilities, including a multispeaker, multichannel sound system. Thus, an electroacoustic component was encouraged, which Xenakis was happy to provide given his experience in that domain.

Xenakis brought op artist Viktor Vasarely into the project. During his association with the Groupe de Recherches de Musique Concrete, Xenakis had produced the soundtrack for a short 1960 film on an exhibition by the Hungarian-French artist, and he admired his work. The choice proved an excellent one, as the black-and-white geometrical design

Vasarely produced, including backdrops and a huge cube and sphere suspended from the ceiling, was visually striking, fit well with the modernist theme, and “superbly supported the music” (Barnes 1969). Plans to bring Rudolph Nureyev in as soloist came to naught, so Petit settled on Georges Piletta, from the Paris Opera Ballet, and Lynn Seymour, a Canadian dancing then for the Berlin Opera Ballet. Xenakis brought in Lukas Foss, who had performed his works in New York, to conduct the orchestra. Given the occasion, the inauguration of a major cultural center in the capital city of Canada, this project received a great deal of international attention.

Kraanerg (“to perfect, accomplish”; “[cerebral] energy”), a title chosen by Xenakis, is concerned, according to the composer, with “the overwhelming fight of man’s brain and the [un]ending obstacles that exist or that he himself creates.”²⁵ Petit responded in quite a literal way to the sense of the title, noting, “*Kraanerg* has no plot. Each of us must freely interpret the choreography.... We have tried to use all our energy to attain a sense of accomplishment and perhaps, with a little luck, each of us will approach his own level of perfection” (Petit 1969).

Petit also drew Vasarely’s decor into his interpretation, citing the ancient symbolization of the circle and square, and linking them to modern topology and transformation. Xenakis, however, acutely conscious of the ferment of student demonstrations going on throughout that period, extended the sense of intellectual struggle to global concerns. Petit does not seem to have responded to this aspect of *Kraanerg* at all. The choreography, “energistic, gymnastic, asexual” (Roosevelt 1969), by most accounts appeared to have been imposed onto the music with little regard for its particular expressive force. Clive Barnes (1969), influential dance critic of the *New York Times*, was blunt in his assessment of the premiere: “The choreography by Roland Petit is totally inadequate to the music.... The groupings are often formal, the invention is both pained and painful, and his sensibility toward the music appears minimal.”

The music of *Kraanerg* is conceived as a vast, continuous structure, built from blocks of material alternating between the recorded sounds on tape and the live orchestra. There are numerous silences, but they serve as an integral part of the structure rather than as pauses between sections. The four-track tape part consists of orchestral sounds (processed in the studio), similar in nature to the material performed live.²⁶ The music consists in large part of a dialogue between these two elements, with a subdialogue occurring between the winds and the strings in the live ensemble. Within the blocks of material for each instrumental group—woodwinds, brass, and strings—there is a further subdivision into contrasting textures.

The static sonorities of the winds bear a strong resemblance to *Akrata*, as in the opening passage of staccato pulsations passed around the ensemble. There are, however, many solo passages throughout *Kraanerg* in which individual instruments play melodies in the style of the opening woodwind section of *Nomos gamma*: phrases of narrow range using microtones, numerous dynamic shifts and fluctuations, and rotating playing modes such as flutter-tongue, quilisma, and so on. There are, in fact, numerous similarities to *Nomos gamma*, understandable considering their chronological proximity, the similarity of compositional means (grouptheory structures and orderings), and the immanent deadline for this monumental score. The passage for brass at 19’30”²⁷ for example, is derived from mm. 114–30 of the earlier score, though the order of elements is reversed. And, though the forces are much reduced, from sixty players to twelve, the string

material strongly resembles that of *Nomos gamma*, particularly in the alternation between complex dispersed sonorities and compact blocks of single or dual entities. The chief difference between them is the greater attention given in *Kraanerg* to glissandi.

Aside from the blocklike alternation and superposition of live ensemble and tape, perhaps the piece's most distinctive element is the major role given to silence. There are twenty such moments, including three intended to be at least twenty seconds in duration (although none of the available recordings hold out that long). Overall, *Kraanerg* divides itself into three large sections of approximately equal length, the first trading off more or less equally between orchestra and tape, the second (beginning at 23'00") primarily featuring the orchestra, and the third (from 52'00") featuring the tape. The final section is perhaps most differentiated in that it is built from three very long tape passages, each sounding for at least six minutes without any interjection from the live musicians.

For the original choreography, Petit paid scant attention to the structural organization of the music. He created a ballet of eleven movements with an intermission, and included overtures to raise the curtain for each half. The National Ballet of Canada, having invested heavily in the work, performed it in Ottawa for the premiere, then again in Toronto in November 1969. Having negotiated exclusive rights to the work for two years (later extended to three), the company toured the piece in North America in 1971, and then Europe in 1972. After that, the work languished. The music has been performed in concert, but it was not until 1988 that a new choreography was created, this time by Graeme Murphy of the Sydney Dance Company.²⁸ The critics were much more positive, and the continuity of the dance was thought to better reflect the awesome sweep of the music.

Just prior to the premiere of *Kraanerg*, Maurice Béjart presented a new choreography of *Nomos alpha* for solo dancer and onstage cellist, at the Royan Festival (where *Nomos gamma* was receiving its premiere). According to the composer, the dancer imitated the music such that "if there is an ascending glissando in the piece, he makes a sort of ascension with his body" (Delalande 1997, 80). Xenakis was not happy with the comic parody that resulted, considering the direct correspondence between movement and music "redundant" (81). On the other hand, he was very impressed with Balanchine's work, and the admiration was mutual: Xenakis received a commission from him for a new ballet. *Antikthton* was to have been presented in 1971 but, unfortunately, it never was.

Over the years, numerous choreographers have set scores by Xenakis. No doubt, they respond to the visceral energy and raw intensity of the music. One critic, in reference to the *Kraanerg* ballet by Graeme Murphy, asked, "How do you choreograph this apocalyptic music: The simple answer is, you can't. Petit tried in 1969 and was overwhelmed.... Instead, having absorbed the music, Murphy came to regard it as a great building, some gigantic powerhouse which had to be entered with dance of complementary energy.... Performed in parallel, the dance inspired by the music yet totally different, the two streams touching yet never merging, it all becomes an astonishing display of the creative process at work" (Hoad 1988).

Anaktoria

Prior to work on *Kraanerg*, which came along rather suddenly (and which must have been all-consuming for several months), Xenakis had been working on sketches for what would become *Persephassa*. Before he set back to work on that, he undertook a commission for the Octuor de Paris, a chamber group known for its performances of Mozart divertimenti and the like. For the group's classical instrumentation of clarinet, bassoon, horn, and string quintet (including double bass), Xenakis created perhaps his most extreme sonic exploration to that point, *Anaktoria* ("beautiful as a palace"; the name of Sappho's lover), which he completed in May 1969.

All of the material for the strings is familiar from earlier scores, the chief difference between this score and *Nomos gamma* or *Kraanerg* being the focus on one sonority at a time (with occasional overlaps) rather than "dispersed" textures (there are three brief mixed sonorities toward the end: mm. 283–85, 289, 322–23). The blocks of material are also treated with more finesse, using clearly shaped gestures and dynamic transitions. With the strings acting as a unit, the dialogue takes place between the winds and the strings, with the sonorities at times coinciding, contrasting, or featuring one group or the other. The clarinet is treated the most extensively, in terms of sonic exploration. The bassoon and horn, however, are also required to play in the extremes of their registers along with wide-ranging glissando contours, microtones, and so forth. The elaborate, narrow-range melodic passages are familiar from *Kraanerg*, but the multiphonic sonorities of the clarinet are new. These intense, at times squealing, sounds are presented in two passages (mm. 237–52, 294–36), the latter providing a haunting conclusion. Xenakis uses the strings to set off the spectral qualities of the clarinet with natural harmonics and an on-the-bridge "scrubbing" sonority that activates the upper partials of the open strings. A tribute to Olivier Messiaen may be heard in the extremely long crescendo and decrescendo by the clarinet (mm. 235–36), recalling "Abîme des oiseaux" from Messiaen's *Quatuor pour la fin du temps* (1941). Perhaps *Anaktoria*'s premiere at the Festival d'Avignon, site of Messiaen's birthplace, sparked the reference.

The formal design is relatively supple, being shaped from the succession of sonorities, at first separated by silences, then overlapped or leading on directly from one to another. The opening concentration on timbral and microtonal variations of a single pitch (*B4*) nicely balances the concluding focus on multiphonics and split-tones of the lowest note of the clarinet (*D3*). In between are passages of greater rhythmic and melodic activity.

Needless to say, *Anaktoria* presented enormous challenges to the classically oriented Octuor de Paris. The ensemble nonetheless tackled the score with great commitment, eventually performing it over 150 times around the world. Apparently the greatest problem in performing it turned out to be programming its place in the concert. As Jean Leber, leader of Octuor de Paris has noted, "the musicians discovered that they could not play anything else after *Anaktoria*, especially not a classical work. The reason is not aesthetic, but physical: the concentration of raw sound, its blending in all directions and all dimensions requires considerable strength and power, and leaves the [musicians' bodies] in a state of great tension" (Leber 1996, 8).

Anaktoria may be a music of beauty and love, but it is certainly not sentimental or "romantic." At the same time, it provided an opportunity for Xenakis to explore new

timbral possibilities within a relatively modest context that suited a rather intuitive approach to musical architecture. He would then return to work on a large-scale piece he had set aside, one that carried the concerns of group theory explicitly into the realm of rhythm. It would also mark his first essay in a medium (percussion) for which he would become renowned.

Persephassa

Persephassa was commissioned for the first Shiraz Festival, held in the ruins of Persepolis, an important center of the ancient Persian dynasty. The score was written for the French group Les Percussions de Strasbourg. Carrying on his spatial concerns, Xenakis places the six players in a hexagonal formation surrounding the audience, with the players potentially at quite a distance from each other. With little direct regard for the difficulties synchronization poses in such circumstances, particularly without a conductor, he created an extraordinarily virtuosic study of rhythm and tempo.²⁹

The final section of *Persephassa* owes a great deal to the concluding section of *Nomos gamma*, although in the new work Xenakis creates an enormous accelerando, building up as many as six layers of spiraling patterns swirling around the listeners. The tempo of that passage winds up to 360 beats per minute, with one complete rotation of rolled accents around the six players every second. As in the orchestral work, these mesmerizing patterns are enhanced by isolated dynamic accents and by interruptions of silence or stochastic clouds of percussive sonorities (Xenakis adds metallic and wooden instruments, pebbles, and mouth-sirens to the drums of *Nomos gamma*).

The balance of the piece is less concerned with linear patterns of spatializing sonorities. There are passages of rhythmic imitation, and the lines are usually superimposed to create complex textures. Significantly, the imitative material derives from sieve structures, applied to durational intervals rather than pitch. If a temporal unit of pulse (e.g., a sixteenth note) is taken as the “step” value, then rhythmic patterns can be generated by treating the intervals between points of the sieve as durations. At mm. 221–22, a rhythmic sieve-pattern is stated first by a single player, then by all six, each coming in independently at a different tempo, creating a complex rhythmic counterpoint, but one in which the “theme” is clearly intended to be recognized (see fig. 9). In this central passage (mm. 221–26), there are two different, but related, sieves presented, both derived from combinations of the values 1–2–3:

Sieve I: 1–1–2–2–1–3–2–1–2–2–2–1–1–2–1–3–1–1–1–2

Sieve II: 1–1–1–3–1–2–1–1–2–2–2–1–2–3–1–2–2–1–1–2.

There are five presentations of these sieves, the latter four utilizing the second sieve, fracturing and reordering it after the initial presentation.

The other major innovation Xenakis explored in *Persephassa* is the layering of regular pulsations. In the first part of the piece, he creates cross-rhythms through the superposition of different subdivisions of the beat, the first coming at m. 62.

The image shows a musical score for six percussion staves, labeled A through F. Above the staves, there are rhythmic patterns: '1 1 & 2 1 3 2 1 & 2 2 1 1 & 1 ...' above staff A, and '1 1 & ...' above staves B, C, D, E, and F. The staves contain rhythmic notation with various dynamics such as 'p' (piano) and 'ff' (fortissimo). The score is for the piece 'Persephassa' at measure 222.

Figure 9. *Persephassa*: Rhythmic sieve, in imitation and layered tempo, m. 222.

The regular half-note pulsation begins to be disrupted by the addition of a quintuplet pulse (the interval lasting nine eighth-note quintuplets, just under one measure in duration), then a triplet pulse (five quarter-note triplets, again just under one measure in duration). In effect, the pulsations occur at a tempo ratio of 72:40:45.2. This interplay continues from m. 62 to m. 144, comprising most of the first main section.

After a canonic passage, Xenakis expands his treatment of layered pulsations in the next section, requiring the performers to switch from a common tempo and meter to independent tempi where no sense of meter (or ongoing temporal reference) is preserved. The tempos utilized form a ratio of 19:20:21:29:37:39. After introducing these layers of unadorned pulses, articulated by each percussionist on a single tom-tom, the music branches out into different rhythmic patterns, dynamics, and drums. The five statements of sieve-patterns (already discussed) are set within this context of independent tempi, leading back to a uniform pulsation as the music shifts, for the first time, from the skin instruments to the metallic and wooden ones (mm. 231–351). This passage, in which different instrumental timbres are introduced and mixed, summarizes the various approaches to rhythm employed in the rest of the piece: unified pulsations; subdivided pulsations and rhythmic patterns; layered tempi; thick clouds of percussive sound both notated and improvised; and atmospheric sonorities featuring sirens, maracas, tom-toms, pebbles, low drumrolls; and so on.

Taken as a whole, *Persephassa* presents an exploration of pulse, meter, and rhythm, its large-scale form being articulated by clearly defined sections.³⁰ The first (mm. 1–191) is introductory, presenting the sonority of the drums through dynamically fluctuating rolls, expectant silences, and strongly metric pulsations (eventually subdivided), and the imitative passage that is not strongly metric but rhythmically “motivic.” The second section focuses on the layered tempi, while the third features the full range of instruments

(skins, metals, woods, etc.). The final section is constructed from the spatialized patterns built up over the course of a long *accelerando*, fractured by moments of silence and stochastic clouds of various sonorities. There are numerous overlaps, of course, in terms of shared materials or compositional processes. The overall architecture is much more difficult to derive directly from group theory than, say, the architecture of *Nomos gamma* is. Still, *Persephassa*, in the sum of its parts, is well-described as a “fresco” (Gualda 1981, 249). The spatialization of the basic elements of pulse and timbre in both space and time³¹—spectacular in the original setting of Persepolis, no doubt—represents its crowning achievement.

The Polytopes

It will be useful to break out of chronological sequence to discuss the polytopes of *Persepolis* (1971) and *Cluny* (1972) within the context of the stage, spatialized, and multimedia works. With the success of *Persephassa* at the 1969 Shiraz Festival, a larger work was commissioned from Xenakis to open the 1971 festival, to celebrate the 2500th anniversary of the Persian monarchy (M.A. Harley 1998, 58). Prior to embarking on this project, however, Xenakis was asked to contribute an installation of sound and light to the Iranian Pavilion at the 1970 World Exposition in Osaka.³² For the same event, he was commissioned to contribute a tape work to a Japanese pavilion (sponsored by the Japanese Steelworkers Federation). The attraction of this project was that the music would be projected through a sound system of 800 loudspeakers grouped in 250 locations.

Hibiki-Hana-Ma (“reverberation-flower-interval”) is just under eighteen minutes in length and was originally composed for twelve tracks, later mixed down to eight for concert diffusion. The music was recorded and assembled at the electronic music studio of Japan Broadcasting Corporation (NHK) in Tokyo. Xenakis had access to an orchestra there, and much of the material comes from orchestral sonorities (typical textures from existing scores with emphasis on strings, particularly glissandi and natural harmonics). To this he added the Japanese plucked biwa and some percussion sounds. As in the tape part of *Kraanerg*, there are varying degrees of studio manipulation of the instrumental sounds, from virtually none to so much that the original sources are unrecognizable. There is a much wider range of sounds presented in *Hibiki-Hana-Ma* than in the earlier ballet, which is understandable considering that the tape is the only sound source. The possibility of deploying up to twelve channels enabled Xenakis to build up layers and complex superpositions of sonorities.

The music is put together from blocks of material spliced into the different channels, in a similar process to *Kraanerg*, extended from three or four layers to twelve. There are many sudden shifts of sonority, density, and intensity, and various layers are brusquely cut in or out. Major articulation points serve to loosely divide the piece into four sections. The first, lasting up to the 3'00" mark, is built from a low, booming, undulatory sonority over which orchestral string sounds are layered, primarily built from glissandi of different speeds, directions, and densities. A sweep up to a sustained high-register cluster signals the start of the second section, which introduces a layer of tinkling bells, stochastic clouds of whips and pizzicati, and much else. A sudden drop in dynamic level and

number of layers at 6'32" signals a new section, although it features successions of a wide range of sonorities, most of which were heard in the previous section. The orchestral winds are introduced, in both sustained sonorities and glissando textures reminiscent of similar passages in *Nomos gamma* and *Kraanerg*. At 11'07", another sudden drop in intensity/density signals the final section. This is the longest and most sustained of the four, introducing various noise-based sonorities of both the sliding and fixed-band types. These continue to the piece's end, layered with previously introduced sounds. The impact of hearing this wide range of sonorities, both sustained and percussive, being projected through a large, spatialized sound system would surely have been powerful.

The dynamic light sculptures and laser projections presented in the same pavilion by Japanese artist Keiji Usami made a great impression on Xenakis. He was particularly interested in the new technology used to control the paths of the lasers and the synchronization of the lights with the sound, especially in view of the problems of precision and speed he had encountered in his *Polytope de Montréal*.

Given the location of his next multimedia project within the archeological site of Persepolis, Xenakis was not able to construct an edifice along the lines of the Philips Pavilion or even an installation such as the *Polytope de Montréal*. Instead, two lasers and ninety-two other spotlights were distributed throughout the site and projected to create "luminous patterns evoking the Zoroastrian symbolism of light as eternal life" (M.A. Harley 1998, 59). From the central portion of the site, where fifty-nine loudspeakers projected the eight channels of sound throughout the audience, the lights swept upward and out toward the hillside tombs of Darius and Artaxerxes. In the distance, bonfires were burning, and parades of children carrying torches wended their way up the hillsides, creating ever-changing linear patterns.

The music, with its noisy sonorities and ever-heightening waves of intensity, recalls *Bohor*. However, *Persepolis* is fifty-six minutes in length,³³ a very long span for a continuously evolving form. According to his sketches, Xenakis constructed the tape from eleven sonic entities, distributed among the eight channels (see fig. 10).³⁴ Multiple layers of similar material create overall textural "zones" that serve to delineate the form, though the shifts from one to another are not easily perceptible. The sonic entities range from textures created from clarinet multiphonics (3) to: complex, high sustained sounds derived from string harmonics (2); low, sliding distortions of timpani rolls (9); gongs (7); and ceramic wind chimes (11). Others are harder to identify, but one seems to have been derived from recordings of cardboard being handled (6), and another sounds as if a strong, buffeting wind had been fed through a distortion module (8). The remaining entities can be identified as metallic, noisy sonorities. Not used at all in the first part are 1 and 4, as they occur only in the final moments. None of the entities are simple or "pure" sonorities, by any means, and the sonic intensity is often overwhelming. All of the material is developed, of course, rather than just repeated, so that the music evolves, while remaining unified, over the course of its journey through this thick, shrouded soundscape.

Hearing the music within the dark ruins of *Persepolis* out in the desolate beauty of the Iranian desert with spotlights sweeping the sky and fires burning in the distance must have been an awesome experience. Its success was such that Xenakis was apparently commissioned to design a "city of arts" for a hillside site near Persepolis. This project

never worked out, but Xenakis immediately embarked upon another polytope, this time for a location right in the heart of Paris.

Polytope de Cluny (1972) was commissioned for the Festival d'Automne, and was set in the historic Roman baths of Cluny, just off the Boulevard Saint-Germaine-Près. It premiered in October 1972, and its success surpassed anyone's wildest expectations. It ran for sixteen months, four times daily, with the audience figures reaching over 200,000. As M.A. Harley has noted, Xenakis had become a symbol for students protesting against tradition and the status quo: for instance, the graffiti slogan "Xenakis, not Gounod," was scrawled on the walls of the Conservatoire National Supérieur de Musique de Paris.³⁵ Those young people, seeking "music that transcended the limits of tradition and nationalism" and rejecting the "formal apparel and conventions of behavior" of the concert ritual, thronged to Cluny, where they "sat on the floor, surrounded by strange sonorities

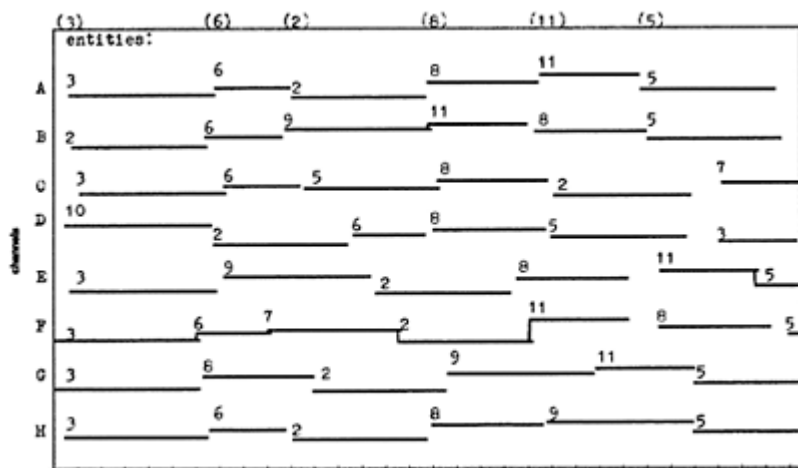


Figure 10. *Persepolis*: Chart showing succession of sonic entities for each channel to the 31'30" mark, with predominant entity given at top (adapted from composer's sketches).

and subjecting themselves to perceptual and aesthetic experimentation" (M.A. Harley 1998, 59).

The T-shaped chambers of Cluny, being part of this historic monument, were not to be altered, so Xenakis's installation was erected within the walls by means of scaffolding and cables. As in the *Polytope de Montréal* there were flashbulbs (here six hundred in number), as well as three lasers—red, green, and blue—directed along paths determined by four hundred adjustable mirrors. All of the operations concerning the overall forms and specific sequences of the flashbulbs and lasers were programmed on a computer and then converted into electromagnetic signals.³⁶ These were recorded onto the eighth track

of the tape containing the music, which was mixed onto the other seven tracks and distributed over twelve loudspeakers placed around the performance space. In this way, the signals controlling the lights could be precisely coordinated with the sounds.

While the music was coordinated with the lighting effects, they were otherwise completely independent: “‘I wanted to establish a contrast: the lights are a multitude of points, with stops, starts, etc., and the music is continuous, for although the sound changes it does not stop,’ explained Xenakis” (Fleuret 1972, 34). The event, which ran some twenty-five minutes, falls in between the six-minute duration of the *Polytope de Montréal* and the hour-long *Persepolis*. The music bears some resemblance to the Iranian piece, and, indeed, borrows some of its sonic material. There is also much that is new, of course, including a wild, brassy sound that is treated extensively throughout. There is a greater prominence given to percussive sounds, the ceramic windchime entity from *Persepolis*, for example, and a plucked African thumb piano. One of the most striking moments comes toward the end, when the music suddenly focuses exclusively on the thumb piano, plucking a single note slowly and evenly. The rhythmic organization of this sonority eventually becomes more complex, but the ear has in the interim become focused on the incredible richness of its rattling, buzzing resonances.

The sounds are layered and distributed across the seven channels, in similar fashion to the earlier pieces, although the density is not as high, perhaps in deference to the vaulted, reverberant performance space. New to *Polytope de Cluny* is the inclusion of synthesized sounds created by means of computer programming. Xenakis was proud to have been the first in France to use digitally synthesized sounds, although similar work had been underway in the United States for over a decade. The relatively minor role played by synthesis here (and in the next electroacoustic piece, *La Légende d’Er*) nonetheless gave impetus to the engineers working at the Centre d’Etudes Mathématiques et Automatique Musicales to develop a computer system for creating music. It was to be unveiled in 1978, along with Xenakis’s first all-digital creation, *Mycenae alpha*.

Throughout this period when Xenakis was working on creating sounds by means of mathematical functions programmed on a computer, he was also exploring new ways of generating instrumental sounds—specifically, melodies. These concerns would preoccupy him throughout the next decade.

5

Arborescences, Random Walks, and Cosmic Conceptions

In 1969, after completing *Persephassa*, Xenakis embarked upon his first concertante work, for piano and orchestra. *Synaphai*, meaning “connexities,” was commissioned by the Pro Arte Symphony of Hofstra University in the United States, but was premiered at the 1971 Royan Festival by French pianist Georges Pludermacher with the Orchestre Philharmonique de l’ORTF, led by the young Swiss conductor Michel Tabachnik.¹ There are similarities to earlier works, so it is likely that group-theory techniques played some part in the compositional process. Xenakis, though, was interested in exploring something new. *Synaphai* manifests two aspects of the notion of continuity, involving the musical material and the formal construction.

The first element of “connexity,” featuring the piano, takes a different approach to the instrument from the rather statistical treatment of *Herma* or *Eonta*. Throughout most of *Synaphai*, Xenakis contrasts a “hard” or “dry” style, in which the notes are accented and played very rhythmically, with a “liquid, legatissimo” style, in which rapidly rearticulated notes are shaped into curling tendrils resembling glissandi. These lines, or bundles of linear fragments, create complex polyphonic textures, often directional overall but with a rich inner form. In the glissando gesture that concludes the work, for example, the composer brings together two separate strands from opposite registral extremes, dropping to the low register as the piano gives way to the rolling tom-toms. The drums appear there for the first time, recalling *Terretektorh* and *Nomos gamma*.²

The piano part is extremely difficult to perform. One problem of interpretation arises from trying to determine whether or not Xenakis intended the glissando notation to indicate that the chromatic passing tones in between the written notes are to be filled in.³ The layers of melodic threads are all notated on separate staves, sometimes with independent dynamics, reaching at times beyond ten simultaneous lines. As the composer notes in the forward to the score, “The pianist plays all the lines, *if he can*” (Xenakis 1985a; emphasis added). The effect is to create a fluid, quicksilver sonority, linear and often strongly directional. These passages are prototypes of what Xenakis would come to call “arborescences,” proliferations of lines created from a generative phrase or contour, used to great effect in later pieces.

There is a direct correlation between the piano’s liquid figurations and the glissandi of the orchestral strings in mm. 120–49, played tremolo in imitation of the repeated notes of the piano, and the woodwind glissandi just following (mm. 161–75), taking over the same

register as the piano's figuration. These parameters, tremolo articulation and registral placement, are used to establish connections between piano and orchestra, a relationship made even more explicit by the temporal juxtaposition of the material. Over the next decade, Xenakis would become more nonlinear in his presentation of such parametrical similarities.

The second element of continuity explored by the composer is the construction of form on the basis of various proximities and similarities between elements. There is an accelerating-decelerating rhythmic figure, for example, first occurring in the "hard" element of the opening piano material. It is found throughout, in all instrumental groups. The identifying pattern is not always easy to discern as it is often layered across several strands of music with a complex "inside-time" distribution. At other times, however, it is used to create zones of increasing or decreasing temporal density. And, in the latter part of the piece, where short blocks of material are traded off between strings, brass, and piano, the timbral contrasts are mitigated by the shared use of this rhythmic figure. It is this multilayered, or multidimensional, approach to form that contributes a sense of suppleness and depth to Xenakis's music sometimes lacking in earlier works.

There are numerous other instances of this formal concern in *Synaphai*. The clarinet multiphonics, for example, familiar from *Anaktoria*, are introduced near the beginning as both a timbral contrast to the high, close chords of the strings and a continuation of the sustained character of this material. It also serves as a bridge to a second type of sustained material in the strings, one built from natural harmonics (also familiar from previous pieces) that take over from the clarinet in m. 26. Both the strings and the clarinet contrast with the percussive attacks of the "hard" material of the piano, but, at the same time, the fixed register of these sounds creates a sense of continuity of its own, particularly as it carries right through several more shifts of material in the orchestra.

In looking at the formal organization, it is evident that Xenakis planned the large-scale divisions in order to create a kind of continuity between sections. The overlapping shifts of the first section (mm. 1–105) give way in the second (mm. 106–75) to the different types of glissandi, passed from the piano to the strings back to the piano and on to the woodwinds. The third section (mm. 175–243) contrasts horizontally static sonorities in the strings (primarily the rich, noisy sound of direct bowing on the bridge) and brass (distributed articulations of a single pitch, eventually expanding to a cluster) with the ongoing legatissimo arborescences of the piano. At m. 244 the piano shifts back to a more percussive style that leads to a "cadenza" built from six chords distributed across the full span of the keyboard. A short, answering outburst of layered pulsations by the full orchestra, outlining a thick, mid-register cluster, leads to a long passage in which the relatively static, though rhythmically active, passages of the solo piano are answered by short interjections from the strings and brass, usually trading off one against the other. This material is primarily based on the accelerating-decelerating rhythmic material also underlying the piano's music. In terms of the piece's overall trajectory, the more sustained, overlapping passages of the opening give way to shorter blocks of contrasting timbral groups. The short closing section (mm. 377–89) introduces the tom-toms, at first continuing the rhythmic material of the previous section, concluding with dynamically dramatic rolls. At the same time, the piano launches a final arborescence, asserting its dominant place in the music while also rounding off the structure with reference to earlier material. Such an act of recapitulation may seem traditional, but its juxtaposition with the

surprising entrance of the drums serves to anchor what might otherwise come across as an architecturally unbalanced concluding gesture.

This would be a good place to insert a word about the role of the solo piano in *Synaphai*. This is certainly not a traditional concerto. The piano is instead treated as an additional orchestral “color,” on a par with the strings, brass, woodwinds, and percussion. Its position is nonetheless privileged, given the virtuosity of the part and its almost continuous presence throughout. Perhaps the most obvious reference to the genre comes with the short cadenza at m. 254, where—alone—the piano introduces material not heard anywhere else. The six four-note chords are presented in a dancelike rhythm derived from the accelerating-decelerating figure already mentioned; the pianist is even given liberty to create ten seconds of “dense irregular clouds” based on these chords. Xenakis has tried to create an original musical context within which a soloist may function as an integral but prominent part of the proceedings, with the focus being on the music rather than on the spotlighted presence of the performer. Whereas the piano in *Eonta* is treated as independent from the brass ensemble, with relatively little musical connection between the two, in *Synaphai* the solo part is highly integrated into the fabric of the composition through shared material and parametrical links. Xenakis has since composed a number of concertante works, and each one adopts a similar approach, even while the musical concerns are different.

Antikhthon, Charisma

As mentioned earlier, George Balanchine had, in 1969, commissioned Xenakis to compose a new ballet for him. This project was unfortunately never realized, but the composer dutifully completed an orchestral score of over twenty minutes’ duration in time for the intended premiere in 1971.⁴ *Antikhthon* (“anti-Earth”), like *Kraanerg*, has no plot or dramatic outline, but the title is intended to provoke certain associations, perhaps to fire the choreographer’s imagination. According to the Pythagorean source from which Xenakis took the term, the anti-Earth revolved with Earth around a central fire. The anti-Earth, itself invisible from Earth, moved in synchronization with it and served to block the central fire from Earth’s view. The parallels with contemporary cosmological speculations on the existence of antimatter and an antiuniverse were not lost on Xenakis. He also noted the psychological parallelism between the conscious and unconscious, viewing the central fire as a “beneficial source of creative energy...a mysterious and unknown source which is still beyond man’s conception.” As well, he wrote, “Because of its very nature, music displays an involuntary affinity with these ideas” (Xenakis 1986). Ballet, on the other hand, may express these ideas with more difficulty. In an interview, Xenakis once commented, “Ballet is based on the human body, which has limited formal possibilities in that it’s confined to the movements we can make with our limbs, our trunk and our head, and that’s all.... The vocabulary of ballet, then, is not rich.... The question is, how to substitute abstract events for [emotions and relationships]?” (Varga 1996, 103).

Obviously, the choreographic failure of *Kraanerg* would not have served as much of an inspiration, although Xenakis had been impressed with Balanchine’s approach to *Metastaseis-Pithoprakta*, and also admired the work of Merce Cunningham.

In any case, *Antikhthon* has achieved its identity purely as an orchestral piece. There are many familiar elements in the score, such as the opening passage for the three

clarinets playing electronic-sounding clusters of multiphonics. The architectural scope is underscored right away, as this sonority continues on its own for a full minute before being joined by brass clusters and chattering snare drums. Unlike the focused trajectory of *Synaphai*, though, *Antikhthon*'s formal outline is episodic, perhaps in deference to an imagined choreography. It is possible to discern, nonetheless, five large-scale divisions where the general sonic character of the music shifts significantly (see table 7).

The strings play the dominant role, as in Xenakis's earliest orchestral scores, with the woodwinds and brass most often contributing episodic material overtop of ongoing string textures. The greatest momentum is built up in the fourth section, by far the longest, where the intricate distribution of glissandi across the strings, sometimes individually and sometimes by section, is set off by regular bursts of short passages in the woodwinds or brass that cut an almost metric pattern into

Table 7. Formal Outline of *Antikhthon*.

Section 1: mm. 1–140 (4:42)—sustained (episodes); clarinets/strings, brass melodies, snares
Section 2: mm. 141–272 (3:50)—rhythmic; strings, growing wind interjections, tom-toms
Section 3: mm. 272–342 (2:20)—mixed; no one instrumental group dominant
Section 4: mm. 342–606 (8:08)—glissandi; strings, wind episodes, sustained, melodic, rhythmic
Section 5 (I'): mm. 607–56 (1:03)—sustained; strings, winds (sustained, glissandi)

the temporal continuities of the strings. These glissandi take most advantage of the spatial seating of the orchestra, similar to *Synaphai* in being intended for a stage (or orchestra pit?) but more elaborate in the distribution of instruments.

Perhaps most striking in the music for winds is the inclusion of soloistic melodic passages, unusual in this composer's output. (Similar moments can be found in *Kraanerg*, not otherwise an apparent model for this ballet.) At their best, these passages convey a strong archaic quality that calls to mind the "Greek" works intended for the stage. At other times, though, the restricted range and diffuse rhythmic schemes render the melodies banal and unfocused, due in part to the avoidance of any extended treatment of this material. Perhaps Xenakis was aware of this himself, for he soon busied himself with developing a new technique for generating melodic contours, as evidenced in *Mikka* (1971), for solo violin, and applied with great effect in *Cendrées* (1974), his next large-scale work involving choir and orchestra.

In the meantime, Xenakis penned a short, intense tribute to the talented young French composer Jean-Pierre Guézec, who had died of a heart attack at age thirtyseven. *Charisma* (1971), for clarinet and cello, was premiered at the Royan Festival a month after Guézec's death. The music is formed of long-held sonorities, usually intensified by timbral extensions, dynamic contours, or extreme registral placement. There is just one central outburst of faster, rhythmically defined material. Nothing about *Charisma* is sentimental, and while the individual parts do not reach the level of virtuosity of, say, 1966's *Nomos alpha*, the extremes of expression called for and the magical weaving of the extended timbres of the two instruments make this a little gem that performers have been happy to save from the "memorial" shelf. Xenakis appended a line from the *Iliad* to

the score: “then the soul like smoke moved into the earth, grinding.” This potent image would be carried through to his next project, *Aroura*, and on to *Cendrées*.

Aroura, Mikka and Mikka “S”

Aroura (“Homer’s earth,” “sonic textures of the earth”), composed in 1971 for the Festival of Lucerne, is scored for strings. Written for a smaller ensemble than *Syrmos*, for twelve instead of eighteen instruments, *Aroura* enabled the composer to turn his attention to formal concerns, given the homogeneity of the ensemble. An architecture based on eight clearly defined sonic entities in the earlier work gives way here to a more complex, multidimensional conception. The music does proceed by means of a succession of sonic entities, usually one at a time, but other parameters such as playing mode and dynamics are used to delineate blocks of contrasting sonority even within a passage involving just one of the basic sonic elements.

The chart outlining the formal structure of *Aroura* shows the succession of these entities (see fig. 11a).⁵ It is interesting to note that while the pizzicato plays a minor part (two events, constituting 2 percent of the piece), along with the mixed sonority (one event, 1.5 percent), silence is a relatively important structural element (7.5 percent), going beyond emphasizing existent articulation points toward a more dynamic role in the temporal design. The dominant entities are the glissando (30 percent) and bowed playing (48 percent), as might be expected.

Large-scale sections are difficult, if not impossible, to determine. While the overall duration of approximately eleven minutes perhaps precludes the necessity of grouping sections into larger formal units, Xenakis appears to have occupied himself with the combinatorial possibilities of the basic sonic entities and the other elements. For example, the basic bowed sonority manifests itself in fourteen variants over the course of the piece (see fig. 11b). Larger blocks of this material are built from successions of these variants, delineated through shifts in other parameters such as rhythmic density, register, overall dynamic levels, and so forth. The dynamic interplay between the temporal placement of particular sonic entities and the timbral-parametrical variations applied to them is rich enough to sustain the music over the course of its duration. In addition, there are numerous transitions of one sort or another between gestures, showing a compositional finesse that was missing from a similarly combinatorial work such as *Nomos alpha*. This signals an assimilation by the composer of the group theory approach. Certainly, *Aroura* displays the composer’s confidence in his ability to achieve his musical aims—and in the capacity of the performers to express them.

While *Antikhthon* had tentatively focused on soloistic linear material, *Aroura* avoids it almost completely. The one significant solo passage (mm. 198–210) features the cello alternating between two double stops, recalled again briefly by the viola at mm. 264–66. This is hardly compelling melodic writing! Quickly, however, Xenakis turned his attention to the creation of nuanced linear contours in his next work, a short “etude” for solo violin.

Mikka (“small,” also named for Mica Salabert, Xenakis’s publisher), was completed in 1971 and premiered at the 1972 Festival d’Automne in Paris, soon after the opening of the *Polytope de Cluny*. The piece’s most immediately striking aspect is the solo line that unfolds in continuous fashion from beginning to end. It consists entirely of a single

glissando, snaking its way along the registral compass of the violin in a perpetually varying contour. The banishment of vibrato from the music lends a metallic edge to the sound, although Xenakis does vary the timbre through ponticello and tremolo effects. Dynamics, too, play an important role in adding depth to the singular sonority of the glissando, even if quite different from the constantly varying markings of *Nomos alpha*. After the relatively neutral *mf* opening, the rest of the score consists of shifts between extreme dynamic levels, usually linked to changes from ponticello (soft) to normal mode (loud).

The glissando contour of *Mikka* was generated by means of a “random walk” procedure that Xenakis had been investigating for the stochastic synthesis of digital waveforms (see Xenakis 1992, 242–54). According to this approach, the limit points (peaks and valleys) of the waveform are generated by means of some probability function, with time intervals also able to be “randomized.” Barriers must be set in place to keep the waveform values from exceeding the limits of the digital converters (or instrument). These can be fixed or elastic, the latter option producing a contour that varies according to both the values of the stochastic function and the changing ambitus of the barriers. It was a simple matter to transfer the process to the

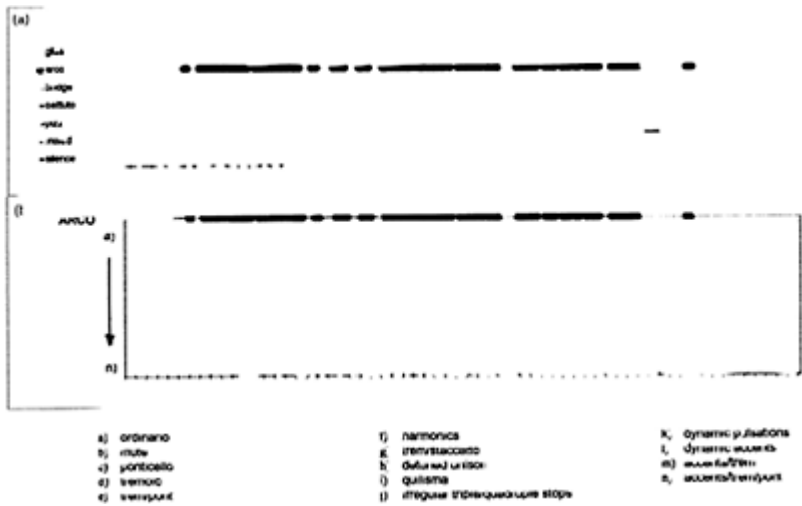


Figure 11. *Aroura*: Formal outline. Sonic entities. Subentities of “arco” sonority.

generation of a melodic contour for the violin. The time values had to be transposed from the order of fifty thousand per second to eight (sixteenth-notes), and the barriers needed to be held within the register of the violin (approximately four and one-half octaves). Xenakis mapped what would have been sample amplitude values onto a grid of quarter-tone pitch values. The performer is not expected to articulate the notated pitches, but should instead keep the glissando in constant motion, gliding from one pitch to the next.

The exceptions are the long held notes, which provide points of orientation both for the performer and the listener.

The resulting score represents a sort of generalization of melodic form, a waveform magnified to allow its inner contour to be revealed (see fig. 12). The “knob” that is twisted is not that of an oscillator, but of a stochastic mathematical process.⁶ At the same time, the music represents a great challenge to the performer, as the process of sliding the fingers along in a continuous glissando goes directly against traditional fingering technique. The violinist has no reference to “tune” the intervallic distances of the contours, so must work to establish an accurate sense of pitch by “feel.” The manifest tension created as the player concentrates on maintaining a sense of orientation while executing what are often huge shifts of register at lightning speed lends a visceral intensity to what might otherwise appear to be mathematical music. It has been Xenakis’s abiding genius to be able to match performance concerns with compositional quests.

In 1975, Xenakis turned again to the solo violin, composing a companion piece, *Mikka* “S”. The glissando contour is set here into a contrapuntal context (so to speak), with two lines played simultaneously. The difficulties for the performer are obviously magnified, even though the composer set narrow barriers so that the two lines can be reached by the fingers of one hand. Obviously, wild fluctuations of pitch are not possible, and there are numerous passages in which one line is held constant (often an open string) while the other continues to trace its contour. In the final section, Xenakis left off the double glissandi, and introduced a new variant of the continuous line. The glissando contour in this passage incorporates bowing and rhythmic articulation, items left to the performer in *Mikka* and the earlier parts of *Mikka* “S”. The direct link to the digital waveform is weakened as these additional performance considerations are taken into account. This approach to glissando melody would become standard for much of Xenakis’s music from this point on.

Eridanos

In the meantime, Xenakis had turned his attention, briefly, to the evocation of conflicts. *Linaia-Agon*, a “game” piece pitting trombone against tuba and/or horn, was premiered at the 1972 London Bach Festival (see chapter 3). In 1973, for the new La Rochelle Festival of Contemporary Music, Xenakis contributed a short orchestral work, *Eridanos* (“quarrelsome,” “ancient river of Athens”). This score pits the brass against the strings (there are no woodwinds or percussion), treating them more or less on equal terms (the strings play no glissandi at all, which is unusual). Rather than construct an architectural form from contrasting sonic entities, Xenakis looked to harmonic structures for his building blocks. Inspired by the structure of DNA chains, four elements (hydrogen, oxygen, carbon, and

that Xenakis poses to the performer: certain passages are physically impossible to play as written. Pianists are seduced by this music—to their peril!

Of the many pianists who have performed and discussed *Evryali*,⁷ dedicatee Marie-Françoise Bucquet perhaps best expresses the performance issues Xenakis raised, writing, “Supreme challenge: he asks us to take risks and overwhelming responsibilities. I find it wonderful that instead of saying to the performer ‘I have written this piece for you, and you are going to play it,’ he said to me ‘Here is the piece. Look at it, and if you think you can do something with it, play it’” (Bucquet 1981, 220).

Canadian pianist Marc Couroux likens the performer to the “warrior” of Don Juan’s teachings in the writings of Carlos Castaneda, emphasizing the need to remain “lucid” in the face of the impossible, choosing—each time the music is to be performed, ideally—“which aspects of *Evryali* are essential and must be preserved, in spite of the sacrifice of certain other details” (Couroux 1994, 64–65).

One of the most striking aspects of *Evryali* is the rhythmic drive that propels the music at a relentlessly steady pace (the sixteenth-note pulse is set at 480 MM). The music is not metric, but most passages are built upon this pulse, the exceptions being two appearances of a more rhythmically diffuse, cloudlike texture, and the three measured silences.⁸ Otherwise, the music is made up of three sonic entities: “waves,” arborescences, and fixed-range rhythmic passages. The waves and arborescences are closely related, in that wavelike contours form the primary outlines of the arborescent passages. The difference is that the waves are monophonic entities, whereas the arborescences are polyphonic. The sketches confirm the importance of graphic design, with the dendritic shapes of these contours being sketched on graph paper rather than plotted on score paper. From his earliest works, Xenakis often sketched musical ideas on graph paper, linking graphic designs with compositional and/or instrumental concerns. Here, for example, he would have had to keep in mind, when tracing his arborescences, that the two hands and ten fingers of the pianist can only reach so far. In fact, Xenakis overlooked this limitation on a number of occasions, and even includes a high *C#*, beyond the range of any piano, in the penultimate passage of arborescences.⁹

As with *Aroua* and *Eridanos*, it is difficult to perceive large-scale divisions in *Evryali*. The alternation and layering of the different textures proceed by means of shorter and longer passages. The silences are, by their placement, treated as independent entities, resonating in a special way the extraordinary rhythmic energy of the music. Harmonically, the set intervallic structure of the static, rhythmically defined passages contrasts with the more fluid waves and arborescences that tend to proceed chromatically. There does not appear to be any overriding principle or sieve linking the numerous manifestations of the fixed-rhythm entity; each is built from a different intervallic configuration, the density ranging from three to eight pitches.¹⁰ Sieves appear to have been applied to the generation of rhythmic patterns, but the layering of these structures makes precise determination or comparison of their content virtually impossible. There is no concern on the composer’s part that these sieves be identified. In very general terms, they exhibit statistical similarities by containing values limited to just a few multiples of the basic unit of pulse.

The connection to the piano writing of *Synaphai* can be found in the contrast between the fixed-range rhythmic passages and the waves and arborescences, very similar to the dialectic in the concertante piece between the relatively static, “dry”/“hard” passages and

the more florid “liquid” passages. The rhythmic drive of *Evryali*, though, is a new element, and one that would be made more of in subsequent works. The intensity engendered by engaging the solo performer with materials stretching the capabilities of the pianist beyond the realm of the possible is another distinctive feature, and is an aspect of Xenakis’s aesthetic that would continue to manifest itself in later solo works. The arborescences, though, represent an important new way of composing linear polyphony. This technique would be a central feature of the keyboard works Xenakis composed shortly after *Evryali: Erikhthon*, for piano and orchestra, *Gmeoorh* (1974), for organ, and *Khoai* (1976), for harpsichord.

Cendrées

First, though, Xenakis turned his attention to a major work for voices and orchestra, his first since the early *Anastenaria*. *Cendrées* (“ashen”) was commissioned by the Gulbenkian Foundation, and was premiered in 1974 by the foundation’s choir and orchestra in Lisbon, conducted by Michel Tabachnik. *Nuits* (1968) had also been a Gulbenkian commission, and its success, capped by the Grand Prix du Disque for the 1968 recording, led to this new piece and a number of other commissions in the years to follow. As in *Nuits*, the choir parts are treated in an instrumental way, using phonemes rather than text. Xenakis did, however, affix a line of text (his own) to the score, pointing to the source of the title and offering a hint of the music’s expressive intent: “Before autumn, before summer, before each season, when the sky is fluffy, when it descends and meets the earth, all is white like opaline then: and it lasts sometimes, a long time. Neither fog nor dew, but ashennes” (Xenakis 1974).

The choir is large (Xenakis specifies a minimum of thirty-six singers, but the subdivisions in the score occasionally call for more than this), to achieve the necessary power and textural depth to balance the instrumental forces. The orchestra, in compensation, is rather small, with double winds and no percussion.

At twenty-three minutes,¹¹ *Cendrées* is one of Xenakis’s most expansive concert works. Harry Halbreich, in his study of the composer’s middle period, considers it a seminal piece, launching a new phase in which many of the compositional techniques Xenakis had worked out earlier are synthesized and applied (1988, 215). The glissando is the primary sonic entity, appearing in a variety of guises, from global textures, as in *Metastaseis*, to intricate “random-walk” contours, as in *Mikka* (actually more closely resembling—prefiguring—the short, rhythmically articulated glissandi at the end of *Mikka* “S”). The detuned unisons can even be heard as “microglissandi,” with one instrument gradually pulling slightly away from the sustained tone of another. In addition to the voice-instrument opposition (and prospective synthesis), Xenakis also shapes the form of *Cendrées* by means of the dramatic contrast between massed sonorities and solo or chamber passages, both vocal and instrumental.

Halbreich divides the form into ten sections, and while some of the boundaries are easier to perceive than others, it is useful to parse the music in this way. The first passage, sustained for close to three minutes, is built from a continuously sounding pitch, *G*₃ (the same open-string sonority that launches *Metastaseis*), above (and below) which long strands of glissandi unfold. Contrasting with these rather spatial gestures are short, aggressive glissandi, constantly repeated according to rhythmic patterns. The play

between these two glissando types continues throughout the section, as the slowly expanding lines of the opening evolve into a variety of shapes and spatial densities. The choir joins in at m. 37 with stringlike glissandi alternating with percussive articulations of fixed pitches, the rhythms shifting from regular pulsations to irregular clouds of attacks. At the close of this opening passage, the underlying sustained pitch gets swept up in the glissandi, only to be abruptly cut off by the start of the second section.

The *fff* sonority of the full strings gives way to a solo bass voice, accompanied by the bass clarinet. Instantly, the sound world of *Cendrées* shifts radically, with the voice assuming a more direct, humanistic role, the narrow, random-walk glissandi, articulated by guttural attacks of different vowels, evoking a rough, primitive expression. The low duo gradually fills out, as individual strings and other voices join in. A brief interruption by the brass at m. 123 leads to a shift in register as the female voices take over with the higher strings and sharp piccolo outbursts. At m. 157, the brass and woodwinds begin to enter, softly, in a lower range, building up a short glissando texture reminiscent of the opening. A climactic cadential gesture of repeated chords rings out over the start of the fourth section, which features intricate interlocking phrases (producing a “hocket” effect) limited to a narrow set of pitches in the central register. The different voice and instrument families are drawn into the game, with the propulsion of the interlocking rhythms being only occasionally reined in by moments of sustained clusters set in the same register.

The fifth section, by contrast, is built from sustained sounds, similar in register but constantly changing through sharp dynamic outbursts at the end of long-held notes by individual brass instruments or voices. The violins offer fleeting moments of the narrow-range random-walk glissando, carried here right up into the high register. At m. 248, a solo flute takes over, playing an evocative passage of glissando melody, this time freed from registral anchoring, etching out a contour that rises up into the instrument’s high register before falling again to be joined by first another flute and then the rest of the woodwinds. Xenakis has not exhibited any particular attraction to the flute, and in fact once stated in an interview, “The only instrument I don’t like is the flute” (Varga 1996, 66)—so this moment in *Cendrées* is all the more precious. Certainly, the shift to a solo line links this passage to the second section, with the bass solo, and to the later solo passage featuring the countertenor.

The seventh section, which takes over from the woodwinds, is an extremely compressed passage of interwoven glissandi featuring choir and strings. Similar in length to the opening section (well over 2–1/2 minutes), as many as nineteen individual contours unfold independently, all of them held to a relatively narrow range, the whole encompassing approximately four octaves of the middle-to-low register. The voices of the choir are made to stand out by the occasional use of a staccato tremolo effect, serrating the sonority’s otherwise polished contours. This passage breaks off suddenly, leaving a solo countertenor to entwine a narrow glissando melody around a sustained horn note.¹² The rhythmic articulation of this material is smoother than the earlier bass solo, but it is broken up with the staccato tremolo carried over from the previous section. The countertenor is four times interrupted by an unusual sonority, clouds of irregular “phantom” sounds (breath noises), adding an unearthly note to the rather gritty expression of the sung passages. The long segment of phantom sounds at mm. 387–407, lasting nearly one minute, could perhaps be considered an independent section, but the

countertenor and horns return for two more brief phrases, weakening the structural significance of the interruption.

The ninth and penultimate section introduces more new material, related to the rhythmic texture of the fourth section. The music here is much more elaborate, with as many as four layers of material each following its own trajectory.¹³ The pitch structure is less static, too, although repeated notes are rampant. While certain layers or instruments are held static, others move, often by stepwise motion (and by means of quarter-tones). At m. 468, the music begins to shift to a more homogeneous sound, as the twelve-part choir and the winds, also divided into twelve, outline undulating contours articulated not by glissandi but by staccato notes. Beginning with a uniform eighth-note rhythm, the music splits into layers of quintuplets and sextuplets. A slight overlap in the lower brass, sustaining a narrow cluster by means of the accelerando-decelerando figure used earlier, carries into the rather ethereal coda, made up entirely of “phantom” sounds. The piece closes with the “ashen” breath sounds of the choir.

Cendrées is wide ranging in its scope and expression, pitting massed glissandi or rhythmic textures against raw, plaintive, soloistic passages. The voices play a part in both sides of this dialectic, and the lack of text (and operatic vibrato) enables them to be thoroughly integrated into the timbral structure of the music without carrying additional semantic baggage. Xenakis would continue this approach to the combination of voices and orchestra in later works, and in the chamber work *N’Shima*, completed the following year. As we will see, though, text does play a role in a few works.

Erikhthon

With *Erikhthon* (“force of the earth,” “son of Attican king Hephaistos and Gaïa”), Xenakis returned to his preoccupation with arborescences, producing one of his most “graphic” scores (even if notated in traditional form). Various pages of the original graphic manuscript of *Erikhthon* have been widely reproduced (see fig. 13), and as Makis Solomos points out, it really is only in examining the visual design of the score that one can get a sense of the formal unity underlying the music. It is difficult, if not impossible, to hear the relationships among different transformations or “rotations” of an arborescence figure (Solomos 1996, 70–71). Freely designed figures (“bushes,” as the composer calls them) are repeated and manipulated in various ways, including transposition, rotation (a generalization of the traditional permutational processes of inversion and retrograde), resizing, and mathematical/topographical variations.

The result, while not as audible to the ear as the designs are clear to the eye, is a complex linear conglomeration that can be “orchestrated” in various ways. The first arborescence in the piano is doubled by the strings, though varied at the same time through the use of glissandi and quarter tones. The transcription of the graphic figures for piano is very different from the process used in *Evryali*, pointing to an additional level of creative input on the part of the composer. In *Erikhthon*, the different lines are often represented only sporadically, or by means of layered rhythms, creating piano music that is polyphonic, but at times pointillistic. The orchestral parts are much simpler rhythmically, as might be expected, but the contours are often treated using a

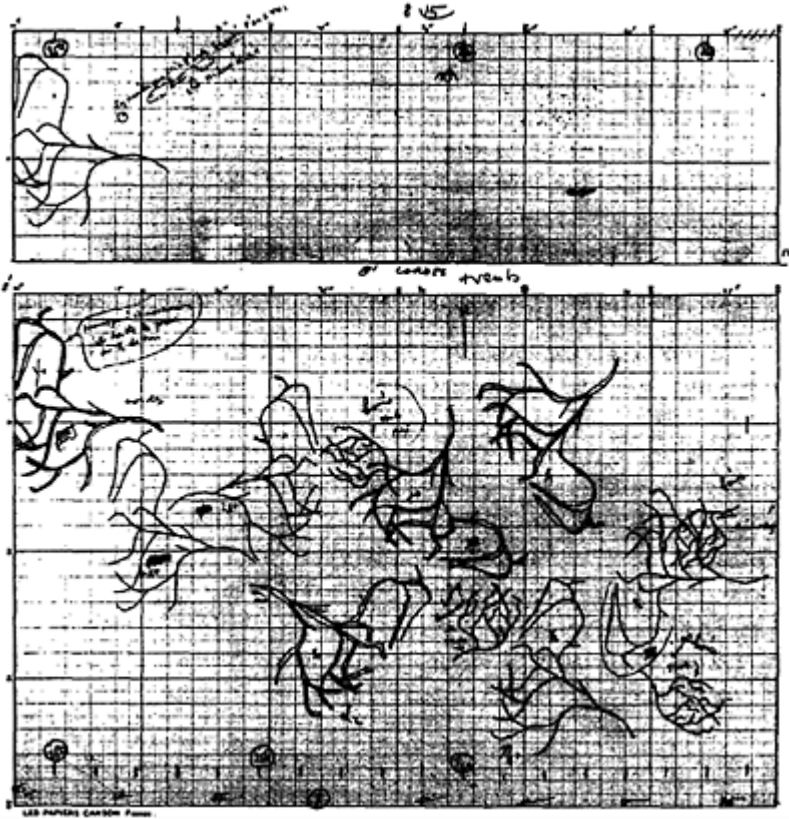


Figure 13. *Erikthton*: Composer's graphic sketch corresponding to p. 53 of score.

Klangfarben approach, distributing fragments among different instruments or individuals within an instrumental group.

The overall shape is unusual, the opening passage giving way to the main, monolithic body of the work, based entirely upon arborescences, layered between, or traded off from, the solo piano, the winds (most often divided into woodwinds and brass), and the strings. To begin, though, the piano reels off expanding and contracting arborescent figures over a sustained and increasingly thickened unison pitch in the woodwinds, *A4*. The strings intermittently tap their strings in a rhythmic fashion, creating a textural link with the rhythmic and percussive articulations of the sustained pitch of the winds in between outbursts of arborescences. After a minute, the brass join the woodwinds as the strings drop out, sliding outward to an accented cluster before closing back in again on the central note. The percussion makes a brief appearance to accent the variations of this gesture with cymbal crashes, never to return. As the winds gradually descend toward a final low cluster, the strings return with a dramatic rising glissando to a sustained high

pitch, *B6*, which, together with the “phantom” clouds of breath and key sounds in the winds, signals the end of the opening section.

From this point on, less than three minutes into this thirteen-minute piece, the music unfolds as a continuous texture built from arborescences, the more sparkling, articulated gestures of the piano being countered by the sustained contours and shapes of the winds and strings. In the rest of the piece, there are no more instances of sustained unisons, rhythmic rearticulations, phantom sounds, or unified gestures such as wind clusters. The sonority is constantly varied by register, density, and duration, and, on the larger scale, by the changing primacy of one instrumental family over another.

It is difficult to sense the formal balance between the brief opening and the bulk of the piece except for the connecting tissue of the solo piano. There may be a programmatic element to it, reflecting the uprooting of Erikhthonios from his birthplace to the Acropolis. In any case, the style of transcription from graphic score to piano solo would serve the composer well for other pieces involving arborescences, notably in his next commission, for solo organ.

Gmeeoorh

Xenakis has said that the organ is one of his favorite instruments (Varga 1996, 66), though he only wrote for it once. The attraction manifests itself more obviously in his later orchestral music, where the instrumental groups are treated as blocks of timbral color, always moving in parallel, rather like mixing different stops on the organ.¹⁴ *Gmeeoorh* (a made-up word) was composed for the 1974 International Contemporary Organ Music Festival in Hartford, Connecticut. Xenakis, who had resigned his position at Indiana University in 1972, taking up an appointment the next year at the Université de Paris, nonetheless continued to profit from contacts made in the United States. He had spent time in New York the previous year, giving lectures at Columbia University and Barnard College, and attending the premiere of *Evrjali* at Lincoln Center.

The foreword to the score of *Gmeeoorh* includes a detailed description of the manuals and stops of the organ for which it was written. Evidently, a recording of their tones and ranges was produced for the composer, and Xenakis made great use of the wide palette of timbral colors. In fact, the changes of stops are so numerous and intricate that the score would be impossible to perform without an assistant. The notes themselves are difficult enough to play, with often extremely concentrated and intricate arborescences involving both hands and feet. There are times when the polyphony is such that the sounds fuse, creating blocks of sound in constant evolution, the inner details being imperceptible. This effect is also due to the lack of distinctive attack in the sounds and the naturally reverberant venues organs are usually located in.

The architecture is much more nuanced than for *Erikhthon*, being formed from clearly demarcated sections and contrasting blocks. The long opening passage of arborescences, lasting close to five minutes, is articulated by a number of points where the arborescences stop, either in sustained clusters or held pitches (the first, mm. 39–42, is enlivened by irregular trills in both hands and the pedals), or in silence, allowing the sonority to resonate as it dies away. The sustained sonorities point the way to the second section, shorter by half, made up of massive clusters achieved by laying boards upon the manuals and pedals in order to open as many pipes as possible. The effect of these powerful

sonorities is awesome. It is also extremely rich dynamically, through the ongoing stop changes. The arborescences return, hesitatingly at first, gradually building up momentum to carry through the longest span of the piece, which lasts around six minutes. After the silences that break up the beginning phrases, there is just one moment, at mm. 149–51, where the music comes to rest on a sustained sonority in the pedals. The arborescences fall off to a similar passage in the pedals, and then that breaks off in order to prepare the stops for the next section.

There follow two contrasting passages, the first being a sustained harmonic sonority in which different pitches enter, then drop out, creating an evolving, but registrally and timbrally restricted, texture. After a break, a more active though still narrow-ranged passage enters to fill in a high span of pitches with staccato figures over a quietly sustained sonority in the pedals. These two passages, lasting four minutes, lead back to a final short passage of involved, linear polyphony, concluding with a return to the immense clusters of the second section.

Gmeeoorh is an extremely impressive work, heard all too rarely, no doubt due to its difficulty, both for the performer and for the need to have an assistant and an organ capable of handling the detailed timbral changes. (A second version of the score, for a smaller organ, has been published.) There is a certain nonlinear circularity in the formal organization, but there is so much to listen to in the various sections that this cannot be perceived as a weakness. And the clusters held at the end for a full minute make for a mightily dramatic conclusion.

While intended for the Organ Festival in Hartford, *Gmeeoorh* was performed in Bonn that year, during a major retrospective of Xenakis's work. Twenty-seven compositions were presented, including the belated concert premiere of *Antikhthon*. According to Xenakis, who was rather surprised, "the Bonn Xenakis Festival... ran without one negative reaction!" (Varga 1996, 46). The force of his music was winning people over in large numbers. By 1974, the *Polytope de Cluny* had finished two years of performances for many thousands of people in Paris. *Cendrées* was premiered in Lisbon; *Erikhthon* in Paris. Xenakis also received a major commission from the Orchestre de Paris, who, in October of that year as part of the Paris Festival d'Automne, premiered *Noomena* under the direction of Georg Solti.

Noomena

Carrying on from *Erikhthon*, *Noomena* (a philosophical term meaning "that which is apprehended by thought, independent of perception by the senses") is built almost entirely from arborescences, shifting from the dialectic of the earlier piece to a more homogeneous play of orchestral color. While there is more layering and mixtures than usual in Xenakis's orchestral scoring, the strings, brass, and woodwinds are generally treated as independent timbral entities. The glissandi sound differently in each group, the strings being the smoothest and most at ease with the continuous undulations of pitch, the woodwinds being the least smooth, battling physical and acoustical limitations of the instruments. In the brass family, the trombones, at least, can play smooth glissandi within limits.

The orchestra called for is enormous (103 musicians), but the full forces are never deployed at one time. Instead, the large number of musicians within each instrumental

family are used to create thickened glissando sonorities, although there are also rarified passages for a soloist or small group of instruments. One of the notable points of articulation in what is otherwise quite a monolithic score comes at m. 176, where a trio of clarinets takes over from the brass and strings. This passage, the longest sustained gesture built from a single timbral entity, gradually draws in a trio of oboes and bassoons, ending up on a held chord, the only one, emphasized by a fermata and a break. This moment serves to divide the piece into two large units, the second slightly shorter than the first (at a ratio of 1.16:1).

The strings carry on with a passage of wide-ranging arborescences that leads into a series of short, rather fragmented brass gestures layered over the strings, joined later by the woodwinds. A second fermata at m. 287 breaks the formal trajectory once more, leading to a more radical shift. A concentrated, narrow-band brass texture, drawn out by a drop in tempo to less than half the original, alternates in short blocks with a high, random-walk violin line. The succession follows the proportions 2(br)–1(vn)–2–2–2–3–5–4–7. At that point (m. 316), the brass music gives way to a trio of oboes playing in a staccato, pointillistic style. This prefigures the unique passage at mm. 327–31 in which the woodwinds break into a staccato, quasi-ostinato rhythmic texture featuring a clearly perceptible interplay between sixteenth-note and eighth-note triplet pulses. Similar material would play an important role in *Jonchaies*, from 1977. With this additional woodwind layer, the block proportions continue to the end: 3(ob)–2(vn)–6(br)–5(ww)–5(br). After the high violin drops out, the full strings enter underneath the penultimate brass texture with a static harmonic block built, perhaps whimsically, from a 12-note chord articulated with sharply accented bowings.

Noomena ends at a very different musical point from which it started, drawing together different compositional strands including arborescences, random walks, rhythmic pulsations, intentionalized harmonic structures, and the temporal counterpoint of orchestral instrumental colors. The score serves, along with *Empreintes*, as preparation for his major orchestral statement of this period, *Jonchaies*.

Empreintes

As a follow-up to *Eridanos*, Xenakis embarked upon a second orchestral commission for La Rochelle. *Empreintes* (“impressions, traces”), with a relatively modest duration of under twelve minutes and a smaller orchestra of eighty-five musicians, was premiered at the festival in June 1975 by the Netherlands Radio Philharmonic Orchestra, conducted by Michel Tabachnik. Strongly resembling the opening of *Cendrées*, *Empreintes* begins with a long sustained unison, this time an octave higher (on *G4*), varied timbrally and rhythmically with long glissando contours unfurling from the central sonority. The *G4* continues past the halfway mark, a radical compositional gesture that serves to focus attention on the variations of the other parameters in a manner reminiscent of the work of Giacinto Scelsi, whose music had started to become championed in France at that time by the “spectral” composers grouped around the Ensemble Itinéraire.

This opening passage features the strings and brass exclusively, and as the glissando texture peels away, absorbing the central pitch, the continuity of the formal trajectory is preserved, leading through timbral variations featuring trills in the strings and flutter-tongue and staccato articulations in the brass. This section leads to an imposing cluster

chord at mm. 94–98. The music shifts abruptly at this point, two-thirds of the way through the score. A low cluster in the brass and contrabassoon introduces a passage of layered glissandi and sporadic sustained notes or narrow clusters involving the full orchestra. These glissandi outline various arborescent figures, breaking off suddenly at m. 109. The third, and final, section, filling out the remaining quarter of the piece, features the winds exclusively. A play of rhythmic versus sustained clusters is combined with registral shifts and tradeoffs between the brass and woodwinds. The rhythmic passages are all based on sieves built from a common pulse, at times layered to create a homogeneous pulsation from complex interactions between the individual patterns. At m. 126, the brass drop out, allowing the woodwinds one passage to themselves. The timbral interplay shifts to the interior divisions of this orchestral family, the flutes, oboes, clarinets, and bassoons being combined kaleidoscopically. After a climactic rhythmic block featuring them all, a decrescendo winds the sonority down—only to be decimated by a final outburst of the horns. The music ends with a softly resonating echo of the climactic sonority, finishing with a low dismissive grunt from the contrabassoon.

In terms of design, *Empreintes* is strange. The three clearly demarcated sections do not seem to be balanced, and are neither strongly contrasted nor correlated. Xenakis appears to have been judging the form not from an architectural perspective, but through concentrating on the temporal unfolding of the music from the perspective of the listener. The music opens by drawing attention to the spectral interior of the sound, varying it in all ways before opening up the sonic vista. The experience of time is gradually telescoped, through the increasing intensity of the ongoing textures, so that the truncated duration of the second section, teeming with complex arborescences, balances the durational bulk of the opening. The closing section, spotlighting the winds in a simpler context, is sustained by the propulsion of both the pulsations of the individual blocks of sonority as well as by the temporal interplay of these timbrally and registraly delineated textures. While always working within single-movement orchestral forms, Xenakis would continue to experiment with architectural designs involving clearly delineated blocks of material rather than trying to create continuous wholes.

Phlegra

The more organic approach, however, was not altogether forgotten. In his first commission for the renowned British ensemble, the London Sinfonietta, Xenakis applied his various concerns regarding timbral, rhythmic, and linear variations to a continually evolving form. *Phlegra* (“battlefield where the Titans and the new gods of Olympus clashed”), was completed in 1975 and premiered in London in January 1976 under the direction of the ubiquitous Michel Tabachnik. It is scored, like *Empreintes*, for woodwinds, brass, and strings, but this time on a reduced scale, with one player to a part to form an ensemble of eleven. The distinct sonic entities are mostly familiar from earlier scores: a sustained unison varied dynamically, timbrally, and by means of neighboring tones or detuning; articulated randomwalk glissandi; arborescences (less prominent here); and sievelike rhythmic patterns built on fixed pitches. There are a few noteworthy additions to the composer’s arsenal. One is the distinction Xenakis makes between glissando passages for the winds and “quasi-glissando” passages in which all of the notes of the contours are written out. Parallel to the narrow clusters used as expansions of the

sustained unisons, are the other melodic passages that the composer scores by means of clusters so that pairs, or families of instruments, play in parallel, a quarter tone away from their neighbors. This would become a prominent feature of Xenakis's ensemble and orchestral music by the 1980s (related to the "organ-stop" approach to sonority he developed later). Xenakis also turned his attention to specific pitch structures, though this aspect of the music does not yet achieve the prominence it would in subsequent works.

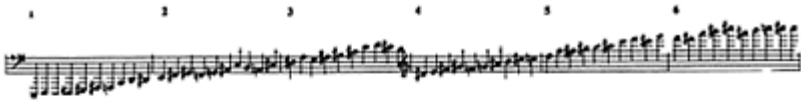
The opening sustained *D3* carries through to the 1'40" mark of the thirteenminute piece.¹⁵ Octave doublings prepare the migration up to *F4* in m. 22, where the sustained entity is taken over by the brass. This group treats it more aggressively by means of detuned unisons, dramatic dynamic shifts, and layered rhythmic pulsations. Throughout this passage, which lasts over a minute, the strings and woodwinds carry on the articulated glissando that the cello had launched at the opening in counterpoint to the sustained unison. These intricate glissando contours are passed from one instrument to another, also branching out into independent tendrils. Xenakis, unusually, scores these contours as unison lines (with octave displacements), creating a tightly knit, essentially heterophonic texture as the strings and woodwinds simply do not articulate glissandi in the same way. When the brass drop out at m. 39, the woodwinds and strings carry on the glissando material until it is finally whittled down to a solo violin at m. 44, with the bassoon settling at the same time onto a sustained *A3*.

The next section features an intricate interaction among a number of contrasting layers: the sustained pitch, usually expanded into a narrow cluster, articulated by intermittent breaks; high, rhythmically pulsating clusters in the woodwinds; short, rhythmic glissandi in the strings, rooted to the sustained pitch or cluster of the woodwinds; arborescent glissando contours in the brass and strings, centered around the sustained pitch; and high string glissandi, including harmonics. At m. 78, the sustained pitch of the opening returns, this time an octave higher, on *D4*. Here, the brass and strings trade off rhythmic outbursts as the oboe's sporadic, quasi-glissando phrases begin to flower in conjunction with matching glissando contours in the strings. By m. 91, the brass also begin to insert short legato phrases, followed in the next measure by the four woodwinds in parallel. The sustained, central pitch band continues while these short melodic fluctuations are passed among woodwinds, brass, and strings (playing glissandi). By m. 96, the phrases start to pull apart so that pairs or individual instruments each add their own contribution, heightening the contrapuntal complexity of the texture. At m. 99, the underlying sustained sonority fans out to a wider harmony, only to tail off two measures later as the swirling melodic contours take over completely. A shift from this legato, quasi-glissando style to more articulated phrases launches a dizzying passage in which each of the eleven instruments traces an independent scalar melodic contour, rhythmically independent with several different subdivisions of the beat occurring simultaneously.

The first real "breath" comes at the end of this passage (m. 107), over two-thirds of the way through. A raucous outburst on an *F#* spread across six octaves signals a change of strategy from a continuously evolving music to a more blocklike organization for the remainder of the piece. After that cadential tutti, there follow four contrasting sections of unequal length, each of a single sonority. The first, just four measures long, is quite new to Xenakis's oeuvre. Essentially, he takes a rising melody covering six octaves, and divides it into six segments, each covering one octave using ten notes, and combines and

layers these and their retrogrades, the mosaic shifting at every beat (see fig. 14). The result is a shimmering texture in constant motion within the limits set forth. The melodic unity underlying the passage is difficult to perceive but does lend a harmonic-melodic identity to the overall sonority.

Following this, the dynamics drop from *ffff* to *ppp* and the pace slows down. The ensemble divides into six parts (flute-oboe, clarinet-bassoon, the individual brass, the strings together), each unfolding a rhythmically fluctuating line, beginning all together with plodding quarter notes (the tempo is 48 MM). Each part breaks into faster flurries resembling the quasi-glissando material from earlier on. After the dynamics rise back up to fortissimo the music breaks off abruptly. The



	109			110			111			112							
fl				4	4	5	6	6r	5r	4r	4	4	5	6	6r	5r	
bb				4	4	5	5	5r	5r	4r	4	4	5	5	5r	5r	
cl			3	3	4	5	4r	3r	5r	4r	3	4	5	5	5r	4r	
fg	2	2	3	4	4r	4r	2r	2r	4r	3r	2r	2r	2	2	2	3	
cr	2	2	3	4	4r	3r	2r	2r	4r	3	2r	2	2	2	2	3*	
tp				4	4	5	4	5	5r	4r	4r	4	5	5	5r	5r	
tb	2	2	3	4	4r	3r	2r	2r	4r	3r	2r	2r	2	2	2	3	
vn				4	4	5	6	6r	5r	4r	4r	4	5	6	6r	5	
vl			3	3	4	5	6	6r	5r	4r	3r	3	5	6	3	3	
vc	2	2	3	4	5	5	5r	5r	4r	3r	2r	2r	2	2	2	3	
cb			1	2	3	4	4r	3r	2r	1r	4r	3r	2r	1r	1	2	3

*written an octave higher

Figure 14. *Phlegra*: Six-segmentscale melody, segmented by octave, and chart showing orchestration and succession of scale segments, mm. 109–12 (“r”=retrograde).

third section features just the winds, with each instrument entering on a fixed pitch, articulating it by means of a sievelike rhythmic pattern. Each follows its own pattern (no relationship appears to link them, though there could well be a logical connection behind the variations), the texture being intensified by the superposition of four different tempi. This passage, the longest of the four (1'45"), is shaped by the succession of instruments, opening with the woodwinds then shifting briefly to the brass before all seven enter together at m. 135, finishing with a mixed trio of bassoon, horn, and trumpet.

The final section, for strings alone, overlaps the previous section slightly, even if timbrally and texturally distinct. It is quite complex, built from three types of material: extremely widespread, disjunct bowed passages; relatively narrow, articulated glissandi; and very narrow melodic contours. The alternation of these elements, together with the

wide dynamic fluctuations and rhythmic layering, creates an evolving sound of great variety and activity. The widespread, disjunct material is unlike anything else in the piece, a radical extension of the mostly linear contours. It is appropriate that *Phlegra* would end in this way, perhaps a sign that the gods of Olympus had prevailed over the Titans. It is also significant that in his foreword to the score, Xenakis discusses the importance of texture in relation to form, writing, "I have continued here the construction of textures and their organization on a higher level. I refer to texture in the general sense of form.... Textures in the sense of form are the cornerstone of art and knowledge" (Xenakis 1976c).

Xenakis, who had long inspired strong support in the United Kingdom, notably through the English Bach Festival, where at that time many of his creations received their British premieres, went on to sustain a long and fruitful relationship with the London Sinfonietta, composing three more works for the ensemble, including his last, *O-Mega* (1997). In the meantime, his attention had turned back to the voice, this time in a chamber setting.

N'Shima

In 1974, with the fall of Greece's military dictatorship, Xenakis was exonerated of the outstanding accusations against him. His return, after an absence of over twenty-five years, proved to be a powerful inspiration. His attention turned to stage works again, and to vocal settings of the Greek language. First, though, he was drawn to another ancient language, Hebrew, for a commission from the Testimonium Festival of Jerusalem. While the voices are treated instrumentally, as in *Nuits* and *Cendrées*, Xenakis does draw upon the syllables of selected words in Hebrew that come, evidently, from a text by Rabbi Nachman, a parable of the children of two families united but divided by the cruelty of the world. *N'Shima* ("breath, spirit"), completed on 25 December 1975, is an extremely concentrated work, conveying an expressive, spiritual intensity of great force. These are fitting qualities for the setting of its premiere in the religious cradle of the Western world.

The two female voices, always conveying a peasantlike tone punctuated with sharp, guttural attacks, are combined with pairs of horns and trombones and a single cello. In a similar manner to the soloistic passages of *Cendrées*, the range of the vocal melodies is extremely limited; in fact, throughout the whole piece they cover just over one octave in range. The brass instruments wander only slightly further afield, covering 1–1/2 octaves. Only the cello breaks away, dropping down to its low register and soaring up high as well. Both the cello and the rest of the ensemble perform random-walk glissandi primarily, the only other sonic entities being the sustained notes, demarcating the succession of glissando phrases, and the fixed-pitch, layered rhythmic pulsations that take over near the end. There are, of course, silences, and one additional passage of noisy breath sounds, taken from *Cendrées*.

On this basis, the form falls into six sections, the first being the longest, divided into two parts by a solo cello interlude, and featuring the voices and horns exclusively. The trombones enter only at m. 140, signaling the beginning of the second cello interlude. They are then treated on an equal basis with the voices and horns through the second section up to m. 194, when the horns drop out. The remaining portion of this section could in fact be designated a separate structural unit, given the shift in instrumentation.

The more-or-less equal distribution between glissandi and sustained sounds carries through, however, and this is the primary distinguishing feature from the opening section, where the random-walk contours predominate.

The third entry of the cello launches a more extensive interlude, structurally significant in its own right. The cello is paired with breath sounds from the voices; it is sustained at first, then gradually rhythimized. The fourth section overlaps the end of the cello/breath texture, and features a lengthy passage in which the brass carry on without the voices. After this break—no doubt a great relief for the highly taxed singers—the voices join back in at m. 293. At this point the sustained sonority evolves into increasingly rhythmic, accented dynamic shifts, creating a transition to the next section. This fifth part contrasts strongly with the rest of the piece, being based not upon random-walk glissandi or sustained notes, but on rhythmic pulsations. Each instrument repeats a fixed pitch at its own rate, eventually filling out a layered texture built from the ratios 13:12:11:10:9:8. The pitches create a tight cluster between *G*4 and *A*#4, with strong dynamic shifts and overlapping entrances and exits of individual instruments adding temporal and textural perspective.

The final section features the voices and cello exclusively. This time the voices sing their usual material, glissandi broken up by rests and sustained notes, an additional textural dimension being sporadic shifts to a staccato articulation. The cello traces a meandering glissando contour both above and below the voices, eventually settling into its low register, shifting back and forth between tremolo and ordinary bowing.

In architectural terms, the major formal factor in *N'Shima* is the shifting role of the cello. Marked “mystique,” the instrument at first serves as respite from the narrowly concentrated, relentless music of the voices and brass, the more ethereal ponticello sonority and the relative ease by which the cello performs its glissandi contrasting with the rather raw, pained outpourings of the others. The extended passage combining the cello with the “phantom” sounds of the voices begins to point to a synthesis, a reconciliation between these distinct expressive and compositional entities. *N'Shima*'s conclusion consummates the union, as the cello flutters about the voices as a butterfly might, the mystical beauty of its sonority drawing the voices away from their brutally imposed limitations (of range and sonority). As the voices fade out on a sustained, archaic-sounding perfect fourth, the cello carries on, narrowing its range, then breaking off into silence.

In his notes on the piece, Xenakis points to the implementation of computergenerated random-walk graphs for creating melodic patterns, and mentions the use of the “logistic” and exponential probability distributions. It is remarkable that the peculiar force of his scientifically trained intellect could give rise to such powerfully expressive music. The human voice, treated here in the most abstract way, cries out with searing eloquence. *N'Shima* is one of Xenakis's masterworks, the compositional techniques and multidimensional architecture matching the music's expressive intensity, particularly given the exposed human emotion through the use of solo voices. He would only match it in *Ais* (1980), which places a solo voice in the orchestral arena.

Psappha

By the mid- 1970s, Xenakis seems to have reached his stride, producing eighty works in the twenty years between 1974 and 1993, including an average of one orchestral work per year. In 1976 alone, there were seven premieres, with six more to follow in 1977, culminating in a monthlong festival in November and December of that year in Paris, with eighteen concerts, thirty-four pieces, and the premiere of one of his greatest orchestral works, *Jonchaies*. Given all this activity, including teaching, traveling, directing the operations of the Centre d'Etudes Mathématiques et Automatique Musicales (CEMAMu), and planning and implementing various multimedia events, it is remarkable that Xenakis was able to retain his compositional focus. This he did, however—and in spades.

Having traveled to London for the premiere of *Phlegra* in January 1976, Xenakis returned in May for several performances at the London Bach Festival—notably the premiere of *Psappha*—for solo percussion. This score is extreme, “a purely rhythmical composition,” he noted at the time (Emmerson 1976, 24). There is no large array of instruments and timbres, as there often are in percussion works. There are no pitches, few dynamic changes, and no sustained sonorities. Each note is treated as an attack, with duration functioning solely as measurement from one attack to the next. The composer is entirely concerned here with time and the articulation of it through the polyrhythmic construction of rhythmic patterns (*polyrhythmic* herein referring to the simultaneity and interaction of independent layers of rhythmic constructions rather than different subdivisions of metric units).¹⁶ The notation avoids the use of bar lines in order that any sense of traditional meter be avoided by the performer. The title refers to the ancient Greek poet, Sappho, whom Xenakis credits with introducing “metabolae” (shifts or changes) into the rhythmic patterns of her poetry. The notion of metabolae is central to the conception, with some changes coming about through systematic organization, and others through intuitive manipulations of the material.¹⁷

Psappha is comprised of five sections (two being divided into subsections), delineated primarily by shifts in tempo and/or density, and instrumental family (see table 8).

Xenakis does not prescribe the exact instruments to be used. Rather, he calls for nine gradations (in terms of register or pitch) of skin and wooden instruments, and seven metallic instruments (metal bars, railway ties, etc.). All need a sharp decay so that the attacks can be clearly perceived. While such an approach to instrumentation is unusual, Xenakis defines the categories with enough precision to ensure that the compositional discourse, comprised of rhythmic structures layered by timbre and register, can be perceived.

Xenakis has stated that his treatment of the rhythmic organization in *Psappha* is not strictly systematic: “The solution is not really calculated or computed, but is a thought-out intuitive approach to the rhythmic problem...with all previous experience as an aid” (Emmerson 1976, 24). He employed a number of techniques developed in earlier works, here applied solely to rhythm. The music follows on from *Persephassa*, to some extent, but the earlier ensemble work is much richer in its timbres, employing spatialization as well. The opening of *Psappha*, a layer of material assigned to the medium-register category of skin and wooden instruments, is built from a sieve. As Ellen Rennie Flint

discovers in her study of the sketches, the sieve is complex, using indices 5 and 8 to create a cyclical structure forty units in length (see fig. 15). The middle instrument (B2) articulates the sieve, with the lower instrument (B3) accenting the longer durations and the upper instrument (B1) filling in the gaps in order that a continuous pulsation be maintained. After one cycle, Xenakis implements a shift (or *metabola*), marked by a unique accent of B2 and B1 together, changing the indices of the sieve to 6 and 7, producing a cycle forty-two units in length. The structure is then altered slightly with the inclusion of a quintuplet figure, the only such irregular subdivision.¹⁸ After the two sieve cycles, this layer continues, shifting to freer variations of the material, with the relationship of the three instruments changing, allowing gaps in the ongoing pulse for the first time. At beat

Table 8. Sections and Their Durations in *Psappha*.

Section A: 292.1 (28.29%)—152 MM—Timbres A/B (+C)
Section B: 55.15 (5.34%)—272 MM—Timbres A–C
Section C1: 135.55 (13.13%)—110 MM—Timbres A/C (+B)
Section C2: 202.63 (19.62%)—110 MM—Timbres A–E
Section C3: 54.1 (5.24%; Section C—37.99%)—110 MM accel.—Timbres A–E
Section D1: 135.67 (13.14%)—134 MM—Timbres A–E
Section D2: 68.06 (6.59%; Section D—19.73%)—134 MM—Timbres A–E (rolls)
Section E: 89.21 (8.64%)—152 MM—Timbres C3/F

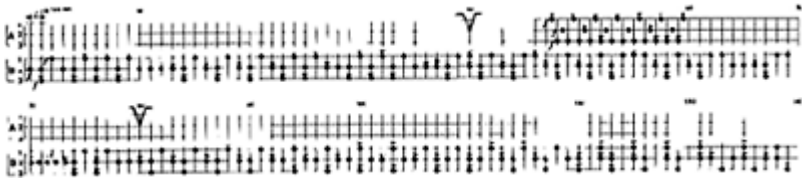


Figure 15. *Psappha*: Opening passage, showing rhythmic sieves.

220, these gaps become extended as the density noticeably decreases.

With the opening layer of rhythmic material establishing the pulse, a second layer makes sporadic appearances, beginning at beat 47, just after the statement of the first sieve. This material, assigned to the higher-register set of skin and wooden instruments (A1–3), proceeds at double the speed of the first layer. The ordered distribution of each note to one of the three instruments is achieved, according to Flint, by a group theory process. Three elements can be ordered in six different ways, and larger cycles can be created by linking one group to another (Flint 1993, 227–28). These interventions of the upper layer occur at decreasing intervals, for varying durations, up to beat 380, then taking over the focus of attention for an extended passage lasting close to a minute. The organization of this section makes use of large-scale symmetries in the group structure

(Flint 1993, 240–44). A gradual crescendo and decrescendo highlights the passage, punctuated at the end by the dramatic introduction of the lowest of the skin and wooden instruments (C3), which, unusually, is precisely specified—a large bass drum.

With the shift in tempo at beat 740 comes an interesting manifestation of the opening sieve in layer B. Beginning at beat 772, the three layers of skin-wood instruments (A, B, and C), each made up of three instruments, state the material in the form of a mensural canon. The higher group proceeds at the fastest pace, with the pulse being set at 2.5 units, the middle group adopting a rate of 3.5 units, and the lowest 5.5 units. The effective ratio of beats is approximately 2.2:1.57:1. The resulting texture, obviously, is highly complex, sounding at first quite statistical; as the identity of the sieve becomes more familiar, however, the triple-layered structure emerges. The canon winds down into the next change of tempo (from 272 MM to 110 MM, a radical shift). Here, starting the third major section, the density reaches its sparsest level, with *ffff* attacks on the bass drum (echoed immediately by A1, the highest of this instrument group) separated by long silences of twenty, then twentytwo, beats (over ten seconds in duration). In terms of formal proportion, this passage occurs approximately one-third of the way through, just prior to the introduction of the metallic instruments at beat 1238. Various forms of textural and rhythmic interplay between the two families of sonority carry on through this, the longest section, right into the fourth, signaled by an acceleration and tempo change at beat 1720. The metallic instruments are not given a passage to themselves at all, the next major signpost being the shift, at beat 2023, to rolls, or multiple attacks for each pulse, creating a more fluid rhythmic texture. Finally, the tempo shifts back to the original rate (152 MM), the continuous pulse being articulated by the bass drum (usually played with a foot pedal). The material of the second layer is reconstructed one last time as the bass drum, after stating a variant of the opening two rhythmic sieves (compressing the three instruments into one), goes into a Fibonacci sequence. The pattern of accents follows the series, expanding from a distance of two beats through to fifty-five (2–3–5–8–13–21–34–55), the final accent ending the piece.

Psappha is an intricate exploration of polyphonic (or polyrhythmic, as Xenakis puts it) rhythmic structures. By building from a common pulse, he draws on the compelling rhythmic force that attracts people the world over to dance music.¹⁹ At the same time, the music is highly complex, utilizing various organizational techniques and degrees of formalization. And, the score is a tour-de-force for the percussionist, requiring enormous strength and stamina as well as timbral sensitivity in order to select the appropriate instruments to articulate the various layers. Xenakis would follow *Psappha* up with another major work for percussion ensemble, *Pléiades*, in 1979. In the meantime, he turned his attention back to the strings.

Windungen

As noted earlier, Xenakis followed up the random-walk glissandos of *Mikka* with a second violin solo, *Mikka* “S”, completed in November 1975. Around the same time, he set to work on an unusual but prestigious commission, for the twelve cellos of the Berlin Philharmonic. The group gives performances as an independent entity, playing arrangements of light classics, and so forth. By this point in his career there would have been no question as to the sort of piece the ensemble could expect from Xenakis—unlike,

perhaps, the Munich commissioners of *Polla ta Dhina* (1962), who had programmed it for a festival of light music.

Windungen (German for “turn, coil, meander”), completed in 1976, exploits the spatial potential of this homogeneous ensemble by placing the twelve cellists in a circle on the stage. The opening, a very fast single line built from just three pitches (the group theory-derived ordering of pitches resembling the upper layer of the opening of *Psappha*), is passed off from one player to the next, spinning around and about the two halves of the circle at dizzying speed. Later, short glissando contours are also passed from one player to the next, this time all the way around the circle creating sonic rotations of varying speeds, with additional materials surfacing or branching off from the main contour. These two sections, both flying by at a very fast pace, the first lasting one minute and the other just two, are separated by a sustained passage in which held chords, enlivened by small, irregular oscillations of pitch, descend by slow glissando to a low *C#2* in the first cello, haltingly articulated with a ponticello tremolo. This quiet solo, which lasts for close to thirty seconds, doubles the length of the sustained section, balancing the opening and providing respite from its whirling energy, which sets off again immediately after.

Following on from the rotations of the third section, built entirely from short glissandi, is a more sustained passage, this time enhanced with trills both during the sustained notes and chords and during the slow glissandi that connect these sonorities. The closing passage is made up of alternating blocks of harsh, repeated chords fleetingly reminiscent of the “Danse des adolescentes” from Igor Stravinsky’s *Le Sacre du Printemps* (1913), trilled clusters, grinding bridge noises, and slow glissandi. A brief outburst of close-range, articulated glissandi gives way to a final tremolo on the low open *C2*, slowly fading away.

There is a great deal of energy in *Windungen*, a concentration of material that packs much into the relatively modest, eight-minute duration. New instrumental techniques are not explored, but the high-speed ensemble coordination the music calls for is breathtaking. This score is a gem of whirling, sparking motion that takes good advantage of the timbral richness of the cello. Xenakis would return to the cello the following year with *Kottos*, his second solo for that instrument. More immediately, though, he occupied himself with a tour-de-force for solo double bass.

Theraps

The double bass appears in a solo context relatively rarely, although a few exceptional performers have attracted greater attention to the instrument. Fernando Grillo, for whom *Theraps* (1976) was written, is one; Robert Black, whose recording of *Theraps* is the only one available on CD, is another, along with Barry Guy, who contributed performance suggestions for the printed score. It is safe to say that such a piece had never been written for the bass before. The music covers a range of five octaves, and includes such niceties as quadruple-stop chords and contrarymotion double-stop glissandi.

The formal outline of *Theraps* (signifying “achievement, level of conscience;” from the same root as “therapy”) is clear and simple, being built from sharply delineated blocks of contrasting materials.²⁰ Essentially, there are three sonic entities employed for the bulk of the score. In addition, a short opening passage is based on a loud, aggressive, descending glissando sonority, repeated forty-five times with a short interruption for

staccato repetitions of the same accented pitch. The ending is built from a similar gesture, a grindingly loud, short descending glissando figure, repeated seven times, but this time as a quadruple stop, nearly impossible to play and certainly demanding enormous strength.

Most of *Theraps* is based on random-walk glissandi, smoother double-stop glissandi, and double-stop natural harmonics. Xenakis returns to the glissando notation he adopted in *Mikka* for the random-walk material, writing out all the notes, with legato bowing, the finger sliding from one note to the next. The composer uses a single pitch sieve here; this has the effect of coloring, subtly, the glissando contours. The sieve is complex in formation, using the quarter tone as the basic unit, with intervals of one, two, or three quarter tones ordered in a nonrepeating pattern over the 103-unit span of the material. The rate the contour fluctuates at is constantly changing, and the line is further detailed by shifts to ponticello and by radical changes in dynamic markings (often associated with the timbral shifts). The double-stop glissandi move at a much slower rate, as might be expected given the considerable technical difficulties involved, including contrary motion. These glissandi do not derive their pitches from the sieve. The natural harmonics, played in double stops with changes of pitch overlapping from one string to the next, are the most static, rhythmically, and lend an ethereal tone to what is otherwise a gritty, growling piece. The succession of these three entities, together with the arching contours of the lines as they range over the register of the instrument, constitute the architecture of the piece simply (see table 9).

The constant shifts in rate of glissando, timbre, dynamics, and intervallic changes (in the double-stop passages) are much more perceptible than they would be in a context of greater formal or textural complexity. The virtuosity exhibited by the performer definitely constitutes a major focus of the music.

Table 9. Formal Outline of *Theraps*.

Entity:	MM:	Beats:	Duration:	(Dur:)	(Dur:)	(Dur:)
Intro	58	12	12.4			
I	58	55		56.9		
III	58	40				41.4
I	58	34		35.2		
III	58	27				27.9
I	58	91.5		94.7		
II	80	60			45	
I	58	53		54.8		
II	80	95			71.25	
III	58	56				57.9
II	80	8			6	
I	58	28		29		

II	80	8			6	
III	58	68				70.3
II	80	27			20.25	
I	58	21		21.7		
Coda	116	10.5	5.4			
		Totals:	17.8 (2.7%)	292.3 (44.5%)	148.5 (22.63%)	197.5 (30.1%)

Kottos

Whereas *Theraps* was composed to stretch the limits of the very best performers in the world, *Kottos*, for solo cello, was commissioned as a test piece for the 1977 Rostropovitch Cello Competition. It was, in other words, intended for performance by many players, rising performers (including Frances-Marie Uitti and Rohan de Saram) rather than established virtuosos. While a comparison of *Theraps* and *Kottos* necessitates a slight chronological jump, it is worthwhile to do so, as the differences between them point to an interesting shift in compositional concerns.

Kottos refers to the name of one of the hundred-armed titans (offspring of Uranus, god of the sky, and Gaea, goddess of the earth) that Zeus fought and conquered, and alludes to “the fury and virtuosity necessary to perform this piece” (Delalande 1997, 161). This is not music to be taken on lightly, even if intended to be accurately played rather than approached through approximation, the more “idealized” orientation the composer adopted in *Theraps*. Perhaps the most striking difference between the two scores is the attention Xenakis pays to transitional material in *Kottos*, almost entirely absent in the earlier piece.

The opening strikes the aggressive tone implied by the title, with the harshly grinding bridge noises also found in *Windungen*. Quickly, though, there is a shift to the keening sound of soft, quick glissandi, played by means of artificial (fingered) harmonics. A dialectic is immediately established between two contrasting entities, both rather extraordinary in terms of traditional cello technique. The grinding noise returns, after an interlude of just five beats (approximately five seconds), this time undergoing a gradual transformation into a sustained pitch, tremolo sul ponticello. This note, held through five measures, is subjected to constant transformation through variations of dynamics, the spectral content of the ponticello sound, and the tremolo speed (which turns into a regular bowed note by either speeding up or slowing down the tremolo). This held note is a natural harmonic, and serves as the link into a passage of double-stop natural harmonics, as found in *Theraps*. In eight measures, then, the music has moved through four sonic entities along with transitional material. Xenakis here sculpts his blocks of material with great attention to detail.

After the long passage of natural harmonics, varied texturally with brief tremolandi, the gull-like cries of the harmonic glissando return briefly, with a longer falling sonority leading back to the grinding sound of the opening. A second exchange between falling glissando and bridge noise carries on to the transition from the grinding sound to a sustained tone played tremolo sul ponticello. A third grinding noise leads to another

sustained note, this time the open *D* string. As this tremolo fades out, the first part comes to a close. The structure of this section produces an arch form.

The next passage, launching the second section, is built from relatively narrow glissandi articulated according to a rhythmic sieve (nonrepeating, with values ranging between one and five units), heard against sustained open strings, moving from one through all four over the course of the passage. This material is broken at two points by glissandi/sustained open strings, the second leading to a fermata on a detuned double-stop unison. The glissando texture here leads seamlessly into a double-stop glissando passage similar to those found in *Theraps*. The material is further developed, though, by intercutting the glissandi with held entities, enlivened with rhythmic bowing action back and forth from one pair of strings to the adjacent pair, keeping the middle string (and sustained pitch) in common. There is an additional variation of the glissando texture by means of tremolo sul ponticello. At m. 41, the double stops close in on a unison, then shift to a fingered semiglissando contour that itself proceeds through variations of dynamics and bow position (ponticello), finishing with a brief two-part passage in which the contour splits, each following an independent rhythmic path (layering irrational subdivisions, such as 5:6 against 9:7). Thus, the second part, featuring various manifestations of the glissando, closes with a graduated transition toward the bowed, pitched material of the third section.

While *Windungen* featured articulated pitch material, *Theraps* did not. The final three sections of *Kottos*, representing close to two-thirds of the piece, feature strongly rhythmically defined music. The first part of this second large division of the score contains transitional material, with a number of short glissandi and legato steplike passages reminiscent of the earlier fingered glissandi. A contrast is set up between fast, regular pulsations and more irregular, stochastic divisions of the temporal grid, further distinguished by pairing each rhythmic pattern with its own pitch sieve. A *fff* glissando flourish leads into the next section, also marked by a drop in tempo. The rhythmic texture here is characterized primarily by continuous pulsations articulated by pitched attacks drawn from the eleven notes of a rather widespread sieve spanning more than three octaves. The arpeggiated character of this passage eventually narrows in on a semitone diad (*B4–C5*), fading out in a cadential gesture which sets up the final section. The tempo notches back up again (the rate of pulsation shifting by a factor of about 20 percent), and the pitch range is narrowed. The character is more melodic, rather toccata-like given its accented and rhythmic character, and the intervallic structure of the sieve lends a quasi modal, Stravinskian flavor to the music.

A quick drop to the lower register, signaled by a trill and crescendo, leads to a shift in character, even if the driving rhythmic pulsations continue. A pair of double-stop perfect fourths alternate irregularly with a single pitch in the same register. The rhythmic momentum is loosened in an *ad libitum* passage where the same material is freely alternated to create a fast, irregular, quasi-tremolo effect, eventually landing on a final manifestation of the grinding bridge noise, a brief recall of the opening section. The music shifts back to the toccata-like rhythmic articulation of double-stops, though here they are even lower in register and more explicitly modal. The material zooms in on an alternating pair of fourths as the music fades from *fff* to *p*, ending on a held *D3–G3*. This pure interval (played with no vibrato) leads quietly into a final brief passage of short

harmonic glissandi (as at the opening), the final sound sliding higher and higher to close the piece with an uplifting, rather than rooted, gesture.

Kottos is a richly detailed composition, built from a clear succession of sections but with numerous details of transition, recall, and variation beyond the parametrical manipulation of the basic sonic entities. Some of the formal concerns and sonic materials relate it not only to other chamber string scores (including the series of works to come in succeeding years), but to the works of other genres. While there are exceptions, pieces in which Xenakis focused on more restricted concerns of one sort or another, *Kottos* marks a shift toward greater structural complexity and formal depth. A wider variety of materials is employed, and ranges of values, or qualities, are established within textures to provide for transformations and contrasts on both the large and small scale.

Khoai

Let us return now to 1976, when Xenakis completed three more chamber works, in one of his busiest and most prolific periods. At the same time as he was occupied with a steady stream of compositions, he traveled widely to give lectures and attend performances. Hugues Gerhards notes that in 1976 the busy composer traveled throughout France, to Germany (Cologne, Bonn), Holland, London (at least twice), Helsinki, Manila, Tokyo, and North America (twice). And, throughout this year and the next, he was also heavily implicated in the design of a new polytope commissioned for the inauguration of the Centre Georges Pompidou in Paris.

After *Theraps*, Xenakis completed a work for another unusual instrument, the harpsichord. Revitalized in the twentieth century as a concert instrument by Polish virtuoso Wanda Landowska, it was another Polish artist, Elisabeth Chojnacka, who made the harpsichord a vital addition to contemporary music. She accomplished this not only through her dedication and fiery virtuosity, but through incorporating amplification as an essential element of her instrument. It is thus possible to project the sound in a large hall and magnify the changes of registration and timbre. *Khoai* (“offerings poured within the earth, libations and vows to the gods of the inferno”) was the first of a series of commissions awarded to Xenakis by Westdeutscher Rundfunk (WDR—West German Radio) in Cologne. The score was written for Chojnacka, in close consultation with her and her instrument. In spite of this, she was, upon receiving it, “completely panic-stricken by its fiendish notation” (Chojnacka 1981, 227).

There are passages of intricate complexity, as in *Gmeeoorh*, in which arborescent tendrils branch out at alarming rates. Overall, though, *Khoai* is more episodic than the organ work, alternating between concentrated polyphonic passages and lighter, rhythmic moments. The concern for timbre, quite subtle in the harpsichord, but nonetheless perceptible, is similarly intricate, with the lines and layers of music shifting back and forth between the two keyboards and the four registral changes along with the mute stop. The linear continuities Xenakis sought to achieve in *Synaphai* through rapid repetitions of individual pitches within an often steplike melodic contour, are easier to perform on the harpsichord, although the attacks are also more distinct. The almost constant fluctuations of rhythmic density lend the music an improvisatory quality, though the thick textures and rather nonlinear architecture do not.

Khoai contains numerous signposts, points at which the material, either contrapuntal or rhythmic/chordal, thins out, or where repetitions of selected pitches, often emphasized by octave doublings, provide a kind of harmonic orientation. The opening, for example, highlights a pedal *F* spread across three octaves, and Xenakis returns to it all the way through the first section up to the entry of the first arborescence passage at m. 37. It returns sporadically in the succeeding rhythmic passage, and many times thereafter as a kind of tonal anchor.

There is a range of harmonic coherence in *Khoai*, from repeated pedal tones (or a combination of pedal tones), to sieves of fixed pitches, to chromatic fluctuations as found in many of the arborescences. The Fibonacci series makes its appearance, too, being used to generate certain rhythmic patterns, and, as in *Psappha*, to signal the end. The expanding duration series that closes the piece is shorn of the ongoing pulse, instead marking increasing durations of silence-resonance.

The needlelike precision of the harpsichord, together with its agility and percussive sonority, particularly when amplified, proved a seductive medium for Xenakis. He would go on to compose a number of works for Chojnacka, who has become a forceful advocate of his music through her mesmerizing performances. His emphasis on the percussive nature of the instrument also led to the unusual combination of harpsichord and percussion. First, though, Xenakis turned to another unusual duo—oboe and percussion—for a performance at Carnegie Hall.

Dmaathen

Carrying on from the extended clarinet sonorities Xenakis explored in *Anaktoria*, *Synaphai*, and *Charisma*, the oboe part in *Dmaathen* (1976) features a number of extended techniques. These include fingered multiphonics, timbral variations on a single pitch, alternate fingerings, glissandi, teeth on reed, and flutter-tonguing. The oboe material alternates between sustained passages built primarily from these effects, and brief flurries of melodic contours. The percussionist alternates between a set of drums (bongos and congas) and a pair of pitched instruments, the vibraphone and the marimba. The rhythmic patterns often shift from one speed (density) to another, sometimes superimposing one on the other. The pitched material is usually linked to the faster passages of the oboe, creating arborescences that on several occasions require the performer to play both the vibraphone and the marimba at the same time, or in rapid alternation. The score, then, requires enormous virtuosity from both players, indicative, no doubt, of the confidence Xenakis had in the two American musicians for whom it was written, Nora Post and Jan Williams.

Dmaathen (the title is a constructed word, signifying nothing, but evocative in its sonic qualities), with a duration of ten minutes, is a relatively ambitious attempt to create an integrated, interactive chamber music for highly contrasting instruments. Whereas *Charisma* explores a range of materials and gestures which link as well as contrast the clarinet and the cello, there is in fact little sonic connection between oboe and percussion. The oboe can pulsate a single pitch in a similar manner to iterations of a drum, and the percussion can play melodic contours on the keyboard instruments, but there is never mistaking the one instrument for the other. The formal continuum from contrast to

integration is more restricted, therefore, and this may be why *Dmaathen* seems less successful than the earlier duo.

Épéï

For his second trip to North America in 1976, Xenakis composed another chamber work, this time for six instruments drawn from the ensemble of the Société de Musique Contemporaine du Québec, based in Montreal. The oboe of *Dmaathen* is changed to a cor anglais, to which is added a clarinet, trumpet, two trombones, and a double bass. The title, *Épéï*, signifies “since,” which implies a statement of events and then a negation by modification or change. The music is very much built upon continuous textural transformations. Timbre, too, or instrumental color, is treated in a continuous fashion, proceeding from homogeneity rather than contrast, restricting the differences between the instruments rather than emphasizing them.

The long opening section proceeds without interruption for close to four minutes, almost one quarter of the piece’s duration. The muted trumpet states a three-note motive, shadowed by the clarinet playing legato an octave lower, and proceeds to vary it slightly with each repetition. The other instruments surround this strange canonic variation with sustained notes in the same register, varied in all manner of ways. After this lengthy, incrementally evolving passage, there are two short, contrasting sections. The first proceeds without break into a narrowband glissando sonority, with all instruments outlining slowly undulating, independent contours, the blocklike dynamic changes moving twice from *pp* to *fff*. A short break leads to the second section, in which a uniform pulse, articulating six-note clusters that vary slightly with each new beat, gradually moves out of phase and then back in again.

The next section, which carries through pretty much to the end, though in less continuous fashion than earlier, begins with a sustained pitch, *A4*, doubled in the trumpet and cor anglais. This pitch is varied through octave doublings, dynamic and rhythmic variations, and by increasingly wide-ranging glissandi. The sonority is strongly reminiscent of the work of Giacinti Scelsi, although the sporadic flurries of notes away from (and back to) the central pitch add an energy that is proper to Xenakis. At m. 111, there is a sharp interruption, a succession of *fff* clusters in all the instruments but the cor anglais. The music then starts up again as before, with little or no sign that this event had any impact on the material. The textural variations otherwise unfold gradually, carrying on right up to the closing passage. A short break signals the end, which bursts into a short statement of layered pulsations, each instrument moving back and forth between two neighboring pitches at a different rate. This gives way gradually to trills in all the instruments, then a rather dramatic heralding of a single pitch, *E*, spread across five octaves.

Épéï could not be farther in style from *Khoai* and *Dmaathen*. The episodic, sharply defined nature of those works is here replaced by a largely continuous form, with the individual colors and characters of the instruments, such as the plaintive tone of the cor anglais in its low register, emerging from a nebulous, narrow band of sustained sounds. There is some resemblance to *N’Shima*, though with less emphasis on rhythmic glissandi, creating a dreamier, more nocturnal atmosphere. In his next score, Xenakis would turn back to the human voice, combining elements from *N’Shima* and *Épéï* to carry forward

the integration of the voice into a chamber setting, before proceeding to the massed voices of a choral setting.

Akanthos

For a festival in Strasbourg in June 1977, Xenakis composed an intriguing work for soprano and a mixed ensemble of eight musicians, including flute, clarinet, strings, and piano. The voice, singing phonemes of no textual significance, is not assigned a privileged position within the ensemble per se, but the distinctiveness of its sonority causes it to stand out nonetheless, even without the usual operatic vibrato. The title comes from the Greek word for “thornbush,” or “hawthorn,” which is celebrated on the capitals of Corinthian architecture. This is reflected in the music by the intertwining lines and textures. The range of sonic entities is much wider than in the previous chamber works, no doubt reflecting the larger ensemble (see table 10).

Table 10. Sonic Entities in *Akanthos*.

short, rhythmically articulated glissandi (primarily strings)
long, continuous or undulating glissandi (primarily strings)
bridge noise (strings)
elaborated unisons, including octaves (all)
medium tempo melodic material (voice, all)
arborescences (primarily piano)
fast, steplike flurries, away from and back to a fixed pitch (winds, soprano, piano)
rhythmic pulsations on a fixed pitch, often layered (all)
rhythmic patterns built from sieves (primarily strings)
chordal, vertical material (all but piano)

There are few clear blocks of material where a single entity dominates. Rather, brief passages highlight a particular sonority, and much of the piece is built from changing mixtures of elements. To take an example, the opening begins with articulated glissandi in the violins, alternating with held notes. These carry into the grinding bridge noise first introduced by the cello then taken over by the other strings. Underneath this sonority the glissandi return, filling out to incorporate all five strings. This is then joined by a complex arborescence passage in the piano, which closes back in again on a single pitch, 44. The soprano enters on this pitch at m. 7, launching a longer passage in which this sustained pitch is elaborated and varied, with a number of instruments joining in over its twenty measures. The element of pitch is organized in different ways, depending on the material. There are quarter tones, chromatically saturated textures (such as the piano’s arborescences), and passages of more restricted content. These latter may be organized by means of sieves, but none are carried through for any substantial period of time, making it difficult to establish harmonic identity.

The voice in *Akanthos* is treated instrumentally, but there are, nonetheless, a few rather dramatic gestures, such as the ascent of two octaves in mm. 56–58, or the glissando in mm. 39–40 that rises more than two octaves before falling back again. Certainly the soprano part, ranging over almost three octaves and requiring absolute intonational precision for the quarter tones and the exclusion of any mitigating vibrato, is formidable. So too are the instrumental parts, of course, but the degree and kind of virtuosity is more unusual for a voice. In any case, having returned to the voice, Xenakis continued, expanding his forces to set texts from ancient Greece in his next two works.

À Colone, À Hélène

For another occasion in the east of France, the 1977 Contemporary Music Festival of Metz, Xenakis was commissioned to write a choral work. Having avoided texts since *Medea*, he happily returned to the Greek classics, choosing an extract from Sophocles' last drama *Oedipus at Colonus*, in which the pleasures of Athens are celebrated in effusive language (with, as the composer notes, an element of melancholy, coming off a long war, the great city's glory fading). Perhaps the composer was celebrating his own recent return to his homeland with this text. He attempts to follow the contours of the language in his melodies, matching them to the metric values (longs and shorts) of the verses. He also speculates as to the nature of the extant polyphony, creating his own version, filling out the mostly two-part choral setting (for either male or female voices) with an instrumental trio of horn, trombone, and double bass.

The music for *À Colone* is very restrained, with the voices chantlike in style, albeit not restricted to a traditional mode. The metric pattern is irregular, but the note values are highly simplified. The instruments provide brief interludes between the strophes and antistrophes of the text, along with various punctuations and harmonic enhancements throughout the choral sections. There are a few moments of glissando—and tremolo in the bass part—but the instrumental parts, too, are austere. A strange purity comes through, in part from the harmonic emphasis on perfect 4ths (Fig. 16a).

The same is true for the other choral work from 1977, *À Hélène*, for women's (or men's) voices, again in two parts, this time without any instruments. Composed just prior to *À Colone*, this work was written for a staged revival of Euripides' drama *Helen of Troy* at the ancient amphitheater of Epidaurus in July 1977. While the style is similar to *À Colone*, there are important differences, no doubt owing to differences in the text (rhythm, style, etc.). In *À Hélène*, the text moves forward with longer stretches of a single rhythmic value, and the melodic contours range over a slightly wider ambitus (see fig. 16b).

These two works indicate Xenakis's profound love of and interest in the ancient language of the masters of Greek theater. The music is intimately married to the text, and any listening experience of them would be greatly enhanced by an understanding of the language (unfortunately ruling out most people). Nonetheless, both are compelling in their simplicity and directness. In addition, the dynamic modal organization Xenakis developed would have implications going

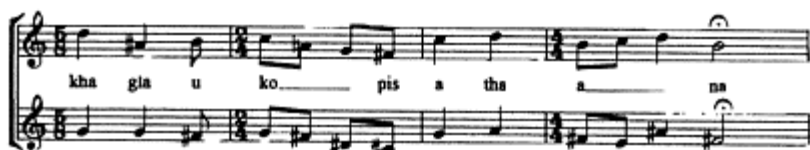


Figure 16a. *À Colone*: Narrow two-part vocal writing, from p. 9.

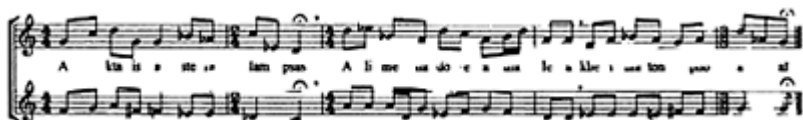


Figure 16b. *À Hélène*: Slightly wider ambitus of two-part vocal writing, from p. 3.

beyond the immediate purpose of setting the texts, showing up in chantlike instrumental passages in subsequent works.

Jonchaies

Throughout the latter half of 1977, leading up to the huge Cycle lannis Xenakis in Paris late that year, Xenakis was engaged concurrently on two major projects. One was the design and construction of *Le Diatope*, a multimedia, architectural creation for the opening of the Centre Georges Pompidou, for which he was composing a large electroacoustic work, itself commissioned by WDR in Cologne. The other was a large orchestral score commissioned for the festival, to be performed by Michel Tabachnik and the Orchestre National de France.

Jonchaies (“rushes, reeds”) calls for an orchestra of gigantic proportions: 109 musicians, including quadruple winds (with six clarinets and six horns), six percussionists, and an extra large string section. Parts of the piece are volcanic, with thickly layered, pounding pulsations, or wailing clusters of brass. Other parts, however, are surprisingly delicate, even lyrical.

The long opening section for strings alone (with a few discrete intrusions by the bass drum and temple blocks) is, without a doubt, one of the most melodically expressive passages in all of Xenakis’s output. After a dramatic launch, a glissando rocketing up to the high register to fall back slightly to a sustained *B6*, a modal melody unfolds. As it wends its way slowly down to the mid-low register and then back up again, the melody splits off into six voices, each following more or less the same contour by some degree of delay. The resulting texture is at the same time quasi-imitative and quasi-heterophonic. Each of the six voices is assigned a roughly equal complement of string instruments split into three layers, one bowing the notes normally, the second bowing them and adding a glissando, and the third (not always present) plucking the notes. The resultant additive

sonority sounds like an Indonesian gamelan, enhanced by the intervallic structure of the pitch sieve used.

Xenakis had long been fascinated by gamelan music, and in particular, the *pelog* scale to which the instruments are tuned.²¹ In attempting to emulate such a sonority in *Jonchaies*, the composer constructed a pitch sieve with a period of seventeen semitones (see fig. 17). Each period contains eight intervals, and most striking about the intervallic structure is the inclusion of two major thirds and one minor third. These intervals, separated by smaller ones, are what lend the music its modal, Indonesian character. The composer has noted in an interview that he found the interlocking fourths of the *pelog* scale (e.g., *F#–B*, *G–C*), with the two semitones acting in some sense like leading tones, a “powerful melodic structure.” He added, “The structure of the melodic scale is very important, not only in melodic patterns—melodies—but also in producing chords of a different timbre.... Tension is important for the melodic patterns, the chords, and for the flow of the music itself...the objective statement is made in the contrast between large and small intervals. Tension diminishes if there are too many of one or the other” (Varga 1996, 145–46).



Figure 17. *Jonchaies*: Pitch sieve for section 1 (strings).

The opening melody zeroes in right away on the intervallic structure Xenakis was attracted to in the Javanese gamelan. The major third is surrounded above and below by a semitone, outlining the interlocking fourths he mentions. The unfolding of the melody proceeds primarily by a steplike motion (from one pitch of the sieve to the next) or by jumping over one note to the next. The difference in sonority between this melodic structure and the chantlike melodies in the choral works written just prior is striking. In those, the contours appear to be freely composed, guided by the prosody of the text and a knowledge of Greek tetrachordal organization. The restricted range allows the flow of the language to proceed in a relatively natural(istic) way. In *Jonchaies*, and many subsequent scores, the intervallic structure of the sieve, which often remains fixed throughout a section or piece, creates a certain identity or “timbre.” The periodic nature of the sieve creates uniformity throughout the full range of the material, though its nonoctaviating structure (where the intervallic pattern does not repeat at the octave) structure has the effect of weakening the tonal implications of the leading tones to create a more mysterious, compelling expression.²² With six rhythmically independent lines carrying on together, the string sound is certainly complex, but the strong identity of the intervallic structure of the underlying sieve produces a clarity that would otherwise be missing.

The remaining sections of *Jonchaies* are quite different from the opening passage, but no less powerful. The second part is the most substantiated (at five minutes, being a full minute longer than the opening), and it is built from layers of rhythmic pulsations

involving the full orchestra. Each layer moves chromatically along a slowly undulating, independently conceived, contour. The driving pulse is occasionally fractured by certain layers shifting to a different tempo. The orchestration is noteworthy for its dynamic mixtures of instruments, the timbral components of each layer shifting as lines enter and drop out.

The third, relatively brief, section turns the spotlight back onto the strings, supported by sustained clusters in the winds and rolls on the low drums. The strings repeat a sharply defined gesture four times, varying the proportions with each. A strongly articulated ascending passage, in which each of the five families of strings proceed along independent rhythmic and melodic trajectories, is succeeded by a static passage of chordal pulsations, this time synchronized, leading into a glissando passage that falls back down again, each group proceeding independently as before. A conceptual link to the earlier sections is found in the wavelike contours of the material, with each passage offering a different musical perspective on the title, conjuring winds blowing through a field of rushes.

This rather enclosed section is succeeded by a narrowly banded texture featuring the brass, each instrument playing articulated glissandi. The emphasis shifts from horns to trumpets and trombones (from the more rounded sonority of the conical tubing to the more pointed sonority of the cylindrical brass). A “still point” is reached at m. 182, where the trombones sustain a chord through a fermata. The sound fills out again as all of the brass reenter, followed by the woodwinds, percussion, and finally the strings, as the concluding section begins. This final portion, quite substantial at something over three minutes, is by far the most complex. As many as seven layers of independent sonic entities are deployed at the same time. Overall, the music is filtered upwards beginning with the ripping glissandi of the horns, and finally concluding with the high chirps of the piccolos, xylophone, and marimba.

Coming at the end of such an intense sonic adventure, this closing gesture has great significance, almost as if the roiling energy of the music needed to be channeled up and out. Given that this passage is virtually identical to the end of Xenakis’s *La Légende d’Eer*, the significance is also cosmic.

Le Diatope; La Légende d’Eer

In his forward to the score of *Jonchaies*, Xenakis states that the orchestral score was inspired by “results obtained and used in *La Légende d’Eer*” (Xenakis 1977). The tape work seems to have been completed first, although not premiered until February 1978²³ at a special concert in Cologne; WDR had commissioned it and had provided the studio facilities for Xenakis to produce the tape.

The music was created as the sonic component of *Le Diatope*, a multimedia spectacle involving, as in *Polytope de Cluny*, sounds and light (1680 flashbulbs and 4 lasers guided by 400 positionable mirrors), and, uniquely, an architectural creation to house the display/performance. It was commissioned for the festivities surrounding the inauguration of the Centre Georges Pompidou in Paris, and was the most modest of the ideas Xenakis proposed (Matossian 1986, 222). According to Maria Anna Harley, the shift from polytope to diatope “indicated a shift in emphasis from the coexistence of a multitude of different spaces/objects/ phenomena to the homogeneous, enveloping

the point of departure was the sphere, but with its double curvature, its “flights” (“ses fuites”), it is an architecture “open to the world” (Xenakis 1978).

Indeed, for the period of its installation at the Centre Georges Pompidou in 1978, the sounds emanating from within the otherworldly vinyl shape would no doubt have spilled out into the world around. One would have had to enter the pavilion, though—and people did in droves, as they had for his *Polytope de Cluny*—to see the dynamic continuities and discontinuities Xenakis created in light with his flashbulbs and lasers. He was, in fact, modeling the basic elements of the universe—grains of matter and rays of photons—governing them by principles of order and disorder (deterministic/geometric and stochastic processes). Ultimately, after the installation was dismantled, it has been the music that has remained the most enduring document of *Le Diatope*.

Unusually, Xenakis put much effort into the program book, presenting his thoughts on the creation of the work, and gathering significant texts that, while not forming a narrative, resonate in multiple ways with the cosmic, even apocalyptic, scope of the sounds and light of *Le Diatope*. The title of the music, *La Légende d'Eer*, is taken from the concluding passage of Plato's *Republic*, in which a soldier is killed in battle then brought back to life full of images of the afterlife, including the famous “music of the spheres.” The medieval era is represented by Hermes Trismegistus, famous as an alchemist, who, in a similar way, is given a vision of the boundless darkness and light of immortality. The passage from Blaise Pascal's *Pensées* contemplates the insignificant place of humanity within the infinity of nature, and Jean-Paul Richter carries the vision further, writing of the terror of being alone in the universe, with no God. The final text is a scientific description of a supernova, presenting its awesome size and energy with detached precision. It is much easier to interpret words than music, but whether one wants to read an atheistic, scientific cosmology into these texts or not, they all share a vision of the vastness of the universe, with different images of light and life within that infinity.

The music, too, is vast in scope. At forty-six minutes in length it is more modest than *Persepolis* (1971), but the formal outline is more concentrated, with sonic intensity maximized throughout. The overall trajectory is one of a gradual descent, returning at the end to the high whistling sounds of the opening (a conclusion very similar, as already noted, to the ending of *Jonchaies*, not to mention *Pithoprakta*, from 1956). The music proceeds in an extremely continuous fashion, with many overlapping sonorities. Multichannel projection enables the different entities to be better perceived, and also allows subtle shifts in emphasis to be effected. There are eight basic sonic entities used in *La Légende d'Eer*, present or dominant at different times (see fig. 19).²⁵ Each of them is treated to a great deal of studio manipulation, including transposition, filtering, and reverberation. Each is also varied in terms of density, and this, together with the other types of processing, has the effect of creating links between the different entities. For example, the high whistling tones of the opening, at first of smooth surface, are varied with a tremolo/amplitude-modulation effect to create a more striated variant. This sound resembles high transpositions of the rattling ceramic sonority,

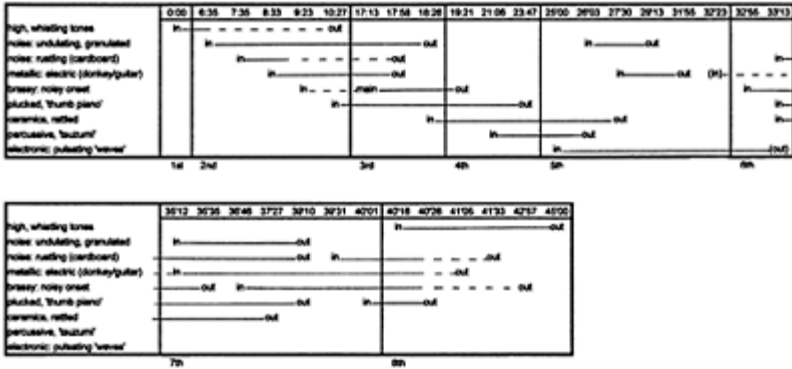


Figure 19. *La légende d'Eer*: Chart of formal outline.

itself filtered to produce a fairly precise sense of pitch. These two entities in turn resemble the high, narrow-band version of the granulated undulating noise, and even the drum (tsuzumi) entity, transposed and mixed to create a texture of high density. Thus, while the entities are relatively distinct, they can also be related along different parametrical continua.

La Légende d'Eer can be divided into eight sections. The first is the clearest, containing only the high, whistling sounds that Xenakis calls “sonic shooting stars.” At over six minutes, this layer alternates between the smooth sound and the striated variant. The second section begins when other sounds begin to enter and the high sonority starts to fade out. This is a transitional section, as five different entities are introduced one after another, none of them dominating the sound-field. The rustling noise alternates with the brassy synthetic sonority until, at the 17'13" mark, this entity begins to layer a number of tracks upon itself, commanding most of the attention. With the abrupt arrest of the brass voices, the fourth section begins with percussive sounds alone, a mixture of the plucked mbira, the rattling ceramics, and the tsuzumi. At the 25'00" mark a rich electronic entity enters and gradually saturates the texture. The pulsating, wavelike contours of this sonority strongly resemble the pounding undulations of the second section of *Jonchaies*. After close to eight minutes, it begins to fade out, and the brassy sonority takes over again. A number of other sounds enter too, and the brass is less dominant. The wild metallic entity, sounding like a cross between the amplified and distorted braying of a donkey and an electric guitar, is prominent throughout this passage. Up to that point, the general range of the sounds had been descending. The lowest transpositions of the brass and metallic entities carry the music through to the final section, where they fade out over some three minutes as the high tones of the opening enter and carry on to the end.

Asked about the *Polytopes*, Xenakis admits to dreaming of the celestial bodies, of the two moons following their independent courses in the nocturnal sky, and of other images taken from nature: “I want to bring the stars down and move them around. Don’t you have this kind of dream?” (Matossian 1981, 50).

UPIC, Mycenae alpha, and the Polytope de Mycènes

The logistics involved in mounting *Le Diatope* were immense. The project had begun in 1974, and along with designing and overseeing the construction of the architectural structure, Xenakis struggled with the digital automation of the various elements. These included sequencing the trajectories of the lasers and the positioning of the mirrors, along with triggering the flashbulbs, but also included the distribution of the seven channels of sound over the eleven installed loudspeakers. In addition, at CEMAMu, he was also working on the creation of digital sounds to include on the tape of *La Légende d'Eer*. The proposition, outlined several years earlier (and researched during his years at Indiana University), was to create the waveforms directly on the basis of stochastic functions (Xenakis 1992, 242–55). While he was only partially successful in 1977, this effort would have direct implications for a new synthesis method finally implemented at CEMAMu in 1991.

In the meantime, Xenakis was producing complex electronic sounds by other means—the UPIC. Developed under his supervision, the Unite Polygogique Informatique de CEMAMu is a computer music system enabling the user to create sounds by means of a graphic interface. All the elements of the sound are designed with an electromagnetic pen on a large electromagnetic drawing board (though recent versions have replaced the pen and drawing board with a mouse). These elements include the waveforms, the dynamic envelopes of the sounds, and the “arcs,” or notes. Interesting sounds can be obtained by designing noisy waveforms and complex envelopes, and also by layering as many as several hundreds of notes (Marino, Serra, and Raczinski 1993)

For Xenakis, who often sketched his music on graph paper, such an approach to sonic composition was perfectly natural. His first piece created on the UPIC was completed in the summer of 1978 for his *Polytope de Mycènes*, an outdoor spectacle mounted at the historic site in Mycenae in Greece. Similar in style to *Persepolis*, this event included torches on the mountainsides, searchlights crossing the sky, several of his “Greek” instrumental and choral works, and, as electronic interludes, repeated presentations of *Mycenae alpha*, his new UPIC composition.

The music is noisy and dense, made up primarily of massive clusters designed in such a way as to be visually compelling (see fig. 20). The basic impetus is to move from complex textures to more constant ones and back again (or to a new complex sound). Interspersed are moments of more focused, simpler sonorities. The first version of the UPIC did not allow the mixing of different “pages” of the graphic score, so Xenakis’s creation is a succession of different screens, one following on the other. In addition, each of these graphic entities could be no longer than one minute in duration, although it was possible to scale one page onto any duration up to that limit. For this work of over nine minutes, Xenakis created twelve graphic/sonic entities, two being repeated to make a total of fourteen pages or screens. A structural distinction can be made between complex sonorities created by means of masses of relatively stable note segments, and other sonorities created from dynamic arcs. Obviously, with no instrumental or procedural limitations, it is very easy to design complex glissandi on the UPIC merely by picking up the electromagnetic pen and tracing them onto the design board. What is not shown in the graphic score are the waveforms used for the individual timbres nor the dynamic envelopes for each note.²⁶

While *Mycenae alpha* is remarkable for demonstrating the innovations of the UPIC system, there is no denying that, sonically, it is less interesting than *La Légende d'Eer*. One reason is that the waveforms used to create timbres on the UPIC are static. No matter how complex the waveform is, the computer will simply read through its limited digital representation and then repeat this process at a rate corresponding to the Hertz value (cycles per second) of the note to which the waveform is attached. Various solutions to this limitation were developed in



Figure 20. *Mycenae alpha*: Portion of graphic score, 5'16" mark to 7'16" mark.

later versions, but acoustic research clearly shows that all instrumental sounds are dynamic to some degree, and never perfectly static. For the polytope in the ancient site at Mycenae, though, the rich, harsh sonorities of Xenakis's piece matched the savage magic of the landscape and the myths that permeate the atmosphere.

Though there have been a number of other plans, 1978 proved to be the last time that a Xenakis polytope was mounted. Perhaps the financial resources were no longer available. In any case, Xenakis, approaching sixty years of age, turned ever more intensively to his musical concerns, occupying himself less with architectural matters and theoretical exegesis (publishing relatively little new written material thereafter). Compositionally, the 1980s would prove to be even more fruitful than the already remarkably productive decade that had just passed.

6

Sieves, Ensembles, and Thoughts of Death

In the frantically busy year of 1978, during which *Le Diatope* and *Polytope de Mycènes* were both mounted and the Unité Polygogique Informatique de CEMAMu computer completed, and in addition to travels to North America, Mexico, Crete, Greece, and two weeks of summer courses at the Centre Acanthes in Aix-en-Provence, Xenakis completed just two instrumental works.

Ikhoor

The first of these was a string trio for the Trio à Cordes Français, who premiered it in Paris in April of that year. Carrying on from *Mikka "S"* (1975), *Theraps* (1976) and *Kottos* (1977), *Ikhoor* continues Xenakis's attraction to string instruments. At the same time—rather as Igor Stravinsky's *Three Pieces for String Quartet* carry on certain compositional preoccupations from *Le Sacre du Printemps* (1913)—this trio owes a good deal to Xenakis's previous *Jonchaies* (1977).

Ikhoor ("the transparent, ethereal liquid that flows in the veins of the gods") exhibits a strong preoccupation with pulse, and with layered pulses in particular. The opening begins with the strongly accented, Stravinskian chords found in the third section of *Jonchaies*. Then, one instrument at a time, the chords move into accented melodic contours, each following an independent trajectory of changing tempi. The three instruments come back into synchronization four times, creating strong articulation points in an otherwise highly complex passage.¹ The melodic undulations in this passage are wide ranging though clearly contoured, built mostly from intervals larger than a tone. While bowed in a deliberate fashion, this material does form a link to the glissando contours of the second section, connected by a transitional passage at mm. 31–37, which layers staggered glissando lines with ostinato pulsations. The second section proper, beginning in m. 37, elongates the glissandi over much longer durations and narrows their scope. The individual parts are built from double-stop glissandi or else from a single line moving above or around a sustained pitch.

The third section returns to the rhythmic orientation of the opening, but here the layered trajectories of changing tempi are articulated by ostinato material, with each instrument repeating one of a set of three double stops in an unpredictable fashion (in terms of ordering and number of repetitions). The relatively static pitch content of this passage opens out at m. 58 with the double stops being varied more frequently. At m. 66, a transition to the next section begins with continuing ostinati in the viola and cello and

short, high, articulated glissandi in the violin. At m. 71, all three instruments play glissandi, independently, signaling the full arrival of the fourth section. This passage is texturally more dynamic than the previous ones; natural harmonics are introduced, adding a more static, glassy sonority to the coiled energy of the glissandi. At m. 79, quiet, scurrying runs begin to infiltrate the texture as the glissandi drop out, taking over completely by m. 89. A dramatic crescendo leads to a high tremolo, which narrows into a sustained chord at m. 93.

After a short breath, the fifth section begins with a “modal” melody played by all three instruments. As in the opening string passage in *Jonchaies*, the instruments each play the same sequence of notes (drawn from just four pitches), but each at a slightly different tempo. Given the restricted range of the melody, this canonic process has the effect of “reverberating” the line, each note articulated and sustained by one or other instrument. Xenakis would make use of this technique in many subsequent works. Fast outbursts disrupt the rather hypnotic effect of the narrow melody, and eventually, by m. 102, they sweep the music up into a higher, faster-paced contrapuntal passage. The four-note sieve of the previous section is expanded to cover the full range of the instruments, from *B6* down to the bottom of the cello register. The density of the double-stop contours alternates with a series of ensemble runs back up to the high register between mm. 111 and 115. The brief closing section returns to the opening, with brief nods to the ostinati of the third section and the fast glissandi of the fourth. The music fades away on a long slow glissando, performed in a tremolo style and shifting to a filtered *sul ponticello* sonority as the music drops off into silence.

Ikhor draws upon many of the same kinds of material as *Jonchaies*. The formal divisions are relatively clear, moreso than in *Kottos* (though less blocklike than *Theraps*), with transitions of overlapping shifts from one texture to another. The concern with pulse and tempo is new to the string music, but would become a major component of many scores thereafter. Xenakis had become fascinated with basic issues of repetition and predictability (and nonrepetition and unpredictability), beginning most explicitly with *Psappha* (1976). He would carry this on in his next piece, a huge work for percussion ensemble. He would also continue to demand an extraordinary level of virtuosity, both from the individual performers and from the ensemble as a whole. In the music for strings, this virtuosity would reach its pinnacle in the 1983 quartet *Tetras*.

Pléiades

Following on from his success with *Persephassa* (1969), Xenakis was commissioned to write a second work for Les Percussions de Strasbourg, to premiere at the Opéra du Rhin in May 1979. *Pléiades* (“the constellation of the seven daughters of Atlas,” “pluralities, several”) lasts about forty-five minutes, making it his longest instrumental work after *Kraanerg* (1969).² Three of the four movements utilize a single family of instruments: keyboards, drums, and metallic instruments (these being specially constructed instruments called sixxens, each having nineteen bars, or “pitches,” not tuned to common equal temperament). The fourth movement combines all three, and draws upon material from the other movements.

By severely restricting the timbral possibilities, as in *Psappha*, Xenakis was able to concentrate on rhythm and pulsation. Unlike the solo, *Pléiades* incorporates pitched

material, creating a range of “scales,” from the modal pitch sieve borrowed from the opening of *Jonchaies*, to chromatically saturated textures, to the exotic tuning of the sixxens, to the ordered collections of drums. The composer allows for two different orderings of the movements: (1) Claviers—Peaux—Métaux—Mélanges; and (2) Mélanges—Claviers—Métaux—Peaux. In the first, the three classes of sonorities are introduced and treated separately, then combined; in the second, the mixed sonorities of *Mélanges* introduce the materials and instruments of the rest of the piece.

Each of the movements of *Pleiades* is constructed from rhythmic processes by which a single layer of pulsations or patterns (sieves) is combined with other strands, most often of the same material, each following its own trajectory of changing tempi, as in *Ikhoor*. The opening of *Métaux* is a clear manifestation of this technique, with the players each striking a single metal bar to focus the attention clearly on the expansion from a single pulsation to independent layers (see fig. 21).

The movement involving the keyboards is perhaps most interesting, compositionally, in that the rhythmic concerns are combined with pitch organization. The instruments are divided between metal (vibraphones) and wood (marimba, xylophone, xylomarimba), a timbral factor that Xenakis emphasizes at the outset. The opening consists of a unison statement of a chromatic melody by the vibraphones. At the end of m. 2, each of these three instruments splits off into its own tempo, continuing to play the same melody but at a slightly different speed. This canonic treatment is very similar to section 5 in *Ikhoor*, and is recalled in the *Mélange* movement at the first entry of the vibraphones (though the imitative process there is not strictly canonic). The pitch content is chromatic, filling in a minor tenth (*F3–G#4*) then gradually expanding upward. The three wooden instruments enter one at a time between mm. 10 and 14, playing ascending, toccatalike lines (each at its own tempo) built from the *Jonchaies* sieve. At m. 16, the vibraphones shift to similar lines and the same sieve, sweeping the music up into the high register. This material continues, with variation in horizontal density and range, and is broken up four times by fast rising scales.

Finally, at m. 43, there is a sudden shift as the wooden instruments drop out again, leaving the vibraphones to play a jazzy, syncopated line built from the same

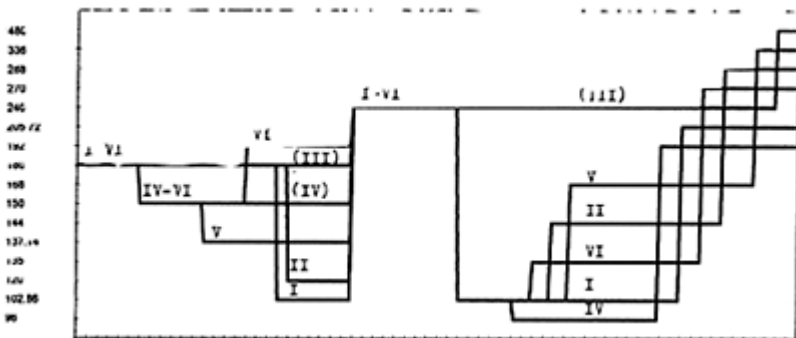


Figure 21. *Pleiades*—Métaux:
Diagram showing layering and
succession of tempi, opening section.

sieve (this passage recurs at m. 58 of the *Mélanges* movement, layered with three other textures involving drums and sixxens). The line fractures into a layered-tempo canonic entity, only to drop off into quite an extraordinary little passage. A simple, slow melody is shaped from six notes of the sieve (with one intrusion by a low $A\flat_3$), selected to emphasize the *D*-centered, modal *pelog* (gamelan-like) character of the line. This is without a doubt one of the simplest, most tonally explicit moments in all of Xenakis's music to that point. There would be more of them. A brief rising sweep interrupts the solo line at m. 56, but it continues, shifting to faster rhythms before giving way to another rising run, this time with all six instruments.

An extended section of layered melodies, all continuing to use the *Jonchaies* sieve, each at a different tempo or trajectory of changing tempi, is again articulated by outbursts of rising scales. The occasional use of tremolo for a few notes serves to shift the spotlight from one instrument to another in the otherwise homogeneous, compact texture. A final upward sweep at mm. 109–10 leads to the concluding passage. This consists of a fast, unison, ostinato pattern built from three notes ($G\sharp_4$ – A_4 – $C\sharp_5$), with widely spaced groups of accents and gonglike articulations on either G_3 or G_4 . These pitches do not come directly from the sieve present throughout the movement, but from a transposition (up a tritone). This ostinato returns several times in the *Mélanges* movement, always using the same pitches (without the sporadic low notes).

In the *Claviers* movement, a single line leads first into a canonic passage then into a complex layered sonority in which a modal-sounding sieve arises out of a chromatic band of pitches. Brief shifts in density to solo or unison lines breath air into the structure. The gamelan-like conclusion is a surprise (though not if the *Mélange* movement has been performed first), sparking a sudden change in perspective, as Xenakis so often does at some point in his formal designs. In quite a different way from *Persephassa*, *Pléiades* is a tour-de-force, through its rhythmic complexity, ambitious scope, and musical and cultural resonances.

Palimpsest

Xenakis explores the notion of resonances, or traces, in a different way in *Palimpsest* (1979), his first Italian commission, premiered by the Divertimento Ensemble in Aquila in March 1979. The title refers to the process of scraping parchments or tablets in order to use them again, and how, with modern spectography, it is possible to decipher the writings of different layers. In applying this notion of layering to music, the composer works from both vertical as well as temporal perspectives.

Palimpsest is for eleven musicians, the same number as for *Phlegra* (1975), but here the winds are reduced to four and solo parts are added for piano and percussion. Arborescent counterpoint is the primary sonic entity. The individual lines are very often notated at different rates, following on from the tempo layering of *Pléiades* and *Ikhoor*. The piano part alone is sometimes required to play as many as four different simultaneous tempi. In the solo piano passage at the beginning, there is an interplay between layered tempi and a single pulsation rate.

In many respects, the whole composition can be heard as a series of variations on the arborescence entity: strongly contrasting materials appear only briefly. For example, as the opening piano solo concludes, the streams of lines narrow into static repeated chords,

reinforced in m. 14 by a sustained chord in the winds. A second solo piano passage signals the start of the second section, and here too, the texture narrows into a repeated chord that continues, with flurried interruptions, throughout mm. 22–27. In a contrasting process, the horn, which enters at m. 22, joined by the bassoon at m. 24, opens out from a high repeated note first to ascending runs then to quickly undulating melodic contours. The strings, on the other hand, enter at m. 30 underneath the complex, layered lines of the winds and piano with a unison melody of very narrow range, covering a minor sixth in a phrase lasting six bars. Other contrasting entities include the slow, extremely widely spaced contours introduced in the strings at m. 57, and the glissandi, which enter at m. 80, moving from the strings to the winds.

Perhaps most contrary to the arborescent material is the percussion part, which sometimes contributes additional metric layering or syncopated rhythmic patterns derived from sieves or other such procedures (particularly in the quasi-solo section at mm. 45–63). Given the strong focus on pitched, articulated contours, the percussion (a set of seven drums) is by its very nature contrasting. And, timbral identity is an important factor in the organization of *Palimpsest*. The blocklike treatment of the instruments (winds, strings, piano, percussion) and the successions and superpositions of these timbral families are key factors in the music's architecture, particularly given the similar material assigned to them. There are just a few moments where the groups of winds and strings are broken down into smaller units, and because of their rarity, these passages stand out. The first, mentioned already, occurs at m. 22, where the horn alone joins the piano, followed by the bassoon. When the wind section enters as a homogeneous group at m. 27 there is a shift to a layered texture of relatively narrow, but disjunct, lines, and includes the piano as well. During the percussion "solo," mentioned above, the drums trade off phrases three times with various combinations of winds and strings until the full complement is brought in at m. 54. Later, there is just one brief moment in which the bassoon and horn come in a full measure earlier than the higher winds, but the effect is not of a contrasting sonority but of staggered entries.

In terms of pitch organization, most of *Palimpsest* draws freely upon the full gamut of chromatic pitches. Unusually, there are no microtones at all, and few held notes. The contours of the lines were likely created graphically. What lends a certain character to the sonorities is the occasional passage of pure diatonicism, such as the opening few beats of the piano solo and the chord that is reiterated at mm. 22–27. These moments are no doubt intentional, but they are always quickly subsumed by, or layered with, chromatic lines.

The introduction of glissandi, about two-thirds of the way through, presents a different perspective on pitch as well as overall sonority. It is just after this brief passage that Xenakis introduces the by now easily recognized pitch sieve from *Jonchaies*, here transposed down a semitone. It is fascinating to listen to this passage, as the scale is introduced, one instrument at a time, into a very complex texture of otherwise chromatic material along with the final wind glissandi. By m. 92, the entire score is "modal," with the exception of certain strands of the piano part. The concentrated counterpoint of this section is thus mitigated by the harmonic identity of the underlying sieve. At m. 106, the music suddenly gives way to a passage of unison rhythms in which the entire ensemble (minus the percussion) intones a slow melody harmonized in parallel, each instrument playing a different note of the sieve.³ The chorale character of this passage gradually gives way to the canonic as each instrument begins to follow its own rhythmic path while

carrying on the same melodic contour. At m. 117, the drums enter for a final flurry of activity while the ensemble slows down, coming to rest on a final chord (derived from the sieve, of course). One final burst of chromatically derived arborescences in the piano concludes the score.

In terms of the “palimpsest” concept, the idea of deriving a proliferating welter of lines from an initial contour relates to the notion of writing over an existing text. Second, there is the layering of rhythms and instrumental lines, along with the juxtaposition of instrumental groups. Third, the temporal unfolding, in which blocks of related material succeed one another, with a recognizable pitch structure appearing out of a previously opaque, relatively chromatic, texture, reflects the historical succession of texts on a parchment. Xenakis came up with the title only after the music was complete, but it appears to be aptly named.

Anemoessa

Xenakis created just one score for large forces in 1979, perhaps in reaction to the frenetic pace he had been maintaining for several years. *Anemoessa*, for mixed choir and orchestra, was a commission for the 1979 Holland Festival, and was premiered in Amsterdam by the Netherlands Radio Choir and Orchestra in June of that year. The title, Greek for “exposed to the wind,” is again very apt given the sweeping textures, which are finely sculpted but often quite nebulous in character. The choir sings vowel sounds exclusively, and is for the most part treated as one (privileged) family of the orchestra. The music is very different from *Cendrées* (1974), containing no soloistic passages for either voices or instruments. It is also different from *Palimpsest*, with sonority taking prominence over pitch structures and rhythmic patterns.

Anemoessa unfolds in a continuous fashion, alternating for the most part between passages for the choir and orchestra together, and others for the choir alone. There are also shorter moments that are exclusively instrumental, and other choral passages accompanied by instruments. Xenakis was clearly thinking in terms of formal blocks, as the proportions of the sections are always multiples of five measures (the tempo is MM 64, so five measures is just under twenty seconds in duration). The fifteen sections are ordered according to the following proportions: 3–5–3–2–1–5–1–5 (**4**+1)–**1**–**3**–2–3–**4**–**2**–3–3–5. The numbers in bold indicate the sections for choir alone (or substantially so), along with section 8, where the voices are doubled by strings.

Almost half the piece, then, is choral, and there are really only four passages of any substance that do not involve voices. Paradoxically, there is little difference between the material for choir or for orchestra beyond the extensions of range the instruments are capable of. The choir sings thickened glissandi, clusters involving quartertones, and so forth. There are two striking passages in which the vocal material stands out as being different. The first is in section 4 (mm. 56–65), where six layers are sung in an interlocking rhythmic fashion. The pitches are organized such that one set of voices is pitted against the other by means of opposing whole-tone scales. The second passage is found in section 12, which is an adaptation of material from the *Claviers* movement of *Pléiades*. Six lines with similar ascending runs articulate a thick bundle of melodies shaped from the *Jonchaies* sieve. The voices produce an utterly different effect from vibraphones, xylophones and marimbas. But, as in *Palimpsest*, the sudden—and here

brief—reference to the pelog scale casts a new light on the otherwise timbral orientation of the music, which in other places resembles the dense polyphonies and clusters of György Ligeti's *Requiem*.

Overall, there is a general evolution in *Anemoessa* toward greater activity, in terms of shaping the blocks of material. In the final three sections, there are many more changes of instrumentation and register than earlier. The ending shifts to the lower registers, featuring the male voices, whereas much of the piece had featured the female voices. As the billowing gestures finally calm down, the brass and female voices sustain a narrow mid-range cluster, a remarkable blend and a reminder of just how well Xenakis could integrate the chorus into the orchestral medium, particularly by forbidding the use of vibrato. The composer would include the voice in his next two orchestral works, *Aïs* and *Nekuia*; these compositions set actual text, though, and are thus approached somewhat differently. First, however, there was a commission for the Beethoven Festival in Bonn.

Dikhthas

The chamber combination of piano and strings is one of the most classical. In *Morsima-Amorsima* (1962), Xenakis had avoided any reference to the repertoire by adopting a stark, pointillistic style, derived from his *ST* computer algorithm. In his exploration of sieve formations and patterns of rhythmic regularities (among other things) throughout the 1970s, the range of expression in his music had expanded considerably. There is little in *Dikhthas* (1979) to directly relate to the violin sonatas of Ludwig von Beethoven, but nonetheless, there are points of reference.

Written for the well-known Italian virtuosi Salvatore Accardo and Bruno Canino, *Dikhthas* is, according to the composer, “like a personage made up of two natures...a dual entity (*dikhthas*)” (Xenakis 1982a). The treatment of the instruments as two equal “personages” is remarkably similar to Elliott Carter's approach in his *Duo for Violin and Piano* (1974), though the music is very different. In terms of the overall structure, there are distinct large-scale sections, but also a great deal of fluidity, with interjections of material looking forward or back. Carrying on from *Kottos*, the violin part moves seamlessly between pitched melodic lines, most often scalar, and glissando contours.

The piano opens the piece with an elaborate arborescence fanning out into as many as five strands before falling to the low register, ending on a sustained dissonant chord. As the violin enters, its lines fit into the linear texture of the piano's arborescences. To begin with, though (and continuing intermittently throughout this passage), it plays a strongly articulated, more static material built from pulsating repeated notes or a limited set of pitches, usually spread over a wide range. The piano, too, joins in with repeated chords or pitches, sometimes within the concentrated strands of moving lines, and sometimes apart. The main differentiating factors between the two instruments in this section are the range and density, with the violin also being distinguished by its occasional glissandi.

At m. 39, as the piano finishes off a final, high-register flourish, the violin launches into a new section with a double-stop unison on *D4*. There follows a long passage of elaborations on this note, the violin playing gradual detunings, expanding out to neighbouring pitches, the piano joining in for rhythmic articulations. Short flurries and other outbursts provide some variation, growing in importance as the music progresses. The rhythmic pulsations on the central pitch expand into an extraordinary passage at mm.

55–58, the violin articulating an additional three pitches, each at its own tempo, and the piano adding a few more, along with fast, dramatic dynamic swells. At m. 71, the violin opens out the glissando fluctuations around *D4*, quickly sawing back and forth at a dizzying rate between its registral extremes. From m. 74, the anchor pitch is left behind as the violin continues its wide-ranging glissando and the piano offers brief flurries of layered melodic strands. The violin line migrates higher, settling on a double-stop *C#7*, moving, at m. 85, into a passage of slow, double-stop glissandi as found in the earlier solo string works. The focus of attention at that point has shifted to the violin, and after a few more interjections by the piano, the violin finishes out this third section alone, ending on a sustained double stop at m. 120.

A brief piano solo follows, made up of an introductory phrase building on a semitone motion into a rapid, two-line arborescence. At m. 124, there is a passage reminiscent of *Evryali* (1973); upon closer examination, it turns out to be directly lifted from the earlier solo. What is especially interesting is that, while the contours are for the most part identical, the actual pitches are often altered. So too is the order of the measures (see fig. 22). The effect, regardless of the changes, is similar; there is a rapid, vertiginous expansion of range as the two lines outline increasingly wide, fast-shifting contours, the quick pace relentlessly constant. Following this central section of “cadenzas,” a brief section of fast, undulating contours is set as a dialogue between the violin and the piano, the violin distinguishing itself through its use of quarter tones and, from m. 137, sharp, intermittent accents. A final wavelike contour in the violin leads to a passage that most strongly resonates with the classical tradition. It is similar to a toccata in style, with the violin and piano playing interlocking sets of fixed pitches in the manner of an ostinato, though the ordering of notes is constantly changing. The figures create a modal (Lydian) effect, tempered by piano runs that dance around the narrow band of fixed pitches.

By m. 149, both instruments fall away from the ostinato, with the violin striking out for the next section, strongly articulated alternations of double-stop fourths, rather like the closing passage of *Kottos*. The piano counters with complex

Figure 22. *Dikhthas*: Comparison of mm. 124–31 with *Evryali*, mm. 138–45.

arborescences recalling the opening, this dialogue giving way to a brief reference to the second section, with the piano rapidly articulating a narrowing band of pitches centered on *D4* again, and the violin, at m. 162, opening out from that note with a rapidly fluctuating glissando. Throughout the final passage, the piano articulates a single, high cluster chord while the violin continues its frenetic doublestop glissando, finally settling in on its lowest register. The music ends with an arborescent flourish in the piano and a ringing of the high cluster.

There is much that is in flux in *Dikhthas*, not only in the highly dynamic materials themselves. The formal design is quite fluid, playing lengthy, strongly defined sections against shorter passages of contrasting material and interjections of various types. Even the tempo fluctuates widely and often—unusual for this composer—ranging from less than 30 MM to 120 MM. The balance between the instruments is carefully conceived, ultimately illuminating a field of interaction built from a wide range of individual statements, contrasts, dialogues, and parallels. Tonal references arise out of the otherwise chromatic, microtonal, or fluctuating fields of pitch. The sustained notes, chords, and collections provide strong anchors that enrich the perceptual experience of the music. *Dikhthas* is extraordinarily difficult to perform, but, at the same time, is worthy of the chamber music tradition the city of Bonn celebrates in Beethoven. Like his haloed predecessor, Xenakis exhibits great fierceness in his music, but underneath there is a compelling range of expression and formal inventiveness. It is no surprise that the Greek composer would have been awarded the Beethoven Prize a few years earlier in 1977. This duo, no doubt commissioned as a result of that award, is a worthy homage.

Aïs

Dikhthas was premiered in June 1980. That year Xenakis completed just two works. (His pace would pick up again the following year.) Carrying on from the choral works of 1977 and a preoccupation with the prosody of the ancient Greek language, Xenakis set to work on his first orchestral work featuring a solo voice. *Aïs* (“Hades, domain of the dead”) takes for its lyrics two short extracts from Homer’s *Odyssey* concerning Ulysses’ visit to the land of the dead, a fragment of poetry by Sappho, and an extract from Homer’s *Illiad* lamenting the death of Petroclos (see table 11).

The focus on death themes continues in subsequent scores, and carries on from the cosmological texts of *La Légende d’Eer* (1977) that reflected on the afterlife and the infinite. In his interview with Xenakis, Bálint András Varga notes the connection between Ulysses unsuccessfully seeking his mother and the composer’s early loss of his own mother. Xenakis, however, is unwilling to draw a direct connection between these aspects of his own life and the music, noting, “Death...is something I think about all the time. Not only my own passing away, of course, but also in a more general dimension: death in Nature, in human society, in our actions, in the past which is finished but not completely finished. I have rediscovered for myself Heraclitus who says that there’s no difference between life and death. He probably meant that the two are equivalent. Existence is not something in progression and neither is non-existence” (Varga 1996, 166).

Table 11. Text for *Ais*.

Odyssey, chant 11, verses 36, 37:

Into the pit; the blood was flowing like black clouds, and from the depths of Erebos gathered the souls of the definitely dead.

Odyssey, chant 11, verses 205–8:

To embrace the soul of my definitely dead mother. Three times I hurled myself; all my heart longed for that. But three times from my hands like a shadow or like a dream, her soul flew away; and in my heart more sharp the distress became.

Sappho, fragment 95:

To die, a longing holds me, and to see the shores of Acheron full of lotuses and dew.

Illiad, chant 16, verses 855–57:

As soon as he ceased speaking the death end covered him. The soul flew away from the limbs and went to Hades, weeping for its destiny, having abandoned force and youth.

His concern with death is not morbid, and, having narrowly escaped dying early on (and soon to face it again in protracted illness), Xenakis could not possibly forget about its close relation to life. In any case, the poetic, stylized texts from ancient Greece allowed the composer a degree of detachment. *Ais* is one of his most dramatic narrative works, also manifesting a number of musical concerns already present in earlier works, carrying them forward in innovative ways.

The striking vocal characteristics of Greek baritone Spyros Sakkas must have been a particular inspiration for *Ais*. So too, evidently, was the spine-tingling cry of a Mediterranean seabird that Xenakis had heard in Corsica, and much earlier in Greece (Varga 1996, 162–63). Interspersed among the different fragments of text are such cries: powerful, elemental utterances speaking as eloquently as the words. Most of the Homeric texts are set in relatively straightforward fashion in the low register, centered on *A2*, with occasional exclamatory leaps up into the extreme falsetto range. The Sappho fragment is treated differently, placed for the most part in the high register. The voice again shifts into a higher register for the final verse of the *Illiad* text, creating a kind of balance that comes from musical considerations but also happens to work dramatically. The three-octave range of the voice part demands careful consideration, as the unusual effect of the falsetto singing could otherwise come across as mere novelty. As it is, the low/high dichotomy underscores, together with the orchestral writing, “the feelings and sensations of the dead-living pair which we are and in which these feelings and sensations are set without any possible escape” (Xenakis 1988a).

The solo voice is accompanied by an obbligato percussion part, written for Xenakis’s close colleague Sylvio Gualda. This layer forges a link between the orchestra and the dramatic presence of the baritone. Its rattling, unpitched sonority is evocative of the underworld, while also exhibiting more abstract concerns relating to rhythmic patterns and layered pulsations.

The orchestra is in no sense intended as accompaniment to the solo baritone and percussion. *Ais* opens with a loud brass declamation, a sustained, rhythmicized *C5*, the extreme high register of the trombones adding urgency to the tone. The baritone joins in on that same pitch, right away signaling the unusual, “otherworldly” nature of the voice part. The clustered brass texture shifts between staggered and unison rhythms,

foreshadowing a central compositional polarity that Xenakis exploits. The dry counterpoint of the solo percussion signals a kestrel cry from the baritone along with a ten-part outwardly spreading arborescence in the strings. By m. 12, then, there are four distinct layers of musical material sounding simultaneously, a sign that Xenakis would be unleashing a contrapuntal complexity (in terms of sonic entities) rarely heard in prior works. At the same time, there are numerous sparsely scored passages in *Ais*, in deference to the singer, and in that respect similar to *Cendrées*. The blocklike formal structure common to many of Xenakis's scores is rather more fractured here, pieced together in mosaic fashion in reponse to the text, but also representative of a more fluid approach to form already present in scores such as *Kottos* or *Dikhthas*.

At m. 16 a new passage begins, introducing the high woodwinds in narrow, clustered flurries. By m. 33 the music shifts to rising gestures: fast glissandi in the strings and voice, and short "rips" in the brass. The music abruptly cuts off at m. 38, signaling the end of the introduction. The declamation of the text begins in the next measure, some three minutes into the seventeen-minute piece. The sparer combination of low baritone, percussion, intermittent screeching harmonics in the strings, and low bassoons carries through the first extract from the *Odyssey*, with occasional, almost hysterical outbursts by the voice in the very high range. Carrying into the second extract, the percussionist adds woodblocks to the drums, and the strings drop out in favor of sinuous melodic phrases in the woodwinds, glissandi mixing with pitched runs and slower segments. The baritone concludes the text with another cry, this time extending it into a long, sliding contour that gradually falls back down to the low *A2*. Muted trombones take over from the woodwinds and lead, with a final outburst from the voice, into an orchestral episode at mm. 76–90.

This passage features a slow melody, which is resonated by each instrument entering at a slight delay so that each note is sustained into the next. Beginning with the brass, the orchestration expands to include the strings at m. 81, when short flurries begin to disrupt the music's surface, taking over completely by the end of the passage. It is worth noting that the pitch sieve from which this melody is derived is similar, but not identical, to the much-used *Jonchaies* scale. The opening shows clearly the interlocking fourths that Xenakis finds so compelling in the pelog scale, but the intervallic structure of the sieve beyond those notes has been altered—it is noncyclic. Nonetheless, the modal quality of this passage is striking; the music to this point had been built from clusters, quarter tones, or freely shifting intervals derived from the chromatic gamut. The sieve had in fact been introduced by the strings in m. 12, but the sonic density makes it difficult to recognize the intervals at that point.

The sustained character of this interlude is carried into the Sappho section. The text is not set in such a prosodic style as that of Homer; the rhythms are much less regular and the melodic contour includes glissandi, fast staccato runs, and tremolo effects. The pitches are derived from the orchestra's sieve for the most part. The range falls into the ambitus of the interlude, creating a structural connection. Significantly, the percussion is absent, apart from a low, tolling *B \flat 2* on the timpani, rooting the otherwise high tessitura of the passage. Sappho's poetic flight comes to rest as the baritone descends to the timpani's register. A final brief flurry in the woodwinds and strings gives way to a low, three-part texture in which the rather tortured glissandi of two bassoons are joined by the

baritone, singing wordlessly. The final *F4* of the voice is taken over by the horns as the percussion enters once more, simply at first, but increasing in density.

A busily percussive sonority involving both the solo and orchestral players provides the basis for the *Illiad* text, the first two verses being again declaimed very simply in the low register, separated by a brief interlude in which an enormous chord is unfolded across the entire orchestra. The third verse is closer in style to the Sappho section, although the cor anglais and muted trumpet, supporting the voice, play lines drawn solely from a *C* diatonic scale. The baritone sings similar material with the exception of an occasional *G#3*, perhaps to temper the impact of the traditional sonority.

The concluding section, with the voice shorn of text, marks a return to the style and pitch sieve of the orchestral interlude of mm. 76–90. Here, though, the broad melody is harmonized directly rather than staggered. The passage begins with woodwinds and piano (silent until this point), the melody being supported by eighteen chordal voices. The sonic character of the harmonies is shaped by the sieve's intervallic structure (each note of the cluster chords is drawn from the sieve so that the contour of each line moves in parallel, but with varying intervals). The music is passed on to the brass, then to the strings, then to the full orchestra. In the meantime, at m. 161, the baritone and percussion enter, creating a busy counterpoint to the orchestra's processional music. A shift in speed at m. 171 causes this texture to unravel, as layered contours proceed at different rates. Finally, at m. 174, an extremely complex passage continues the melodic material from before, but staggered across the whole orchestra. The cries of the voice and the outbursts from the percussion eventually prevail as the orchestra gradually fades out on a sustained sieve chord.

There is no sense of resolution in *Ais*, in the music, the treatment of the text, or the dramatic presence of the voice. This is fitting, considering Xenakis's stance regarding the "meaning" of death: "I didn't want to write programmatic music, in any sense. I wanted the music to be self-sufficient without a need to know what it's about" (Varga 1996, 161). The ancient Greek text is, after all, not directly intelligible by virtually anyone, so little semantic content can be conveyed explicitly. Rather, the text stands in conjunction with the music, expressing something similar, but separate, like the adjunct texts collected for *La Diatope*. As Xenakis stated in his foreword to that earlier work, "Music is not a language. A musical work is like a rock of complex formation with streaks and patterns engraved inside and out, which people can decipher a thousand different ways without one way being the best or most true.... As for myself, I wanted to deal with the chasms which surround us and among which we live. The most formidable are those of our destiny, of life and death, of the visible and invisible universes" (Xenakis 1978).

The voice in *Ais*, then, both is and is not a protagonist. The relationships among the soloist, percussion obbligato, and orchestra are complex and changing. The cries of the kestrel that the baritone sings can be heard as "the voice of Destiny" (Varga 1996, 163), but they are also musical entities that are developed, sparking a range of associations with other material (the rips of the brass in the opening section, for example, or the rapid "down-up" contours in the percussion part). The dramatic and emotional intensity, in any case, is undeniable.

Mists

Xenakis would continue his exploration of the theme of death in his next largescale work, *Nekuia*. Prior to that, however, he set to work on a third piano solo, this time for another remarkable pianist, Roger Woodward. For inspiration, the composer turned again to nature, the title being suggested in the music by the scattered clouds of notes in the stochastic sections, and perhaps in the rolling waves of ascending scales. Compositionally, Xenakis was concerned with two things: pitch-sieves and arborescences.

The formal outline of *Mists* (1980) is simpler than that of *Evryali* (1973). There really are just two types of materials, each subject to considerable variation.⁴ The first is linear, arborescent material, and the second is statistical clouds of notes. This is the first piece in which Xenakis employed a new type of notation to provide a clear, direct way of representing music generated by stochastic means (see fig. 23). The notes are fitted graphically into the spaces between beamed subdivisions of the beat. It is thus possible to play the music with a high degree of accuracy, but allowing for a certain amount of flexibility. Xenakis would make use of this notational innovation in many subsequent scores.

Mists falls into three main sections, each roughly equal in length. The first is made up exclusively of arborescences, opening with a series of rising lines that are overlapped then interspersed with contrapuntal, graphically derived segments opening out from the middle. There is a dramatic shift in tempo and velocity at m. 31, and the upward-sweeping lines become fast up-and-down contours scurrying over the full range of the keyboard, most often in two voices. Xenakis uses one basic pitch sieve for this first main section. Interestingly, it bears no resemblance to the *Jonchaies* sieve, avoiding the characteristic interlocking fourths of the earlier scale. At m. 16, a transposed version of the sieve is introduced, creating a kind of harmonic polarity through the differing pitch content. These two collections alternate until m. 34, the fast, closing passage of the section, when a third, then fourth, transposition of the sieve are introduced in close succession. The sense of harmonic compression Xenakis creates is difficult to perceive, given the welter of information being presented, but careful listening reveals some of the characteristic intervals of the sieve: tritones, perfect fourths, and various triads buried within the structure.



Figure 23. *Mists*: New notation for narrowly indeterminate rhythms, mm. 47–48.

The second section is created entirely of stochastic clouds, recalling *Herma* (1962). The density from one moment to the next varies greatly, as do the ambitus and dynamics (with one level prevailing at a time, unlike *Herma*, with its layers of dynamically differentiated material). The pitches continue to be derived from the main sieve, in new transpositions. During the sparser passages, there are often blatant statements of easily recognized triads, products of the combination of density and sieve. Whether intentional or not, these are strong points of perceptual reference. Toward the end of this section the pitch collections are layered, creating a more chromatic sonority. This saturated harmonic structure continues into the final main section, built from an alternation of nine short passages of the linear and stochastic entities. Throughout, the ambitus of particular passages or segments is quite narrow, with repeated notes in both types of material. The closing arborescent passage expands out again to the full range of the piano, with a brief coda of two more short segments closing the piece in the mid-high register.

Mists, as Ronald Squibbs points out, is also—along with its varying densities and extraordinary pianistic challenges—a music aerated with silence. These pauses are not of radical length, as in *Herma*, but they nonetheless underscore the nonlinearity of Xenakis's architecture. This is not music of accumulating momentum, but of moments of often violent intensity, placed into frames of silence. Underlying these gestures, though, is a consistency of style and pitch organization that lends coherence to this wild, strangely fascinating music.

Embellie

The year 1981 was a prolific one for Xenakis. He completed five works, including *Nekuia*, a major composition for choir and orchestra, and *Pour la paix*, a radiophonic work for narrators, choir, and electronic tape. He also composed a smaller-scale work for choir, and two chamber works. This was also the year in which *Regards sur Iannis Xenakis* was published, in advance of his sixtieth birthday—a collection of articles and tributes by performers, musicologists, and other colleagues. *Arts/Sciences, Alliages*, the transcription of his doctoral defense from 1976, had also just been published, and honors such as Officier de l'Ordre des Arts et des Lettres and Chevalier de la Légion d'Honneur were starting to flow in. Xenakis, characteristically, remained busy as ever, concentrating on his music above all.

Having written solos for all the other string instruments, the composer at last turned his attention to the viola. *Embellie* means “lull in the storm,” and it is to some extent an antidote to the crashing waves and ocean spray of *Mists*. Capturing the dark tone of the instrument, this score is more reflective, though not without moments of virtuosic outburst. The form is rather fluid, like *Kottos*, with larger sections conceived in a dynamic way, with shifting references.

The opening right away brings out the rich color of the viola's low register, with a stately melody (the leading tone being sharpened by a quarter tone) spanning the bottom fifth of the instrument's range. A brief excursion to a high, whispering, double-stop glissando passage leads into a two-part contrapuntal section that resonates with the solo string music of Johann Sebastian Bach. These phrases have a modal flavor without being strictly limited to any scale or sieve. With interjections of other kinds of material—fast

runs, trills, high melodic passages, glissandi—this music continues up to the fermata at m. 42, close to halfway through the piece.

A toccata-like passage, marked “très violent,” shifts the music into a faster, more rhythmic style. It is based on a four-note chord spread over a wide range (*E3-C#4-G4-F5*), which is later filled in with more notes. The toccata is interrupted by a dizzying passage of running melodic contours, racing up and down while becoming increasingly disjunct. The more static material returns at m. 66 with different, even more widely spaced pitches. A descent back down to the low register signals a return to double-stop fourths and fifths, here varied by the use of narrow glissandi. Various interjections—grinding bridge noises, high melodic phrases and runs—fracture the smooth progression of the music, though finally the glissandi settle in on a tritone double stop. A high, ethereal glissando, played as harmonics and similar in tone to those ending *Kottos* and *Ikhoor*, closes the work.

Embellie effectively portrays the particular characteristics of the viola while at the same time drawing upon many of the techniques and sonic elements used in previous pieces for strings. The pitch organization is less fixed and rigorous than that of *Mists*, but Xenakis would turn his attention to sieves again in his next composition.

Serment

The World Congress of the International Society for Cardiovascular Surgery, meeting in Athens in September 1981, commissioned a short choral work from Xenakis to be presented at the Herodes Atticus Odeon. For this piece, the composer chose to set the Hippocratic oath by which all doctors swear. There are elements of *Serment* that strongly recall *Nuits* (1968), such as the long, narrowly undulating glissandi that occur later on, and the rhythmic chanting and percussive noises that are similar to the Indonesian *ketjak*.

The opening, by contrast, is striking for the simple, vowel-based contours, moving steplike up and down a restricted range in a regular pulsing rhythm, the notes derived from a newly invented sieve. Similar to *Jonchaies*, the *Serment* sieve is even more restricted in terms of intervallic content (see fig. 24). The structure is symmetrical, built from major and minor thirds alternating with half steps. Xenakis moves away from this scale on occasion, but most of the piece is based on it, and there are several passages, like the opening, that explore its melodic and harmonic properties explicitly. In similar fashion to the chordal passage at the end of *Aïs*, the choir harmonizes a slow melody, at mm. 2–5 and mm. 11–13, with each of the twelve voices moving in parallel, forming a colored cluster built from the notes of the sieve. There are also intricate contrapuntal passages, as in mm. 15–20, again outlining the steps of the sieve but in a more rhapsodic manner, with greater rhythmic variety and trade-offs among voices.

The text, in fact, takes up relatively little of the piece’s duration. The words are set in a prosodic style, by and large, and layered over other material. After a long central passage in which the choir sings all manner of glissandi, cries, and rhythmic breath sounds, a slow, unison melody arises, with each of the sixteen voices following at a short delay (there is a similar passage in *Aïs*). The choir sings out the syllables of the name Hippocrates, ending on a sixteen-note cluster chord covering most of the range of the ensemble.

Serment is more accessible to choirs than *Nuits*, although the precision and confidence required is still enormous. The almost exclusive reliance on a pitch sieve that is far from chromatic makes the otherwise thick sonorities much more colorful and evocative of cultures past or far away. *Komboï*, Xenakis's next piece, continues the fascination with the exotic, being a duo for the unusual combination of harpsichord and percussion.

Komboï

Elisabeth Chojnacka and Sylvio Gualda had by 1981 already established themselves as champions of Xenakis's music, and, having written solos for each of them, it must have seemed natural for the composer to bring them together. The combination of harpsichord and percussion is not at all a common one, but the percussive nature of the keyboard, together with the power it is capable of when amplified, makes it an interesting match for the percussion's range of sonorities and dynamics. Rather than exploit the aggressive characteristics of the instruments, however, Xenakis creates passages of delicacy and beauty, particularly in the combination of harpsichord and vibraphone.

The title, *Komboï*, means "knots," in this case of rhythms, timbres, structures, personalities (Xenakis 1982b). There are, as might be expected, a wide range of rhythmic structures and patterns deployed. The opening, for example, launches into a fast, regular pulsation on the bongo. Xenakis sets up an interlocking pattern



Figure 24. *Serment*: Palindromic interval structure of main pitch sieve.

of accents on top of the ticking drum: the dynamic accents at first follow a durational pattern of 8–3–3; the timbral accents, manifested by punctuations on other drums, follow a more variable pattern of 4–4–long (18, 30, 16). The variation of these elements, together with the agogic accent created by the occasional shift of the bongo pulse to triplets, continues through the first section.

Set against this, the harpsichord outlines a pitch sieve by means of rising chordal sequences. This sieve bears little resemblance to the pelog sonorities of *Serment* or *Jonchaies*. There are no adjacent intervals of a major third, and there are segments of three whole steps outlining whole-tone tritone segments. The pattern of the six-note chords remains fixed, and the harpsichord continues the passage by fragmenting the rising sequences into increasing disjunct segments. A brief reference to *Mists* is found at m. 16. An elaborate arborescent flourish in the harpsichord drops down to the low register in preparation for a pause, then the vibraphone signals the second section.

As in the piano solo from the previous year, this long section features stochastic clouds of notes, beginning with the harpsichord (the pitches belong to the same sieve as before), then adding the vibraphone. In his score, Xenakis uses the word *crystalline* to describe the character of this passage. The timbres of the two instruments fuse in a

remarkable way, creating a sound of striking beauty. The density and ambitus of the notes ebb and flow, passing back and forth between the instruments. The two do not share the same pitch sieve, counteracting the timbral synthesis of the instrumental combination. Brief interjections of a repeated chord in the vibraphone (an *A* major triad with an added *B*) act as transition to the next section, which continues the combination of harpsichord and vibraphone but in a completely different style.

In a passage toward the end of *Dikhthas* Xenakis creates a tonal, toccata-like atmosphere by combining two modal segments. *Komboi* contains a similar section, though the sonority is much closer to gamelan than to Beethoven. A three-note pattern in the harpsichord is juxtaposed against a four-note pattern in the vibraphone, with additional gonglike punctuations from lower notes in both instruments. As in the beginning, Xenakis layers a number of temporal patterns onto the pulsating three-note figure in the harpsichord. While the left hand of the harpsichord creates a triplet pattern, accenting every three notes, the vibraphone articulates a more complex pattern: 3–3–3–3–3–2/3–3–3–2/3–3–2. The number of repetitions of the triplet follows a 5–3–2 pattern. Interestingly, the ordering of the notes, both in the vibraphone and the harpsichord, repeats, these cycles coinciding with the rhythmic cycle of the vibraphone. Thus, the material is very carefully constructed, setting up a cycle of repetition that, once established, is then subject to permutation.

After well over a minute of this, the harpsichord breaks out with another *Mists*-like flourish, only to have the vibraphone jump right back in, taking over the harpsichord's pattern from before. This reversal carries into a more radical variation, a rhythmic layering in which each instrument sees its material broken into two independent tempi. Subsequently, the hitherto static pitch material opens out into layered contours, meandering lower and lower until the section ends with an ascent and final pause, the gamelan sonority ringing on.

A sparser passage follows, built on a fixed sonority of two interlocking chords different from the previous section. They are paired either with the vibraphone or the harpsichord, but the vibraphone soon drops out to switch to woodblocks. Gradually, a regular pulse is built up, the harpsichord playing an irregular pattern of alternations between the two chords. As the woodblocks join the pulse, the harpsichord breaks away, first with another flourish of layered runs and then with a much more sporadic continuation of the two chords. The irregular structure of the harpsichord part leads quite smoothly into a second passage of stochastic flurries, this time in counterpoint to the regular pulse in the woodblocks. A further rhythmic variation is introduced in a short passage for harpsichord as the woodblocks fade out, where two-part layered scalar contours accordion in and out over the range of the keyboards.

The fifth section of *Komboi* features the harpsichord alone. In an effort to explore the subtle resonances and timbral changes the instrument is capable of, Xenakis asks the player to keep her fingers down on a ten-note chord. The passage consists of pseudo-melodies created by the articulations of these notes one at a time, punctuated by chords of both hands, or one or the other. These are accentuated by the addition of registral changes effected by the pedals. After some two minutes, the music finally breaks away to new pitch material, though still held to the same narrow range. As the percussion enters, the harpsichord shifts—after a break—to a reprise of the two-part, layered running contours, sailing right into another stochastic passage.

The final section, the longest at over four minutes, constitutes an extended series of variations on seven chords, set against a whole range of rhythmic and timbral elements in the percussion, most notably a set of ceramic flowerpots. The chords, of variable intervallic content, are first introduced in order, accompanied by an irregular rhythmic structure on the woodblocks and drums. Thereafter, the progression is reordered in an unpredictable fashion, though the seventh chord becomes a kind of anchor, recurring more often than the others. As the percussion shifts to stochastic rhythms, the left- and right-hand components of the chords become separated and start to be treated independently. Finally, as the percussion switches to the flowerpots, the harpsichord repeats the seventh chord in its entirety for twelve beats. The percussion then takes over the pulse and the harpsichord launches into a complex passage in which the chordal components are again reordered and recombined, colored by intricate pedal changes (like the solo passage earlier). With various pauses and fluctuations of density, this material continues to the end, along with the evocative ceramic sonority of the flowerpots.⁵ The final chord is a composite, created from the left-hand portion of the sixth chord and the right-hand portion of the seventh chord.

At seventeen minutes, *Komboï* is one of Xenakis's more substantial chamber works. The sections are laid out on a broad scale, with many "knots" and fluctuations of elements. It is striking just how well the two instruments go together. The plucked metallic sound of the harpsichord blends both with the vibraphone and the ringing tones of the flowerpots (strokes of a vivid sonic imagination). The various types of rhythmic material are familiar from earlier works, but the range of harmonic material is new. There is not just one sieve used, but several, and chords or melodic patterns of limited range are chosen with care. The chordal combinatoriality found in the concluding section is a technique Xenakis would draw upon many times in subsequent works. Chojnacka and Gualda would often perform *Komboï* over the next several years to great acclaim, and a second piece, *Oophaa*, appeared in 1989 in celebration of their success.

Nekuïa

It is surely just a fateful coincidence, but *Nekuïa* (1981), one of Xenakis's few text-based vocal works and one of the very few set in a language other than ancient Greek, would prove to be his last large-scale composition for voice(s) and orchestra. As in *Aïs*, the treatment of the theme of death is highly poetic; the title itself refers to a funerary ceremony (as well as the magical rite of necromancy). The text includes fragments in German, by Jean-Paul Richter (Xenakis had also drawn upon this source for *La Légende d'Eer*), and in French by his wife, noted author Françoise Xenakis. The semantic content arises out of the music, expressing "implicitly the same everlasting disarray that man has in front of death and life" (Xenakis 1982c):

gales; snow-whirlpools of stars; scintillating dew of stars cease shining
(Richter: *Siebenkäs*);

the wind that disarranges the hair of the dead, while helmets have rolled
far away; the belly cut open...like a spread-out corolla (F.Xenakis:
Écoute).

The texts are not particularly privileged; over the course of *Nekuia*'s twenty-six-minute duration, they appear but briefly (see fig. 25). Still, they are remarkable for being there at all, considering Xenakis's reticence, apart from in stageworks, to place directly perceivable semantic content into his music.

Nekuia is very different from both *Anemoessa* and *Cendrées*. Perhaps the major distinguishing feature is the emphasis on melodic structures built from sieves. Rather than creating complex, nebulous textures, Xenakis concentrates much more on linear, contrapuntal material. The opening, for example, featuring the strings alone (like *Jonchaies*), unfolds two stately melodies: one rises, the other descends, and the two come back together again by m. 7. In three spots, the strings break into cluster chords to briefly harmonize the melody, a gesture that returns on numerous occasions later. The main pitch sieve is identical to that of *Serment*, although its ambitus covers the full range of the orchestra. The division of the strings into two parts holds throughout the first section, though each part often expands into several strands.

The music sweeps up into the high register as the choir enters, triggering a brief transitional passage in which sieve clusters percolate through the full

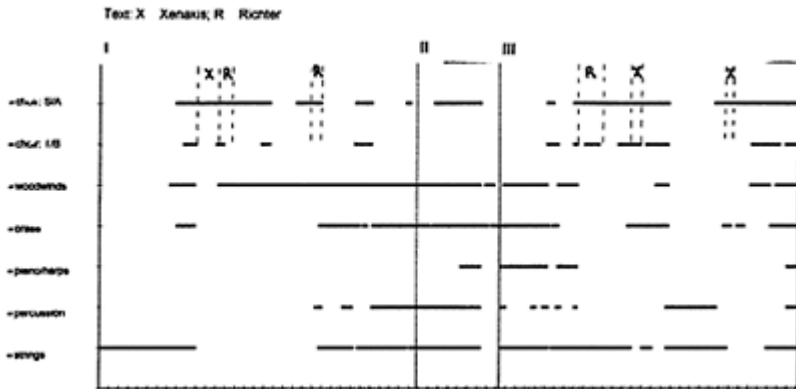


Figure 25. *Nekuia*: Chart of formal outline.

orchestra, punctuated by rhythmic attacks trading off between strings and voices. The section that follows is one of the few in which the choir sings by itself. A staggered melody in the sopranos, where each voice sings the same line after a short delay, is joined later by a counter-melody in the altos. This passage sets a fragment of the text from *Écoute*. It is succeeded by a more complex passage for female voices and bassoons setting part of the Richter text. Still using the same sieve, the layers follow different metric subdivisions to create an intricate contrapuntal texture. At m. 70, a solo oboe takes over from the choir and bassoons, shifting the music to the high woodwinds as the rest of the oboes and the clarinets accent and color the solo line. The female voices enter again, with a similar melody to the oboe's, pitched lower.

At m. 91, the full orchestra takes over. This section is built from twelve rhythmically layered lines, one for each instrumental family (four woodwinds, three brass, five

strings), falling off in their general contour in conjunction with a decrescendo. The music rears back up, only to descend again as before. This happens four times, and is perhaps an intentional “affect.” As the fourth phrase is extended, fast clustered runs begin to infiltrate first the brass and then the entire orchestra, including the choir, which enters again at m. 106. The music disintegrates into a sequence of short runs—the effect heightened by the addition of rolls in the tom-toms and cymbals—and then into a hocket-like, rhythmic passage, each layer leaping up and down between two widely spread pitches to create a kind of distorted ostinato.

This section, coming just before the halfway point where the sieve-based counterpoint is taken over by clusters, gestural effects, and fractured rhythms, is pivotal to the piece as a whole. The single, distinctive pitch sieve and the melodic textures that had carried all through the first part are swept away, leaving behind clusters, chromatic lines, and glissandi. The choir (female voices only) joins in at m. 139, doubling the strings in tracing slow glissando contours, fanning out to create clusters and then closing back in again around a central sustained *F#4*. Interlocking rhythms, no doubt derived from duration sieves, continue in the winds along with patterns of accents on fast repeated notes. The glissandi become shorter and more articulated as the passage closes in on fast, pitched runs that connect the voices and strings with the winds.

A short brass passage signals the start of a lengthy interlude for orchestra alone. This is gradually subsumed by a slow, rising melody in the harp and strings that draws in the woodwinds and finally the brass as well. The sieve underlying this line is a permutation of the original one, but its intervallic structure is quite different. The return to a more linear orientation launches the third main section, which features melodies and a range of contrapuntal textures. The three remaining text settings are very much integrated into the ongoing flow of the music. There are two elements that serve to differentiate this section from the opening. The first is the combination of linear entities with sonic ones, such as layers of glissando ostinati in the strings as an accompaniment to the choral polyphony. The other is the rotation of different pitch-sieves. The music shifts relatively quickly from one permutation to the next, and later, they are actually combined. For example, from m. 266 to the end, each orchestral group (woodwinds, brass, choir, strings) uses a different sieve. As the musical material is also organized by group, the superposition of sieves emphasizes the textural counterpoint.

The density of this final passage is extreme, though far from “statistical.” Xenakis states in his foreword to the score that “the general idea of this music, the background, is the remarkable crisis of crisscrossing ideologies in the ether, on the planet’s surface” (Xenakis 1982c). The thick counterpoint, particularly at the end, expresses this vision along with the “everlasting disarray” of facing death. Commissioned by WDR in Cologne and premiered there in March 1982, *Nekuia* is a powerful work, too rarely heard. Perhaps the difficulties in preparing symphonic choirs to perform it (and his other two scores for choir and orchestra) was a discouragement for Xenakis.⁶ For, while he did compose more music for choir, this was to be his last “postoperatorio” work.

Pour la paix

That same year, 1981, Xenakis was commissioned by Radio-France to produce a radiophonic work for the Prix Italia. (It was, however, never entered in the competition.)

In response, he put together a collagelike work for speaking voices, choir, and electronic sounds created on the Unité Polygogique Informatique de CEMAMu (UPIC) computer system. The texts are taken from two works by Francoise Xenakis, *Écoute* and *Les morts pleureront*, including the same fragments used in *Nekuia*. Indeed, the choir sings the very same text in three of its ten short musical sequences (only two other sequences contain text: “mourir” [to die], and “les morts pleureront” [the dead will cry]).

The full version of the piece lasts some twenty-six minutes (there is a short version for choir alone, singing through the ten musical sequences). The spoken texts constitute roughly half the work, and there are numerous sequences of UPIC material. The electronic sounds cover a much wider timbral range than does *Mycenae alpha*. Some are cinematic, creating the sounds of war, for example, in response to a passage of text. Others are more abstract, and still others accompany either the choir or the reciters. The choir parts range from straightforward chanting on a restricted set of notes, as in the first sequence, to more complex sonorities—a compendium, really, of elements from *Serment*. There are two pitch-sieves used, neither resembling the pelog scale of the earlier piece. In comparing the two-part settings of the second and the seventh sequences (the text, from *Écoute*, is the same), one notes that the upper voice keeps the same four pitches, but the lower line changes, with quite different resultant harmonic effect.

In spite of the intensity of the texts, *Pour la paix* is rather disappointing as a radiophonic presentation. The sequences of material mostly succeed each other with little overlap, though the electronic sounds do appear at times in conjunction both with the spoken and sung parts. There is also a lack of sonic depth and spatial organization that is troublesome considering the level of sophistication common in all kinds of broadcasts, not to mention other electroacoustic works including Xenakis’s own. This would be his only foray into the medium of radio art.

Pour Maurice

Xenakis has penned a number of tribute works over the years. *Charisma*, the short duo clarinet and cello duo from 1971, was one; *Mikka*, for violin solo, also from 1971, was another. In 1982, he produced two more.

The first, *Pour Maurice*, is dedicated to Maurice Fleuret on the occasion of his fiftieth birthday. Fleuret—critic, organizer, friend, and, as of that year, director of music for the French Ministry of Culture—had long been a supporter of Xenakis. He would prove to be valuable in the struggle by the Centre d’Etudes Mathématiques et Automatique Musicales for funds in the shadow of IRCAM’s huge budget. Tragically, Fleuret’s life was cut short in 1990, giving rise to another Xenakis tribute work (*Knephas*). But *Pour Maurice* was a celebratory piece, and Spryos Sakkas and pianist Claude Helffer presented it in Brussels in October 1982.

With such an extraordinary singer as inspiration, the vocal part was bound to be unusual. There are only phonemes used, but most of the material takes place in the high range, expanding downward to eventually encompass the baritone register as well. The singer touches on just ten pitches over the course of the four-minute duration, moving at last up a half step on the very last note to a new pitch, recalling the cadential Picardy third shift from minor to major in tonal music. The piano part begins with its own ten-note sieve, meant to be played with the fingers always on the keys, rather like the solo

harpichord passage in *Komboï*. The texture alternates between fluctuating figurations, usually split between the hands, and accented chords. When the voice enters at beat 18 (there are no barlines in this piece), the upper two notes of its opening collection of five overlap the range of the piano, though they do not share any common pitches. The pitch sieves for voice and piano contain just one common note: *C5*. (The final *B4* of the vocal part, though, is common to the piano, forming part of the chord sustained through the voice's final phrase).

When the piano begins breaking out of its opening harmonic stasis at beat 29, it first fills in the upper register, only moving into the bass-clef register at beat 62, with a shift to a running, descending motion. This passage, in which overlapping, descending scales are layered one on top of the other, none going lower than *D3*, resembles a reverse Shepard's tone, an acoustical *trompe l'oreille* whereby a sliding tone seems to be continually ascending (different partials fade in and out to create the effect of continuity). After a return to the ten-note range of the opening, the piano finally expands down into the low register at beat 110 (more than two-thirds of the way through), in a passage alternating the central cluster chord of the opening with two- or three-note chords skipping all over the piano. Throughout this final passage, the voice, too, begins to break out of its narrow-band rhythmic chanting to finish in the high register, as noted before.

Pour Maurice, then, is a fully conceived, concentrated miniature. The extreme treatment of the voice, along with the guttural attacks of each vowel sound, assure an intensity of expression that belies the music's modest proportions.

Pour les baleines, Shaar

"The fight for the right to life of the whales and dolphins is part of the fight for human rights, trampled upon so much just about everywhere today," noted Xenakis (1987a) in the foreword to the score for *Pour les baleines*, a short work for string orchestra of some 2-1/2 minutes, written as a contribution to a published anthology in support of Greenpeace, an organization well known for its environmental activism. While the former Greek revolutionary expressed pessimism in his assessment of the human (and environmental) situation, it is notable that he offered here a positive contribution toward the cause for improvement.

The score is fully conceived, if highly compressed—a series of short gestures drawing on a wide range of materials. The opening features short, rhythmically articulated glissandi, rising incrementally from the lowest open string of each instrument to a high tremolo chord. Various glissando contours follow, interspersed with rhythmic pulsations on fixed chords, trills, and dynamic fluctuations. A brief stochastic cloud of pizzicato notes signals the final section, in which down-bow articulations of melodic contours, thickened by closely voiced chords moving in parallel, trace undulating contours (as in *Ikhoor*), each instrumental group following a different rhythmic trajectory. When these layers reach their high point the music shifts to a unison glissando echoing the evocative sonority of whale songs.

As *Pour les baleines* (1982) was intended first of all for publication rather than performance, it waited until December 1983 for its premiere. It served, however, as a study for a more ambitious 1982 work for string orchestra, commissioned by the Testimonium Festival of Jerusalem for performance in February 1983. The conductor

was Juan Pablo Izquierdo, a Chilean musician who had worked with Hermann Scherchen and who had given the premiere of *N'Shima* in 1976 at the same festival.

Shaar (“doorway,” from ancient Hebrew) begins, in a certain sense, where *Pour les baleines* leaves off. A unison glissando, alternating between quick, articulated, falling gestures and more expansive contours, opens the piece, a kind of keening recitative leading to the music to come. The energy contained in this sonority, with the whole orchestra of strings (excluding the basses) playing the monodic line together, is very powerful. Underscored by radically fluctuating dynamics, the passage continues for over thirty seconds. Then, briefly (at m. 7), the strings break into several layers, quickly coming together on a sustained *D4* then splitting at m. 9 into five parts, the glissandi being played tremolo sul ponticello. The lines fall off into silence at m. 10, lending closure to this introductory section.

The overall structure of *Shaar* falls neatly into six sections, although most contain subsections of contrasting material referencing other sections. The second—the longest, at 3–3/4 minutes—is built primarily upon rhythmic ideas. After a short passage in which a narrow melody is harmonized as a ten-note cluster moving in parallel, a long passage of alternating chords begins, each being articulated a variable number of times. The relentless pulse of these bowed sounds builds up a rhythmic drive that is briefly interrupted by two short passages of layered polyrhythms. The chordal patterns also split, creating a kind of counterpoint that heightens the eventual return to harmonic and rhythmic synchronization. As the passage proceeds, the two-chord ostinato expands until each of the five instrumental groups is playing what are essentially clustered melodies. At m. 31, the rhythms lock in on one layer (following a long-short pattern), the ongoing bowed articulations being applied to slow-moving glissandi. The degree of ensemble coordination necessary for this passage (and the preceding one) is extreme, and prefigures similar material in *Tetras*, Xenakis’s string quartet of the following year. The rhythmicized glissandi then settle in on a central cluster, colored by soft, high glissandi in the upper strings. A break at m. 44 signals the beginning of the third section, following on with the same cluster.

This section is built primarily from clusters, usually tight, quarter-tone groupings. The registral design of the passage is sculpted with care, with one contrasting passage taking a wide cluster and narrowing it to a unison *G#4* by means of glissandi. The section ends on another wide cluster spread across forty-two pitches, broken off by a bar of silence. The fourth section returns to rhythmic ostinati reminiscent of the second section. The clusters of the previous passage, though, continue throughout, as a secondary element. The pitch material is primarily static, with layered patterns of repeated notes placed in the high register and more intermittent punctuations and hocketing patterns in the lower registers. The clusters are sometimes sustained, sometimes rhythmic. At m. 91, the music breaks out of its harmonic stasis and the strings, split into six rhythmic layers, gather in on a central cluster again, carrying the polyrhythmic texture through three measures of this fixed sonority before opening back out again by expanding stepwise motion. At m. 101, a wide cluster is again sustained, this time as tremolo, leading directly into the fifth section. Here the music returns to the glissando material of the opening, with the original unison line expanded into a cluster moving in parallel. As the passage unfolds, the first violins are joined by a contrasting cluster line in the second violins, punctuated by short phrases of rhythmic cluster melodies in the lower strings. The two-part glissando is then

expanded by a third layer in the violas and then a fourth in the cellos and basses. As earlier, the glissandi vary from slowly undulating contours to fast, rhythmically articulated slides. The performance difficulties of this passage are again enormous; *Shaar* is essentially chamber music of the highest order of virtuosity scored for a full string orchestra.

Coming right out of this extremely active passage, a solo violin announces the final section with a descending, modal melody. The shift from sonic material of great complexity to something very simple is a stroke of dramatic flair. The violin, which elaborates its melody from just eight pitches, is joined by a second violin playing a countermelody. At m. 130, the texture is expanded to eight voices, performing essentially a canon, each layer following a different tempo. The fixed register of this passage, still using just the eight pitches of the solo violin, suddenly shifts at m. 136, as a staggered melody using a new sieve develops into a thick band of sound in which the notes of the melody are harmonized by successively lower notes of the sieve. In fact, as this passage progresses, the sieve is transformed into a new one, an expansion of the violin material, intercut with chromatic clusters. Each of these “harmonizations” is staggered so that the overall effect is of a nebulous, thick sonority in constant evolution. The music ends with a pyramidal accumulation of all forty-two notes of the final sieve, built up from the bottom, then sustained through a cadential crescendo and fade-out.

Compared to the early orchestral scores featuring strings, *Shaar* is much more clearly focused in its details of form and texture. Nevertheless, it explores the full range of the orchestral strings and draws upon a wide range of sonic entities. There is much less reliance upon statistical sonorities, entailing a higher degree of precision in order for the music to be presented convincingly. In this, it looks forward to the almost bewildering virtuosity of *Tetras*.

Tetras

By 1982, the Arditti String Quartet had established itself as a major force in the world of contemporary music. They were performing the demanding quartets of Elliot Carter, Brian Ferneyhough, György Ligeti, and many others. Having presented monograph concerts of the chamber string works of Xenakis, including *ST/4*, *Ikhoor*, and the solo pieces, an LP of this music was released that year. It seems inevitable that Xenakis would compose a new quartet for this ensemble. That score, *Tetras*, would help to solidify the Arditti Quartet’s reputation as the foremost new music quartet, as they performed it to great acclaim all around the world. (Few other groups have even attempted it.)

The title, *Tetras*, means “four,” and Xenakis takes it as signifying “four in one.” Certainly this is an ensemble work; there are few solo passages, and little counterpoint in the sense of layered or overlapping sonic entities. Much of the piece treats the four instruments as a single organism, and much of the sonic variation takes place on the level of temporal succession, along with parametrical changes within homogeneous passages. Where there are moments of layered entities, or solo passages, they are all the more significant in terms of formal trajectory and dramatic structure.

There are essentially six sonic entities deployed in *Tetras* (see fig. 26).⁷ The sectional articulation of the overall structure becomes less obvious later on, with increasing use of transitional elements, but generally, a single sonic entity dominates each of the nine

sections. The glissando is the predominant element overall, being featured in the first, third, and ninth sections, with substantial usage in the fifth as well. The opening, similar to *Shaar*, spotlights a single glissando line, this time scored for the low string of the first violin (Irvine Arditti himself). As the glissando narrows into a trill, the viola takes over, expanding the sonority by mixing double-stop glissandi with a single glissando over a sustained open string. At beat 34 the full quartet enters quietly, creating a concentrated sonority of double-stop glissandi with the spotlight shifting from one instrument to another by means of briefly notched-up dynamics and shifts to *sul ponticello*. The linear trajectory of this passage, moving from a single line to double stops to full ensemble, is then fractured as the glissandi falter on occasional sustained sonorities, fall off into silence, or are interrupted by rather rude grunts obtained by short, heavy bow strokes right on

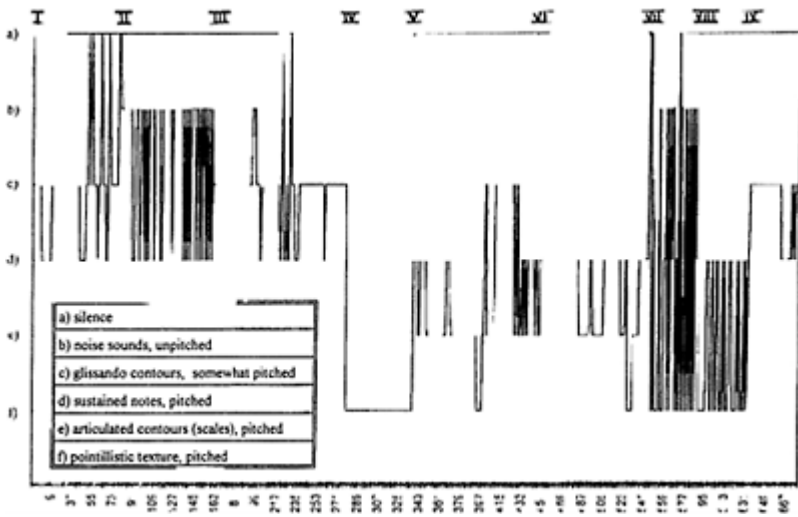


Figure 26. *Tetras*: Chart of formal outline.

the bridge. A final glissando flourish, winding erratically up into the high register then back down again in conjunction with a grand crescendo-decrescendo dynamic envelope, finishes off the section.

The second section is quite unique in Xenakis's chamber output. It is a compendium of noise sounds, including bowing on the bridge, the tailpiece, and lengthwise along the lowest string, knocking on the body of the instrument, tapping the strings with the wood of the bow, and so on. Over a duration of 1–1/4 minutes, these sounds are stochastically distributed among the instruments and the temporal divisions (notated geometrically/spatially, with occasional moments of regular pulse), mixed with a quiet, intermittent layer of sustained high harmonics. These noiselike, percussive sonorities appear again as accompaniment to the solo violin in section seven. As noted above, the grinding bridge noise had already debuted as a disrupting factor in the first section, and

this same sonority also serves as bridge to the next section. At beat 153, the cello launches a subtle transition, in which this bowed noise is gradually transformed into a pitched tremolo played *sul ponticello*. This transition is fascinating for a number of reasons. Sonically, it draws a connection between the unpitched noise of the grinding bow and the “noisy” timbral components of the tremolo and the *sul ponticello*. In retrospect—“outside time,” so to speak—the rather theatrical grunts of the first section are structurally related along a continuum of noise-pitch to the more integrated appearances of the tremolo and the *sul ponticello* in that first section (and thereafter). Formal nonlinearity, created from an outside-time network of such continua, is central to *Tetras*, and indeed, is treated with an extraordinary degree of detail. The richness and depth of this music is a marvel of musical construction.

Having returned to the glissando as primary entity for the third section, Xenakis varies it through shifting densities, registers, speeds, and degrees of synchronization. At beat 175 (this piece contains no barlines), there is even a brief recall of the opening violin solo, with interruptions by grinding noises, sustained chords and trills, and short breaks. A lightning-fast burst of double-stop glissandi leads into the fourth section, a stochastic texture of short bowed notes of mixed contours and intervallic structure. This is the first point when pitched material is given any prominence, but the density of notes and the generally chromatic content makes the perception of a coherent organization difficult. Again, Xenakis sets up a continuum, or “flux,” in which the element of pitch is treated with no regard, very little (the generally fast-moving glissandi), little (the brief sustained sonorities of the earlier sections), more (the articulated pitches of this section), and finally, in the fifth section, with a great deal more attention.

Section 5 begins with a pedantic exposition of a pitch sieve, played first as an ascending series of chords marked “pesante,” and then, after some scurrying outbursts of fast scales, a marked ascending scale in the cello. In this passage of primarily scalar material, there are two particular elements linking the music to other sections. The first occurs at beat 383, where, after fast passage-work in which the strings all play in parallel, the four lines separate off into repeating up-down scale contours of different lengths. These cycles, 16:9:14:12, prefigure the rhythmically layered ostinato patterns of the next section in which each instrument superimposes one polyrhythm on top of another (first violin: 7:5 over 5:4). The players break off, leaving the first violin to trigger a brief recall of the mixed-contour material of the previous section. As the instruments come back into synchronization at beat 396, the scalar figure gives way to a glissando, covering exactly the same register, conveying an explicit connection between the glissando and the scalar entities. A final outburst of wider-ranging scales leads into a more extensive glissando passage, finishing off with a final brief scale figure as the instruments move, one by one, to the ostinato material of the sixth section.

This intense (but harmonically static) passage alternates with scalar material and a brief stochastic cloud of pizzicato, the only such passage. A final high trill, carried along by a series of accents, slowly fades out over five beats and seems to signal the end. This gesture, though, is another in Xenakis’s arsenal serving a dramatic purpose as well as highlighting the “outside-time” connections between sonic entities. In this case, the trills link the shorter trills appearing earlier and the glissando element that, when restricted in range and regulated in rhythm, can become transformed into a trill.

The seventh section, launching the truncated second major part of the piece, returns to the noise elements of the second section, layered here with melodic material primarily in the first violin (based on a new pitch sieve). Interjections of pitched material by the other instruments is based on the original sieve of sections five and six, even if their sporadic nature weakens the dialectic aspect of this juxtaposition. The eighth section unfurls full-scale counterpoint, the melodies layered polyrhythmically with the pitch organization reverting back to the sieve of section five. Intercut with this linear material are brief harmonic passages of measured tremolos, played *sul ponticello*. This sonority prefigures the final section, built from continuous glissandi played with a tightly controlled tremolo. The progression of accents (long to short at first, in imitation of a similar passage in *Shaar*, but breaking away to a more complex pattern thereafter) is synchronized between the instruments. As this texture settles onto the closing cluster, the instruments slip one by one into a high, soft, slow glissando, finishing the composition on an ethereal note (as in so many other scores).

Tetras is a substantial contribution to the string quartet repertoire, demanding technical and ensemble virtuosity of the highest order. Some of the ensemble glissando passages are so fast in their back-and-forth oscillations that they defy belief. Other textures are so compressed, or require such tightly coordinated playing, that they are almost frightening. At the same time, some of the juxtapositions of different materials are vividly dramatic, even comic—a side of Xenakis less often seen. Most memorable, and most rewarding of repeat hearings, is the complex, multidimensional integration of the sonic entities to create a nonlinear form of great organic strength and depth. Truly, *Tetras* is a major contribution to music composition as a whole.

It is always tempting to draw neat lines around certain phases of an artist's work. With Xenakis, this is a foolhardy strategy. *Tetras*, in retrospect, seems to represent something of a pinnacle of achievement in terms of ensemble virtuosity seamlessly melded with formal construction. After that point, the scale begins to tip in the direction of compositional concerns at the expense of instrumental exuberance. Be that as it may, there would be many more pieces to thrill the senses with their energy and dazzling pyrotechnics. One senses, however, a note of austerity, perhaps arising from the composer's metaphysical preoccupation with death.

7

Melody, Harmonic Color, and Nonlinear Form

Throughout the 1980s, Xenakis continued to compose at a prolific rate, completing works in most genres, from orchestral to ensemble to concertante scores, and chamber, solo, vocal, stage, and electroacoustic compositions as well. His concern for sonority, weighted so strongly toward glissando and noise entities in *Tetras* (1982), shifted in the direction of harmonic-melodic concerns. Still, for the composer, “the question of global structure and of timbre [is at] the forefront” (Restagno 1988, 61).

Chant des soleils, Khal Perr

Not since *Eonta* (1963) and *Linaia-Agon* (1972) had Xenakis concerned himself directly with brass instruments outside of orchestral or mixed ensemble works. In 1983, between *Tetras* and his next orchestral work, *Lichens*, he turned his attention back to brass, with percussion. In quick succession, he produced two pieces for performance in different regions of France. *Chant des soleils* was commissioned on the initiative of Maurice Fleuret for the Fête de la Musique, an event he inaugurated upon his appointment as director of music for all of France. Every year, on 21 June (the summer solstice), the day is devoted to music—all forms, in all kinds of public venues. The idea was to present music for everyone at no charge, and to involve as many people as possible in the music making. Xenakis’s contribution, a short work for brass, percussion, mixed and children’s choirs, was given simultaneous performances in several locations throughout the northern region of Nord-Pasde-Calais.

The text is inspired by the sixteenth-century French poet Jacques Peletier du Mans. The phonemes are drawn from just a few words, and rarely intelligible, but the source is of some significance. Peletier du Mans is known for his translations of Greek and Roman classics and for his proposals regarding the reform of the French language. In addition, he influenced the group of French Renaissance poets who called themselves La Pléiade (a Greek term Xenakis had already employed for the title of his 1978 percussion work *Pléiades*).

The score calls for a minimum of six each of horns, trumpets, and trombones. There is also a part at the end that appears to be scored for low tubas and baritones, marked simply “brass,” although the specified instruments—horns, trumpets, and trombones—are otherwise engaged throughout the passage. Other sections give the option of doubling the

choir parts with woodwinds. This somewhat enigmatic, provisional scoring indicates that the music may have been aimed at wind ensemble programs.

The repeated notes of the opening, expanding from a unison to cluster chords, carry through much of the piece, and constitute one of its primary entities (vaguely reminiscent of 1965's *Akrata*, scored for winds). Xenakis explores subtle timbral variations by adding and subtracting individual members of the instrumental groups while maintaining the pulsing energy of the repeated notes. After the lengthy brass introduction, carrying on for forty-five seconds, the female voices of the choir enter on the same pitch as the opening horns (*A4*), then expand out to a cluster by means of glissandi. The third time this gesture occurs, the choir launches into the same repeated note material that the brass had been presenting. Rather quickly, though, the texture shifts, dropping in density to a solo glissando line in the female voices, joined shortly afterward by the trombones. The sonority quickly fills out to eight layers of glissandi in the choir along with percussion and staccato repeated-note patterns in the brass.

At beat 155 (there are no barlines in this score), the fast oscillating glissandi of the women's voices shift to an ostinato pattern built from irregular alternations between two chords. The brass, meanwhile, begin punctuating their pulsations with accented cluster chords. Eventually, the men's voices enter, filling out the two-chord rhythmic pattern. Shortly thereafter, beginning at beat 195, the women's voices shift to glissandi, one layer at a time, while the brass and percussion drop out. By beat 236, the voices carry on the glissando material a cappella (with short, intermittent interjections by the percussion). The alto voices revert to the ostinato material of the previous passage, providing a link to the next section in which repeated cluster chords in the brass alternate between quintuplets and triplets, eventually settling on the quintuplets (with the accents carrying on the 5-3 pattern). Over this concentrated, but static, sonority, the female voices sing a narrow, unison melody of a Bartókian flavor (chromatic rather than modal). The male voices enter with a countermelody, and the brass (with percussion) shift to more intermittent patterns of repeated notes built from clusters, with occasional melodic phrases matching the choir. By beat 315, the melodic material takes over completely, proceeding in alternation between brass and choir, each component built from interlocking strands of melody.

At beat 399, the trumpets herald the final section, built from a distinctive pitch sieve deployed contrapuntally in eight layers of female voices. Prior material utilized sieves only in localized spots, often layered in conjunction with distinct instrumental or vocal groups. Even for this final section, where the restricted pitch material of the voices is quite recognizable, Xenakis juxtaposes contrasting pitch material in the children's choir, chanting a restricted melody accompanied by a massed, metallic percussion sonority. The brass, too, contribute foundational pitches from below the range of the voices, taking over the contrapuntal, sieved material from the voices in preparation for the end, trading off with the men's voices who enter for a second brief passage. The children's chant closes the piece, accompanied by low clusters in the "brass" (tubas, etc.) and handheld percussion.

Chant des soleils is rather fragmented, but is woven together by the primacy of the pulsating repeated notes and related material that passes back and forth between the brass and the choir. The sketchy nature of the score, with its possible doublings and additional

instruments, makes it less accessible than other of Xenakis's choral works. In spite of the textual reference, though, there is nothing archaic about the music.

Khal Perr, for brass quintet and two percussionists, premiered in Beaune, in the Bourgogne region of France, in July 1983. Almost the entire piece is based on a single pitch sieve. The only exceptions are the glissandi, which become more prominent later, and the final pitched passage which shifts to quarter tones. In following the treatment of the sieve material, it is fascinating to see the variety of textures to which it is joined. These include the imitative, resonated melody of the opening, tonal in its intervallic configuration until that implication is wiped away as the register expands. There is also the rhythmically articulated sieve cluster of the second section, when the brass enter into a dialogue with the bongos, and the more complex polyrhythmic entities and stochastic material. This composition is rather fragmented in structure, like *Chant des soleils*, perhaps because the underlying pitch consistency enabled a rapid interplay of textures.

The first glissando does not appear until at beat 89, in the trombone, then taken up intermittently by the other instruments (obviously with less "natural" results). The central portion pits stochastic rhythms in the brass against measured interjections by the vibraphone and drums, with various brief interruptions by synchronized or patterned music. By beat 256, some two-thirds of the way through, the brass quintet is drawn back into a measured rhythmic organization, with only occasional reversions to a more statistical texture. The drum parts become busily active, and the brass, after closing off the rhythmic passage of what amounts to five-part, first-species counterpoint, stretch out into a sparser passage of drawnout glissandi. At beat 316, these turn into much more rapid, oscillating lines resembling the string parts of *Tetras*. The aural result, though, is much different, the rapid melodic phrases being filled with "bent" notes, rather as a jazz improviser might play. As the different instruments briefly break away from this sonority, they fill in the texture with rapidly articulated scalar passages built from quarter tones. Indeed, this is how *Khal Perr* closes, the brass playing rhythmically layered, narrow contours, accompanied by virtuosic percussion playing.

Xenakis is able to intercut a wide range of materials, sustaining continuity by limiting the pitch organization. The mastery over formal construction is apparent as he draws upon the intensity and dramatic novelty of the glissando sonority to pull the listener away from the stability of the sieve into a different sound world, ending the piece at a completely different point from which it began. While many contemporary composers have sought to achieve a sense of formal closure by returning to material stated at the opening (as a generalization of the sonata-form principle of exposition-development-recapitulation), Xenakis has most often tried to create a dynamic form—either evolutionary or nonlinear. His conception of formal structure is derived from the interaction of the various layers of the music, from the largest scale to the individual details, and from the continuities, permutations, and discontinuities that can be applied at each level. "While perceiving music one is in all the domains, on all levels at the same time," Xenakis notes. "In music we have not only the multidimensionality of space...but a much more complex way of thinking, perhaps the most complex in the whole of human creation.... The problem at the root of all these layers, of the ways in which they are constructed, is again the problem of repetitions, of symmetries and the problem of the destruction and change of these symmetries in the flow of musical movement. It is like being in the flow of a stream or river, where everything is either expected or happens

unexpectedly. Therefore our problem is linked with the question of determinacy and indeterminacy in the widest sense and with so-called causality” (Xenakis 1996, 146–47).

Lichens

In November of 1983, Xenakis completed a major orchestral score, his first since *Jonchaies*, six years earlier. *Lichens* was an important international commission,¹ for the Communauté Radiophonique des Programmes de Langue Française, which meant that the premiere by the Orchestre Philharmonique de Liège in Belgium was to be broadcast throughout the French-speaking world.

Like *Jonchaies* (1977), as well as *Nekuia* (1981), *Lichens* begins with a lengthy passage for strings alone, though very different in style from the earlier works. An eight-part texture unfolds as a series of short heterophonic phrases, anchored by unisons that gather the parts together before setting off on a new phrase. Each part is similar to the others, though not identical, and each follows an independent tempo by means of layered polyrhythms. A third element is introduced in the second measure, the glissando, again treated heterophonically, but less active than the articulated material. A further element is added, going into m. 4, with the addition of the basses to weight the middle of the phrase toward the lower register, assisted by the bassoons, timpani, and bass drum. This dynamic accent is balanced by a pause at the end of that measure, with the strings sustaining a high cluster rather than the unison *D6*. A compressed version of the opening is presented in m. 5, with the phrases this time moving upward from *A4* to *D6*. The third such gesture continues into a lengthy passage, ending with another high, sustained cluster at m. 10.

It is possible that the composer, always fascinated by natural phenomena, drew inspiration from lichens, organisms that proliferate in mysterious fashion in the harsh environment of the Arctic or on the barren surfaces of rock formations. This music proliferates from a brief fragment of a phrase, carrying on an involved polyphonic texture over a duration of close to a minute. The symbiotic relationship between the algae and fungi components of lichen may be reflected in the dialectic between the unison pitches and the complex heterophony of this passage. Regardless, the lichen is certainly related to the arborescences that Xenakis has described as “bushes.” It is a more austere metaphor, though, reflecting changing preoccupations.

Nonetheless, *Lichens* is a complex, richly detailed score, its aggressive intensity enhanced by the prominent role of the percussion. There are layers of contrasting material that at times seem almost *too* thick, as the brass or percussion overpower the rest. At the same time, though, there are moments of lucent transparency, as in the dialogue following on from the opening string passage between a single violin (and later, two) and the rest of the strings (mm. 13–20).

After the initial section featuring the strings, the focus shifts to timbral and rhythmic concerns. The high cluster chords and trills of the strings carry through m. 21, where the high woodwinds join in with cluster chords shaped by staggered durations in individual instruments. This technique of sculpting a more complex “envelope” from sustained chords or sonorities derives from electroacoustic studio techniques, and Xenakis makes much use of it in later orchestral scores. The xylophone enters at m. 23, a further addition to the high-register sonority. As the low strings descend and begin a complex ostinato

built from layered polyrhythms on a fixed set of notes, the low brass enter with a flutter-tongue cluster, adding a growling intensity. A third layer of material is added at m. 25, as the woodwinds and muted trumpets present an oscillating pulsation of two sixteen-note chords spread over 2-1/2 octaves of a pitch sieve not shared by the strings—the one used in *Nekuia*, and in *Serment* (1981). In this passage, the symbiotic nature of the lichens is found in the mixed textures across the different registers: the violins and xylophones, the woodwinds and trumpets, the low brass and strings. The mixtures of instruments and sonorities is unusual for Xenakis; many of his orchestral scores tend to treat the three main families—woodwinds, brass, and strings—as separate entities.

As these layers fade out (between mm. 26 and 28), the xylophone and high violins carry on, the ambitus gradually filling in as other strings join in to play hockets built from the pitch sieve introduced by the woodwinds and trumpets. At m. 37, there is a reprise of the previous section, with high, sculpted woodwind clusters leading to low clusters in the brass and percussion, with two-note chordal oscillations in the woodwinds and trumpets. A more extended dialogue between these three entities (the low brass reverting to the ostinato material of the low strings earlier on) continues to m. 48, where all of the winds (with percussion) converge on a widespread, flutter-tongue sieve cluster sustained through the measure. This monolithic sonority is then fractured and reconstructed, while the strings shift from patterned rhythmic articulations of repeated chords to glissandi. These, in turn, trigger fast, tightly harmonized descending runs in the brass (and the strings, as a contrast to the glissandi). As these runs finish off in low, sustained clusters, and a static chord in the strings is articulated according to a short-long pattern (not strictly regular), the percussion takes over for a short, busy interlude, colored by grinding bridge noises in the strings. The noisy end of the sonic spectrum continues to be featured even as the outburst of the drums runs its course. Low rumblings in the brass, bassoons, and low strings carry through m. 81, along with high, piercing clusters in the woodwinds and high strings that saturate the upper frequencies. Twice, the brass struggle to rise up from the low-register morass, succeeding the second time in climbing to a high, strident chord, signaling the start of a new section at m. 85, close to halfway through.

At this point, the attention swings back to linear, melodic concerns. The woodwinds launch into a lengthy passage of stochastic-geometric notation, in which nine notes of a contrasting sieve to the earlier one are distributed among six layers. The result is a contrapuntal texture of fluctuating density, held within the range of a tenth. Accents in the drums, high whistling harmonics in the violins, and sporadic interventions by the brass serve as accompaniment, all material heard before. At m. 91, the density of the woodwinds increases, the range widens, and the sieve is abandoned in favor of a fully chromatic canvas. By m. 97, the brass are also drawn in, but the entrance at m. 100 of regular pulsations in the timpani signals the end of the section as the full orchestra is drawn into a lumbering dance, each line spinning out a melody based on four notes of the second sieve. The overall effect is of a giant cluster moving in parallel according to an irregular pattern of short durations punctuated by longer ones.

After another brief outburst of drumming, this material is continued, fragmented as the music is passed from one instrumental configuration to another. The rhythms start to unravel as different layers shift speeds. By m. 122, this strongly pulsating “vertical” music fades out, leaving in its wake a rather nebulous sonority of string clusters. Staggered entrances by the ten groups of strings enable the composer to continually shape

the sound into smoothly sweeping gestures, upward or downward. The quarter-tone clusters ensure that individual notes receive no undue prominence. Again, this “filtering” of what is essentially a colored-noise sonority is drawn directly from the studio. With the acoustic energy of sixty instruments to work with instead of oscillators or electronic noise generators, Xenakis creates a vividly intense sonority of great originality.²

As the articulation of the clusters shifts to a measured tremolo at m. 135, the texture gradually thins, arriving at a widely spread ten-note chord at m. 139. It is gradually joined by the woodwinds and brass, the pulsating sonority shifting into triplets now and then in preparation for the layered polyrhythms that appear at m. 148. A third percussion interlude interrupts this briefly at mm. 153–55 and then, at m. 160, the layered rising lines that had been heard earlier in the brass reappear. This gesture leads to the closing section in which huge clusters sweep across the full orchestra, finally thinning out to a sustained chord spread across the entire range of the instruments. Four interruptions by the percussion carry the sonority along until at last it reaches the end.

Lichens follows a trajectory from distinct, mixed textures to giant orchestral sonorities. The progression is not linear, of course, with the homogeneous sound of the strings beginning the piece and returning later on in a very different guise, and the percussion delineating a sectional form through its dramatic interludes and other punctuations. Just as the algae produce food for the fungi, and the fungi provide air and shade for the algae, so too, perhaps, do the formal and sonic continuities and articulations thrive through their symbiotic relationship. *Lichens* is a strong work, both in terms of its expression and its organization. Xenakis had, by 1983, been composing orchestral music for thirty years. What is striking is that while his compositional concerns shifted radically over that period, he was still able to write innovative orchestral music of great vitality and force. And so he would continue.

Naama

The year 1984 was a lean one for Xenakis, compositionally; he completed just two works. They are nonetheless both significant ones, arising out of long-term relationships with particular performers. *Naama*, his second solo for harpsichord, was written for and dedicated to Elisabeth Chojnacka, for whom he had already written two works (and would write two more).

Naama (“flux”) is quite a different piece from *Khoai*, and very different from the piano music. Xenakis concentrates primarily on the percussive aspects of the instrument, emphasizing harmonic and rhythmic structures. There are no arborescences, for example—a major component of all the earlier keyboard scores. The “flux” of the title concerns itself with aspects of regularity and irregularity, often on several levels. The music is laid out as blocks of clearly defined materials analyzable in terms of four primary entities. Each block is harmonically delineated either by a distinctive sieve or by limiting the material to a fixed register or set of chords. They may be quite short, or rather lengthy, but each recurs at a later point, sometimes varied, sometimes verbatim. While many of these passages run smoothly into the next, or overlap, there are a few distinct points of structural articulation dividing the material into six sections. Note, though, that each textural entity occurs in more than one section, distinguishing the “outside-time” structure from the “inside-time” succession of temporally ordered events.

The first few lines of the score are worth detailed examination as a means of uncovering the network of compositional processes at work in *Naama*. To begin with, the ascending pattern of parallel chords (modal sounding rather than chromatic, indicating a pitch sieve) sets up a sense of continuity. This expectation is quickly thwarted, however, as the two hands separate to pursue independent trajectories. Each returns to the opening chord to start the rising sequence again, setting up a layer of repetition beyond the pulsing chords. This, too, is quickly left behind, though, the right hand shifting its starting point at the third ascent. The left hand begins its third ascent from the same point, but just prior to this it breaks out of the ascending pattern by inserting two descending chords. This tiny subterfuge is underscored by the inclusion of a triplet, shifting away from the steady pulse of the music to that point.

As the passage goes on, the ascending sequence becomes increasingly fractured, with growing “intrusions” by descending, or mixed, patterns. The cross-rhythm of the triplet also occurs with increasing frequency. At m. 3, the three-against-two becomes four-against-three at the first appearance of the repeated-chord material. The growing instability of the chordal sequences gives way, then, to the harmonic stasis of a single repeating chord in each hand, playing off each other through complex polyrhythms. After several beats of this, the music suddenly reverts back to the parallel progressions of the opening, though again, the two-handed block chords soon pull away into diverging trajectories. This brief recall of the beginning is soon swept away by a fast scalar run up the keyboard to a high repeated chord. The repetitions follow the short-long pattern Xenakis had favored in recent compositions (echoing Greek poetic rhythms), accented by left-hand punctuations. A final sustained “long” value closes off this first section.

The flux that we have been immersed in, with the shifting patterns, permutating repetitions, and shifting textures, does not end with the agogic pause at mm 7–8. New material is introduced—a melodic idea—accompanied by chords drawn from the same sieve as the opening, with a low pedal chord adding a percussive punctuation. Quickly, though, this material is swept away by another scalar run, this time descending. The music then shifts to more new material, a cyclical pattern of two repeating chords in the right hand over a pedal chord and middle-register chord to fill out the sound. This passage uses a new pitch sieve, introducing an additional dimension to the network of compositional elements (Xenakis deploys two sieves in *Naama* along with passages of chromatic material). A six-pulse pattern is set up, but after three repetitions it becomes varied. This entity continues for a longer period than any of the previous passages, but, after some nineteen seconds, it is interrupted. A variant of the melodic idea of mm. 8–9, underscored with chromatic chords, makes a brief appearance before giving way to long-short repeated chords. After two iterations of this pattern, the material begins to evolve, adding a third, bass chord and shifting to a more complex rhythmic pattern, each chord being treated independently. The harmonically static nature of this material indicates the presence of a sieve, and the smooth link to the next passage, a return to the cyclical chordal entity of mm. 10–13, confirms that these two entities share the same pitches.

Having over the course of the first few minutes introduced a number of distinct entities, treating them in a highly fluid manner, Xenakis creates an expectation of structural instability, of dynamism and detailed development of the material. He counteracts this later on with more expansive passages of unified content. In addition, having set out the predominantly chordal, rhythmic character of the music, the composer

inserts moments of surprising melodic simplicity and lyricism. The figure beginning at m. 115 is particularly notable for its rhythmic fluidity, with the insertion of several fermatas and rhythmic values fluctuating between thirty-second notes and quarter notes. The modal flavor of the sieve heard at the beginning is exposed here with the greatest clarity. Its character is linked to the gamelan-influenced pelog sieve originating with *Serment* (itself adapted from *Jonchaies*).

While less obviously difficult for the performer than *Khoai*, *Naama* is nonetheless extremely challenging. At the same time, the music is perhaps more idiomatic to the instrument, without being traditional. As Xenakis states in his notes for the score, the music “requires from the performer a mastery of the architecture and of techniques specific to the harpsichord, along with an exemplary [courageous] determination” (Xenakis 1984). What is also noteworthy about *Naama* for the listener is its transparency and harmonic coherence in spite of the density of chordal material. The judicious use of pitch sieves helps to achieve this effect.

Thallein

The second of four commissions for the London Sinfonietta, *Thallein* (1984) demonstrates an idiomatic mastery of the mixed large ensemble as *Naama* does for the harpsichord and *Tetras* for the string quartet. The title is a verb signifying “to sprout,” in the botanical sense. Sprouting, budding, flowering: in the figurative sense, there is an implication of flourishing or prospering.³ Certainly, *Thallein* is a work of profusion and abundance. There is a counterpoint of textures and dynamic transformations of these entities that carry the music forward with great energy. Even the sustained sonorities are enriched with trills, undulations, tremolos, or dramatic dynamic fluctuations.

While not as “theatrical” as *Tetras*, with its comic noises and awe-inspiring virtuosity, *Thallein* is nonetheless dramatic. It opens with a loud, tutti chord, accented by the addition of a gong stroke, an unusual percussion sonority for Xenakis. The first fifteen measures (just over one minute in duration) are shaped as a single gesture, and while it may be tempting to see this passage as “germinating” the rest of the piece it does not, although it is an engaging introduction nonetheless. After the opening chord, the high woodwinds and strings sustain a high cluster sonority over three measures, punctuated by a Varèsian vertical sonority in the rest of the ensemble—including the gong—drawn from the opening chord. The sustained pitches are destabilized by means of quilisma (irregular undulation). Going into m. 5, the three woodwinds carry on the quilisma alone, turning it into an irregular glissando as the focal pitches migrate up to the original notes of the opening chord, joined at that point by the rest of the ensemble. This time, however, the unstable sonority of the sustained chord is gradually taken over by measured, neighbor-tone oscillations, first in the trumpet and then in the three upper strings and oboe. One final articulation of the opening chord at the end of m. 9 leads to a passage in which the full ensemble pulsates with the two-note oscillations. Breaking out of this otherwise static rhythmic entity are descending runs, first in the strings, then the brass followed by the woodwinds, a final tutti descent landing on a low chord that closes off the passage. Thus, a number of elements have been introduced in this introduction: accented chords, sustained sonorities decorated by microtonal undulations, glissandi, an articulated rhythmic pulse, and parallel ensemble runs.

There follow nine episodes of varying degrees of unity and structural clarity, usually marked by strongly contrasting textures. Within each, however, there is often considerable development or layering of material. The second section, for example, begins with short strands of glissandi, first in the muted brass, then woodwinds followed by strings. The rhythms are written in Xenakis's stochastic notation, creating an fluid, improvisatory flow. The piano takes over, creating a cloud of notes concentrated in the upper registers. After a short break, the process starts again, this time with the winds and strings playing melodic phrases making free use of quarter tones. The rhythms, in contrast to the previous passage, are regulated and coordinated, with the piano again taking over with a lengthy passage of faster material built essentially from two diverging contours. At m. 28, toward the end of the piano's phrase, the strings enter, playing quarter-tone phrases (each instrument spinning out two lines, doubling the contrapuntal complexity) layered by means of polyrhythms (essentially different tempos). After a lengthy passage (about thirty seconds), the strings lock into rhythmic synchronization (with an *accelerando*) to finish, while the piano enters again with material carrying on from where it had previously left off. With brief woodwind/percussion punctuations, the strings launch once more into similar, two-part melodic material, this time following a coordinated tempo (in cross-relation to the piano), splitting apart briefly into three rhythmic layers, then finishing off on a fading, static *sul ponticello* sonority articulated with a measured tremolo. There is clearly a good deal of development in this section, particularly in the treatment of rhythm. The consistent alternation of fixed instrumental groups (woodwinds, brass, piano, strings), however, and the concentration on linear contrapuntal textures, lends a recognizable identity to this episode.

By contrast, the third section is less unified. The opening passage is linear, superimposing woodwind melodies, stochastically dispersed, onto layered melodies in the brass carrying on the previous string material. After drawing the winds into a single thread that finishes on a sustained *quilisma* chord, the strings enter with articulated, parallel glissandi. A short transitional phrase in the horn, playing covered, rather strange-sounding glissandi, leads to a more chamberlike section, accompanied by pointillistic punctuations from piano and woodblocks. The horn is succeeded by the flute, which is joined by the rest of the woodwinds before passing back to the horn, followed by trumpet and trombone. These passages are a mixture of glissandi, pitched notes, and sustained *quilismas*, creating an evocative, exotic effect that is at the same time quite lyrical. The piano and woodblocks gradually drop out, coming back in again to signal the start of the fourth section.

There the music becomes more aggressive, primarily rhythmic and harmonically static, with an elaborate part for percussion. Registral layers are established by means of repetition, sometimes pulsating, sometimes patterned. The piano contributes a low, pounding cluster in conjunction with flutter-tongue pedal tones in the bassoon, horn, and trombone. The high woodwinds and muted piccolo trumpet form the high-register layer, with staccato articulations of layered rhythm sieves and occasional brief outbursts of fast solo melodies. Finishing this section off is a *tutti* passage in which all the winds and the piano carry a widespread chord, articulating a rhythmic structure that begins with the familiar long-short pattern and evolves into something more complex. In counterpoint to this, the percussion continues its soloistic material, ending with a bang at m. 99, the start of the fifth section.

This central passage uses a pitch sieve for the first time, one quite different from those used in earlier compositions. In roughly parallel fashion (the rhythms do not coincide exactly), the woodwinds and piano trace a downward arc, moving back up as the brass join in. As the slow melodic undulations continue, the lines diverge, gradually shifting from a kind of chorale to a contrapuntal texture. When the strings join in at m. 106 the density increases, leading to an explosion of fast, downward chromatic runs in the winds and piano, as if to escape from the relentless unfolding of the twelve-part counterpoint. The strings continue, however, and after a few articulations of a low, growling chord, the winds join back in briefly. The strings keep going past the end of the final phrase of the winds and piano, dropping out one by one to leave the high violins for a transition to the next section. There the pitch material continues to be taken from the same sieve, but the emphasis shifts again to rhythm and pulse. Beginning with a dyad in the violins, a tightly voiced, high-register chord is presented through a series of pulsations, at times layered by means of polyrhythms, with the woodwinds and strings entering in blocks to fill out the ongoing sonority of the violins. The brass enter at m. 120, and the passage is adorned with two short, successive melodic phrases in the viola and cello. This section closes with the two violins again, their pulsing ostinato changing to trills on the same pitches.

There follows a brief reminiscence of the solo violin passages from the opening section of *Lichens*, with an exact quotation in the first phrase and a reworking of the second, separated by a legato chordal passage in the full strings. One can only wonder at the significance of this self-quotation. The intervening phrase is again drawn from the main pitch sieve, but the second brief violin fragment leads directly into a whirling passage of chromatic runs in the full ensemble, interspersed with brief trills. The predominantly downward motion of these scales turns around at the end of the passage, leading to high, sustained trills in the strings.

The eighth section is longer, and combines melodic and harmonic-rhythmic ideas. Limited to the higher register (again), a collection of eleven pitches not taken from the previous sieve underlies three layers. The first is a series of melodic phrases, first in the violin and viola, then shifting to other instrument pairs: clarinet and trumpet, clarinet and horn, flute and trumpet, flute and bassoon. The second is a series of accented chordal punctuations, alternating irregularly between two harmonic entities. The third is the cloud of stochastically distributed notes, creating what amounts to a background layer of polyphonic material (the notes are sustained). The cloud formation shifts from winds to strings to the full ensemble in varying distributions and densities. All the while, the accented tutti chords continue, demanding enormous agility from the musicians, who must switch extraordinarily quickly between soft geometrically notated background material and sharply articulated, precisely coordinated chords. Like the tutti chord in the fourth section, the pattern of these accents creates a complex structure, generally increasing in density then stretching out again as the passage comes to a close. The kaleidoscopic nature of this passage retains interest even while the pitch material is static and quite limited. One compositional detail worthy of note is the doubling of the winds up an octave by the strings, an orchestrational technique showing a fine sensibility for timbral organization.

The ninth section, introduced by a brief interlude for percussion alone, recalls the first part of the fourth section with its layers of harmonically static, rhythmic material. Again, different strata are set up, more dynamic here than earlier. The high woodwinds create a

pulsating band of closely voiced pitches, each instrument playing more than one note and not remaining fixed for the whole passage. The brass form a second layer, a series of closely voiced chords telescoping rhythmically to eventually turn into a similar sonority to the woodwinds. The bassoon comprises a layer by itself at first, but then joins forces with the piano and double bass in closely voiced but wide-ranging chords. The percussion continues with intermittent soloistic phrases. By m. 170, then, five distinct layers have been introduced, making this the most complex passage of the score. At m. 177, however, the brass reenter with chordal phrases of a more melodic, legato style. And, at m. 195, the woodwinds begin playing similar material in counterpoint to the brass, the music intensifying through m. 204, where the three strands (woodwinds, brass, and piano—the percussion out at m. 197) join for measured repetitions of three neighboring chords, the dynamics increasing to a maximum then falling away. This section sees a general shift from rhythmic to melodic concerns (in conjunction with harmonic structures) and then back again.

Finally, *Thallein* closes with a sustained passage focusing on timbre. The detuned unisons of the brass that take over from the final sonority of the previous section lead to variations of articulation and dynamics. Along with the outbursts of percussion are low bassoon interjections that recall its brief solo passage of the previous section. The brass sonority is then swept away by trills in the woodwinds and a tremolo unison in the strings (entering the fray after a lengthy absence). This unison fans out and back in again by means of smooth glissandi, the range becoming extended each time. As the winds drop out, the strings narrow in on the middle register, closing out the piece with a long, sustained chord—constructed using quarter tones, so in no sense a “resolution”—varying it with tremolo, *sul ponticello*, and dynamic fluctuations. The percussion colors the final decrescendo with quietly swirling maracas (an unusual sonority for Xenakis, like the *tamtam* of the opening).

The “burgeoning” of *Thallein* takes place not in a linear fashion, but in the more abstract, outside-time domain. There is certainly a great proliferation of material, but there are also many cross-references between different textures and musical elements. In certain ways, for example, the final section is a simplification of the opening, with its sustained sonorities that are passed off. There are also, though, elements carrying on from the previous section, such as the bassoon and the percussion. The whole is created through the interaction of the various elements over time, but there are also relationships that are not linked in a linear fashion. It is the friction between the temporal and nontemporal aspects of the music that sets off sparks of tension and energy, and, ultimately, produces a musical form that has no real counterpart in the visual or narrative domains.

Nyuyo

Xenakis had long been fascinated with the culture of Japan. His first visit there was in 1961, and he often returned. Early on, he noted the parallels between Noh theater and ancient Greek drama, and was much taken with the “noisy” timbres (and lack of vibrato) of the voices and instruments (Matossian 1986, 146–47). In 1985, when approached to compose for a traditional Japanese ensemble, Xenakis was happy to oblige: “I wanted to

combine the Eastern tradition with a Western style. It is a challenge, of sorts, and I wanted to take it up” (Langlois 1996, 7).

Nyūyo (“setting sun”) is scored for shakuhachi (traditional bamboo flute) and three plucked string instruments: a *sangen* and two *kotos*. Given the composer’s own predilection for unusual timbres, playing techniques, and nonvibrato sonorities, the musical rapprochement was easier than might otherwise have been the case. In addition, the modal nature of Japanese music resembles the pitch-sieve model that Xenakis had developed, even if he has generally drawn a closer connection to the Javanese *pelog*. The piece draws its material from a single sieve, but in some passages the strong accents, glissandi, and breath sounds have the effect of shifting attention away from pitch to the timbres.

Proceeding in segments, the form of *Nyūyo* can be distinguished primarily by the alternation between passages featuring the shakuhachi and those that do not. The flute tends to play long held notes, modulated by changes of timbre or articulation. The plucked instruments propel the music with patterns of continuous pulse, sporadically adorned with characteristic sharp attacks, often in a lower or higher register. In the fourth section, the rhythmic flow is disturbed by a sparse texture of unusual sonorities. There are seven sections in this score of some ten minutes’ duration.

Essentially, *Nyūyo* is quite typical of this composer’s style, albeit using a novel instrumentation. For someone familiar with traditional Japanese music, what would be immediately apparent is the stiffness of the rhythms and ensemble coordination. Japanese music, while sometimes notated, is primarily an aural discipline. In ensemble playing, cues for entrances come from listening to other parts, and there is a built-in fluidity to the flow of time in the music that, while often quite subtle, is highly characteristic (Shonu 1987). Toru Takemitsu, who spent several years studying traditional Japanese music, particularly in conjunction with his large-scale work for *gagaku* (a large ensemble of traditional instruments), *In an Autumn Garden* (1973–79), has written, “The metrical system of modern European music is controlled by absolute time that is determined in a physical manner. Variations in tempo brought about by agogics, although plastic in nature, still work within a time scheme that is linear and single-layered. Rhythmic type...in which the length of each beat is different, and the practice according to which... instruments proceed in different time schemes simultaneously, do not have equivalents in Western practice” (Takemitsu 1987, 11–12).

Xenakis would no doubt have studied recordings of Japanese music, and he incorporates a number of idiomatic elements, particularly the attacks, glissando ornaments, and breath sounds of the shakuhachi. The rhythmic structure of the music, though, is typical of his own style, and even simpler than most of his other scores, no doubt to take account of the ensemble’s lack of experience outside of its traditional domain. In 1993, French flutist Cécile Daroux worked with Xenakis on a transcription of *Nyūyo* for flute and three guitars. The result is very successful, an indication that this peculiarly idiosyncratic mixture of Eastern and Western elements can be applied in both directions.

Idmen A+B

After *Nyuyo*, Xenakis looked again to ancient Greece for inspiration for his next commission, a large-scale work for mixed choir and percussion ensemble. For this important commission from the French Ministry of Culture in celebration of European Music Year (1985), the composer turned to Hesiod's *Theogony*, the most ancient of texts from the time of Homer. While he does not try to "set" the text, instead drawing upon its phonemes and certain sequences of words, these lines are certainly of some relevance. Xenakis quotes part of it in his foreword to the score: "We know how to make lies seem the truth." He then adds his own ironic twist: "We also know how to make the truth seem like lies" (Xenakis 1985b). The fragment of *Theogony* he draws on, though, describes how the muses "breathe a sacred voice into [the] mouth [of the poet] with which to celebrate the things to come and things which were before." Thus, while the concerns of the piece are primarily abstract musical ones, the text in some measure signals the celebratory occasion of the commission.

The mixed choir is large, divided into thirty-two parts. *Idmen A* is written primarily for choir, with the accompaniment of two percussionists playing keyboards. *Idmen B* is primarily for percussion, with occasional contributions from the choir (or "crowd"). The intended percussion ensemble was the Percussions de Strasbourg, longtime collaborators (for whom he had composed *Persephassa* in 1969 and *Pléiades* in 1978). The structure of the two scores is unusual, as Xenakis rarely composed works in movements (*Pléiades* being a notable exception). In this case, each of the two *Idmen* pieces is made up of three movements, and while the two works can be performed autonomously, they are also designed to be interleaved: A1–B1–A2–B2–A3–B3. Altogether, they create a substantial work of close to half an hour.

The opening movement of *Idmen A* is the shortest of the set, lasting just over two minutes. The choral writing is varied, shifting between sculpted sonorities of staggered entrances across the ten layers of voices, homophonic chordal phrases, and linear contrapuntal segments. The melodic motion is governed by an octatonic scale, but each of the layers is harmonized by semitone clusters three or four notes thick. The intensity of sound is palpable, and the final passage lays out a complex, distributed rhythmic cycle, each layer moving in succession, but not ordered from top to bottom, or vice versa. While there is much interior motion to this texture, the general impression is of a mass of voices, flickering with energy but static overall. The two marimbas support the choral sonority throughout with stochastically generated articulations of a low collection of nine pitches.

By contrast, the first movement of *Idmen B* is the longest of the percussion segments, at 5–1/2 minutes. The generally nebulous rhythms of the opening choral movement are also contrasted by a starkly simple rhythmic pattern that underpins the bulk of this movement. Scored for drums alone, and split between the two halves of the ensemble (the line of six players being divided into left and right trios), a basic pattern of 2–3–3–2–2 is repeated throughout, with elaborations and occasional variations. On top of this, freer patterns of pulsations are layered in two parts, increasing in density as the section goes on, and leading to occasional crosstriplets. The music shifts between one trio and the next in an ordered way, the succession being governed by units of measures drawn from the

Fibonacci series. Additional layers of musical structure are added through the distribution of accents, dynamic gradations (quite detailed, unusually), and specific instrumentation. After a transition of measured patterns for the temple blocks, the choir/crowd (female) enters with unstable sustained tones grouped into a cluster, along with short glissando “cries.” The percussionists play stochastic fields of varying density, including substantial silences. This passage is essentially a separate segment, providing a link to the choral music that follows.

The second movement of *Idmen A* contrasts both A1 and B1. The female voices open with a modal melody drawn from the *Serment* sieve. This line fluctuates between monody and close-voiced harmonizations, eventually becoming more contrapuntal with occasional counter-melodies and harmonies. The male voices enter at m. 13, increasing the thickness of the chords. Sporadically, the marimbas contribute brief stochastic clouds of a limited collection of eight pitches, similar to the first movement, here scored for a wider range, overlapping the choir. After a fermata at m. 27 (at the 2'3" mark), the choir finishes on a hissing sound, joined by the “crowd” (which can be the audience). After a suspended passage of this sonority lasting some sixteen seconds, marked by a dramatic crescendo, the marimba joins in with a measured line in the lower register. After a second crescendo and decrescendo of the hissing sound, and a loud punctuating accent on the drums, the movement ends with the attention shifting back to the percussion.

Part Two of *Idmen B*, also quite substantial (about five minutes in length), is again scored for drums alone, and is even simpler, rhythmically, than the first movement. In fact, there is but a single line of continuous pulsation, broken up with occasional double-time duplets. The bulk of the musical argument rests on the changing distribution (or spatialization) of the performers and the shifting instrumentation. The most radical shift in sonority is in the second part, in which the “gamma” layer (drums played with fingers and palms) is interleaved with the “beta” layer (drums played with mallets). Again, the dynamic shading from one note to the next is detailed, ranging from *mf* to *fff*. A brief passage at the end of this movement shifts to a high metallic sonority, with insistent iterations from the glockenspiel and xylophone or, alternatively, the sixxen, the piercing metallic bars created for *Pléiades*.

This transition carries right into the start of the third movement of *Idmen A*, the longest by far of the set, at nine minutes in duration. The choral texture recalls the opening of the second piece, with a simple, undulating modal melody sung by the female voices. This sieve, though, is different, and the close imitation of the sopranos by the altos, at first creating a resonating effect, soon splits into two lines, ending on a sieve cluster sung *fff*. A developmental passage follows, alternating among sustained chords, melodic fragments, and measured “trills” (alternations between two fixed notes in each voice), with brief interjections by the high metallic percussion that led into the movement. By m. 15, the semitone clusters of the first movement have also reappeared. At m. 18, four layers of male voices enter in turn. A thick chorale, divided into two layers (female and male) of eight voices, is set against four lines of narrow-ranged chant, along with a more active layer of percussion. The two choral strands are brought together at m. 29 on a pulsating cluster. A brief interlocking hocket-like passage between the women and men leads into a series of short alternations of the rhythmic chant material and the more wide-ranging chordal passages, again with various interjections from the keyboards. At m. 52, the sopranos and altos shift into closely voiced glissandi and quilisma, the male

voices and percussion adding punctuation. Thereafter, the texture becomes extremely complex, with successions and superpositions of the sustained quilisma, short glissandi, rhythmically layered chordal contours, and faster melodic passages. By m. 67, the melodic passages win out, and the music thins to just four lines moving in quasi-parallel motion. After a short pause at m. 71, a sixteen-voice cluster sonority is introduced, with the gendered voices trading off between sustained chords, often trilled, and rhythmically patterned articulations of the harmonies. The punctuations of the keyboards gradually increase in density until the music becomes a call-and-response between choir and percussion. A final stochastic keyboard flurry signals the entrance of the “crowd,” who join the choir in a long, concluding whole-tone cluster, destabilized by asynchronous oscillations (quilisma) of individual notes, and thundering accents on the drums. This movement could stand as an individual work, although the ambitious percussion part, calling here for at least four players (not the duo specified in the foreword to the score), would no doubt act as a deterrent to many choirs.

The final percussion movement returns to the layered structure of the first piece of the set, here considerably shorter, at just three minutes. There are four strands, anchored as before by a repeating rhythmic pattern, this time based on a 5–3–9 succession. The final passage adds a more elaborate fifth layer, and includes the option of adding temple blocks or the metallic sixxen.

Idmen A and B juxtaposes the more hieratic percussion movements with choral works of considerable scope and variety. There is no real linear trajectory to the overall form, although the final choral movement is obviously the most substantial and complex. The rather hypnotic patterns of the drums (vastly simplified from the hypercomplexity of *Pléiades*) is balanced by the dynamism of the vocal writing. Perhaps the percussion is intended to invoke a kind of ritual ceremony through which the muses “breath a sacred voice into [one’s] mouth.” A more abstract kind of ceremony would be conjured in Xenakis’s next work, for three ensembles.

Alax

While the spatialization of sound had continued in such works from the 1970s and 1980s as *Windungen* (1975), *La Légende d’Eer* (1977), and *Idmen B*, Xenakis had given up on the more radical experiments of *Terretektorh* (1966) and *Nomos gamma* (1968). The impracticalities of deplacing orchestra members and requiring a nontraditional performance space, along with the resistance of performers and presenters, had evidently worn away at the composer’s convictions: as Xenakis notes, Anna Harley, “Even with fantastic ideas, a composition too unusual will never be performed, or will only be performed once, which is not enough” (M.A. Harley 1994b, 20). The chances for repeat performances of a work for three identical ensembles of ten players each (five winds, one harpist, one percussionist, three strings) would have been no more assured, but Xenakis evidently could not resist the offer from Wolfgang Becker at Westdeutscher Rundfunk (West German Radio) to write something for three of the top new music groups in Germany: the Ensemble Modern (Frankfurt), the Köln Ensemble (Cologne), and the Gruppe für Neue Musik Hans Eisler (Leipzig). The ensembles were intended to form the points of an equilateral triangle, although by this time Xenakis was worldly enough to also allow for the ensembles to be placed side by side on a regular stage.

Alax signifies interchange or transformation, and the spatial position of the sounds comprises one element of this idea, along with sonority, density, degree of order, and so on. In fact, Xenakis shifts quite fluidly in his layout of the score between groupings by ensemble and by instrumentation. The blending of instrumental timbres is a fundamental element of the music, and the spatial placement of the performers enhances the fusion of sonorities, particularly in the final section where the full complement of instruments combines into a rich, homogeneous sound. Along the way, there are some fascinating, evocative moments, particularly in the treatment of the harps and the plaintive dirges of the brass.

Strangely, *Alax* opens with the very same violin motive that had reappeared in *Thallein* after its initial presentation in *Lichens*. In the brief opening section, this figure is transposed, layered, and varied, all in conjunction with rhythmically synchronized chordal fragments that serve to introduce the strings (one violin and two cellos in each ensemble). This high-register, relatively restrained material gives way in m. 8 to a heart-stopping flourish of rapid double-stop glissandi for all nine string instruments that is equal to such passages in *Tetras*. Rough pedal tones introduce the brass (two horns and one trombone in each ensemble), who by m. 17 join the glissando texture, taking over completely by the following bar. The staggering of entrances and dynamic fluctuations proceed by ensemble in this section, even while the overall sonority is uniform. As the glissandi settle on a fixed oscillation between two chords, the brass and cellos drop down to a low, growling cluster as the flutes and clarinets carry on the high oscillations and the percussionists make their entrance with a staggered crescendo-decrescendo gesture on the bongos. By m. 28, the close of the second section, all of the instruments have been introduced with the exception of the harps.

The noisy, aggressive racket of the rest of the ensemble is then suddenly torn off, leaving the spotlight on the harps. The simple unison melody of mm. 28–30 recalls a similarly quiet, lyrical moment at m. 115 in *Naama*, although the pitch sieve is different. This coordinated statement shifts to staggered phrases, each harp utilizing a different sieve, enhancing their spatial separation. The harps are adorned by solo cello lines of articulated glissandi played *sul ponticello*. As the harps are drawn back into rhythmic formation at m. 35, accented by bass drum(s),⁴ the cellos provide a link to the previous section, landing on a low cluster as the brass join in. This time, though, the growling, flutter-tongue/tremolo sonority explodes not into glissandi but fast scalar contours. It is notable that this passage assigns one pitch sieve to the winds and a second one to the strings. While they may be related in terms of generative structure, they are intervallically distinct (and noncomplementary).

What follows at m. 44 is another simple melody, this time scored for the full ensemble of winds and harps (the strings sustain a high octave throughout this passage). The melody is resonated by close imitation across twelve layers of instruments. The spatial deployment is interesting in that the melody is made to rotate around the ensembles, breaking out of this pattern after the eighth layer: 1–2–3–1–2–3–1–2–2–1–3–3. As a subset of this spatial structure, the succession of the horns is noteworthy, with the six being scored in alternate layers: 1–3–2–1–2–3. Whether or not the rate of succession is clear enough to allow the listener to perceive these patterns, it is evident that Xenakis was intimately engaged with the element of spatialization here and in many other passages.

As the line begins to refract (with the resonating layers diverging from the leader), the flurries of scalar material returns, pausing for a breath at the end of m. 54.

The long, central portion takes up roughly one-third of the twenty-two-minute piece. The main sonority in this section is a somber brass “chant,” set off by chordal passages in the woodwinds and strings. The brass material owes something to the two-part psalmodic style of Xenakis’s choral work *A Hélène* (1977), but it goes much further with its subtle coloring of basic intervals such as the *minor third*. The first phrase creates an arch as the brass slowly climb to a highpoint, the intervallic content staying centered around the *m3*, occasionally expanding from two voices to three or four, then opening to larger intervals as the phrase descends slightly to land on a cadential octave at the pause. As the dirge continues it rises higher, jumping back to the initial interval (*C3-E♭3*) at m. 58 to start over, this time with a more staggered deployment of the three brass groups. The chorale passages of the woodwinds, strings, and harps are calmer, the two lines being each harmonized by tight chords derived from a sieve (with the puzzling exception of one chord, perhaps used as a sort of harmonic “dissonance”). After the brass and the woodwinds/strings have traded off twice, they are superimposed at m. 77. Coming out of this timbral counterpoint there are a few brief passages to close off the section. The first joins the horns and strings in a chordal progression with a unified rhythmic structure based on a sievelike succession of 1–2–3. At m. 91, this layer is joined by a second chordal progression, slower, in the brass, leading to a long sustained sonority adorned with trills and staggered dynamic fluctuations.

The passage that follows reprises the cello glissandi from the harp feature at m. 31, expanding into a wider passage with all six cellos, set off by stochastically notated lines in the woodwinds. The horns trade off the glissando entity with the cellos, and by the end of the passage, the woodwinds join in, too. At m. 115, there is another sudden shift to the harps, this time in a texture that mixes accented chords with flurries of activity built from the same pitches as the chords. Various punctuating or countering layers make their appearance, including accented brass chords, low cello clusters, rhythmically articulated string harmonics, and chordal passages recalling the central section. The full ensemble locks onto a synchronized pulse at m. 140, signaling the eighth section. The emphasis remains on chordal sonorities, layered in a complex seven-part counterpoint of woodwinds, horns, trombones, harps, percussion, violins, and cellos. The violins are the most rhythmically active, and this faster material is taken over at m. 160 by the percussion, who, after a brief cadenza-like outburst, settle into a three-part rhythmic pattern similar to the first movement of *Idmen B*, here supported by active violins and sustained quilisma chords in the winds, harps, and cellos.

The work culminates in a sustained passage involving the full ensemble. Each of the winds and strings plays a slow melody, the rhythms being overlapped so that note changes are often imperceptible. The harps articulate a slow chordal progression while the drums pound out occasional accents in counterpoint to the harps. Underneath all of this, the timpani trace a contour of continuous glissandi, filling in the low register. After all the various sonic superpositions and contrasts, along with the different spatial projections, Xenakis closes *Alax* with a unified sonority, a fusion of the different instrumental colors.

Given the distinctive instrumentation and the spatial separation of the ensembles, it is perhaps typical that this composer would choose something atypical for his ending. In

any case, this is a fascinating score. The impressionistic character of the harps contrasts with the powerfully lamenting chants of the brass, and the whirlwinds of glissandi and melodic runs eventually settle into passages of harmonic counterpoint and stately lines. It would be wonderful to hear *Alax* in its proper, spatialized setting. As Xenakis was well aware, the separation of instruments or sonorities adds a depth to the music that cannot be achieved any other way. It is a shame that resistance to alternative presentations of instrumental music is so strong.

Alax was completed in June 1985. While Xenakis did not complete any other scores that year, he was certainly busy. He spent six weeks in July and August lecturing at the Centre Acanthes, which, in honor of 1985 being European Music Year, traveled from its then usual home in Aix-en-Provence,⁵ to Salzburg, and then to Delphi. He was also busy composing, and 1986 saw the completion of no less than two major orchestral works, two ensemble pieces, a chamber work, and a trombone solo.

Keqrops

In a way, *Keqrops*—completed in January 1986—carries on from where *Alax* leaves off, though to a completely different expressive end. The new score, scored for piano solo and large orchestra, opens with a full, sustained sonority. The quarter-note pulse, accented by the bass drum, gradually starts to be eroded as the different strands pull away into separate polyrhythms and melodic contours (although the weight of the bass drum carries the pulse until it stops at m. 6). Out of this dense morass of sound, spread across the full range of the orchestra, faster material in different instruments or instrumental combinations begins to highlight the soundscape, preparing the way for the entrance of the solo piano at m. 11.⁶

The title *Keqrops* comes from two Greek words signifying “weave together.” There are numerous manifestations of this image in the music, from the treatment of the piano as both soloist and as additional layer of orchestral sonority, to the layering and temporal placement of the various musical components throughout. *Keqrops* was also a mythical figure (c. 1500 B.C.), evidently a ruler of Athens possessing a double nature, that of both man and dragon. This is no doubt where, at least in part, the volatile, fiery character of the music comes from, for this is one of Xenakis’s most active, aggressive creations, exploding with rhythmic energy, textural intensity, and formal tension.

The piano, when it enters at m. 11, launches one of the score’s lengthiest passages. Dramatically tolling *B \flat* octaves in the bass propel an ostinato-like chordal pattern in the right hand, cycling irregularly through three midregister cluster chords derived from a pitch sieve. Hurlled against this solo music are short outbursts of closely voiced, fast melodic contours in the strings, then sharply articulated chords in the full orchestra. These accents turn into a two-chord oscillation that carries through a change of tempo and into a contrapuntal passage where the different instrumental groups play melodic contours, each filled out as a cluster moving in parallel. As this thick magma continues, the piano drops out briefly, entering again at m. 28 as the orchestra closes in on a narrow sustained chord at m. 30. Interspersed with two brief references to the earlier ostinato and bass pedal, the piano begins a series of fast scalar flourishes up the keyboard or fanning outward and back in contrary motion. The orchestral texture thins, with brief fragments of interlocking melodic material, fast descending scales, and glissandi in the strings

serving as foils to the piano part. Most of the music is built from sieves, but they shift one to another very quickly, without really establishing any sense of harmonic identity or coherence. Some material is actually adapted from *Mists*.⁷ At m. 52, with the layered glissandi in the strings becoming increasingly intense, the piano introduces a new idea among the scalar flourishes, a combination of chords and melodic figuration. At m. 55, the orchestra, by then a teeming mass of brass and strings, builds up energy and then suddenly drops away. At the end of m. 57, the piano finds itself alone.

This cadenza, close to a minute in length, is built upon a series of gestures expanding upon an initial melodic figure. The sieve underlying this material remains consistent throughout the cadenza and the subsequent section. As more voices are added, the texture becomes chordal, and from m. 61 on each phrase finishes on a sustained, repeated, or accented chord. The final chord of the passage is extended for four measures, overlapping the entrance of the flutes and oboes to launch the next section. This extensive passage, lasting well over two minutes, is a fascinating study in continuity. The music is performed *legatissimo*, with each group of instruments creating a registrally limited bundle of intricate melodic counterpoint. The high, seven-note “region” of the flutes and oboes is joined by the violins at m. 76, with horns and clarinets adding a second layer based on a six-note region in the middle register. The piano adds a more dynamic layer of rising scales in the low to middle register, joined at m. 77 by the bassoons. As the winds drop out at m. 80, the violins carry on, with the rest of the strings filling in the lower registers (notably, the cellos are scored in a higher, though overlapping, range from the violas). At m. 84 the bassoons join the double basses, and shortly thereafter the strings shift to glissandi (the melodic, *legatissimo* character is preserved). In succession, the different families of winds join in playing, as best they can, *legato* glissando contours. All of the material to this point has been based on the sieve introduced by the piano, so the sustained *legato* character of the music is enhanced by the consistent pitch structure. The only subversive element is the dry, staccato clouds of notes (still sieve-based) introduced by the piano at m. 88 as the orchestra shifts to glissandi. This material is continued, in intermittent spurts, into the next section.

The sonic continuity in the orchestra carries on, but there is a striking shift of character at m. 94. The glissandi settle onto chords, which Xenakis treats as blocks, playing one group of instruments against another in a rhythmic counterpoint that is enhanced by pulsating dynamic fluctuations and independent accents on the timpani. The orchestra breaks off at m. 100 and the piano returns to the layered rising scales it had played earlier, expanded to six voices (each following its own trajectory of polyrhythms). The piano utilizes the same sieve as before, but, as the orchestral instruments enter with their own interjections of clustered scale contours, the sieve gives way to a more unstable, chromatic pitch environment. The density of the orchestra increases to a maximum at m. 113. There is then a sudden break, as the piano, still in six rhythmically independent voices, plays a final solo passage of *legato* counterpoint, this time in a more complex, less directional configuration. The full orchestra enters again, finally settling onto another clustered *quilisma* chord at m. 118. The staggered dynamic fluctuations eventually subside and the chord fades out in the winds by the end of m. 122. In the meantime, the piano shifts to a dancelike passage of block chords, the regular, loud-soft accent pattern being thrown off by occasional units of three (loud-soft-soft) and brief tempo shifts. At m. 121, the violins join in with a countering texture of slower *legato* chords, followed by

other instrumental groups. The orchestral parts start to unravel into individual melodic lines at m. 126, similar to the section after the piano cadenza, while the piano continues with its chords. The piano's pitch sieve is contrasted to that of the orchestra, neither being the one featured earlier.

At m. 133 the piano drops out briefly, and the orchestra continues with melodic layers in the high woodwinds and violins and chords in the bassoons and horns. There is another sharp shift at m. 137, the piano playing stochastically dispersed clouds of notes in the upper register, paired with double bass clusters and wideranging melodic phrases in the harp, its first prominent appearance (a timbral link to *Alax*). This unusual combination of sonorities is set against staggered clusters in the rest of the orchestra. The passage is brief, however, as the piano returns to its layered rising contours and the orchestra gradually coalesces into a monumental cluster sonority which carries to the end. As the piano tosses out short phrases of the various materials introduced throughout the piece the orchestra trains the spotlight on fast passages moving from one group of instruments to another (recalling the opening passage). A long *rallentando*, by which steady pulsations of block chords in the orchestra slow down from 72 MM to 10 MM (the piano plays a complex six-voice polyrhythmic passage against this, before joining in at the end). Low clusters mark the end of the orchestral music, and the piano launches into one last reference to the chordal ostinato material from early on, closing with a dramatic tolling of the low *B_b* octave.

The piano part in *Keqrops* is of enormous technical difficulty. The orchestra plays for much of the time and is often scored with extremely concentrated material, but the most active music is usually reserved for the piano, particularly its recurring scalar runs and ascending gestures. One can imagine the dragon rearing its head, roaring flames. From the formal point of view, while the textural complexity is often bewildering, there are different signposts along the way. The ostinato material in the piano after the introduction, for example, is quite transparent, harmonically, and helps generate a sense of rhythmic propulsion to carry through more complex, diffuse passages. The middle part, in which a single sieve is used, provides a harmonic anchor. The final section, is strongly recapitulatory and contributes to a sense of structural coherence that is often difficult to grasp in music of such miasmatic intensity and volcanic energy.

À l'île de Gorée

Xenakis has a seemingly endless capacity to reinvent himself, to shift to other concerns before falling into too predictable a pattern. Originality, in the profound sense of beginning from nothing, lies at the heart of his aesthetic. In a series of French interviews he once noted, “[I] faut cultiver constamment le regard neuf. Il faut être constamment un immigré. Dans tout.” [One must always cultivate a new approach. One must always be an immigrant. In everything] (Delalande 1997, 123). And so, after *Keqrops*, Xenakis composed another concertante work, but of a totally different character.

À l'île de Gorée is scored for harpsichord solo (to be played, once again, by Elisabeth Chojnacka) and a mixed ensemble of twelve players. Compared to the piano concerto, the music is light and transparent—almost classical (or Baroque, to be more accurate). This in spite of the title's political references: Gorea, off of Senegal, was a clearinghouse for the slave trade, and Xenakis makes explicit the connection between this historical

situation and the “black heroes and victims of apartheid in South Africa, last bastion of a hysterical racism” (Xenakis 1988b). Unlike *Nuits* (1968), a piece with an explicitly political dedication in some measure reflected in the keening and wailing of the voices, *À l’île de Gorée* would appear to be a gesture of support whose content is independent of its contribution to the cause.

While Chojnacka was already a familiar member of the small (but growing) cadre of musicians dedicated to the music of Xenakis, this is the first (and only, as it turns out) score written for the Dutch group named after the composer. The Xenakis Ensemble was formed in 1981, primarily for performances at the Middelburg Festival Nieuwe Muziek in the Netherlands, where Xenakis was a frequent guest. Over the years the ensemble has performed over forty of his chamber works.⁸

While classical in its restraint, *À l’île de Gorée* is far from traditional in its construction. While there are certain recurring pitch structures that provide recognizable points of harmonic orientation, the unfolding of the material and the cross-referencing of episodes create a complex, beguiling structure. What is especially noteworthy is the way certain elements are carried forward while new ones are introduced, or else are recalled after a brief departure, making for overlapping and interlocking entities that hinder clear identification of formal sections. This process of construction speaks to the composer’s increasingly nonlinear sense of form in which multilayered networks between different materials reach across the temporal structure. Nonetheless, for the sake of orientation, it is possible to divide the form into nine sections of varying lengths and degrees of distinctiveness.

The opening immediately proclaims the timbral transparency of the music, in sharp contrast to *Kegrops*. A five-note, midregister octatonic cluster is sounded by the harpsichord and echoed by the strings and muted brass. The chord is repeated numerous times, at first according to a regular rhythmic pattern, and thereafter at more irregular intervals. The ensemble sonority is varied by the addition of a highpitched entity, alternating between an unusual harmonic in the violins and an unstable double sonority in the piccolo. As the opening sounds resonate, the harpsichord adds melodic notes in the gaps among the chords, first presenting octave *D*s around the cluster, then creating short melodic fragments using these and the octatonic pitches. The suspended, expectant state of the music is carefully sustained for close to a minute, with the harpsichord eventually adding chromatic neighbor-tones to its melodic material. At m. 5, the piccolo shifts to a lower multiphonic in the flute and the bassoon intones a portentous descending line that prepares a dramatic crescendo built from the by now familiar cluster chord, here expanded by the addition of a low tremolo in the double bass and the noisy timbre of the overblown bassoon.

At the end of m. 8 the ensemble drops out, making room for a brief solo passage, building from a declamatory opening into fast, sweeping runs, colored briefly by similar fragments in the woodwinds and strings. Abruptly, this cadenza-like material is cut off, making way for the next section. With the interlocking ostinati in the brass and harpsichord along with the jaunty bass pattern in the bassoon (built on a perfect fifth), this passage sounds like that of a neoclassical Igor Stravinsky. As the music carries on, each instrument gradually breaks out of its ostinato pattern into wider-ranging, melodic material. There is a shift to the woodwinds at m. 28, their melodies proliferating out from a unison *A4*. Throughout this section, there is also a harmonic move to the familiar

Serment pitch sieve. By the time the woodwinds enter the range of the sieve containing the distinctive pelog sound (major thirds and minor seconds), the listener is in no doubt as to the sieve's identity.

An interesting transition occurs at that point, leading to the third section. After the brief woodwind passage the harpsichord enters on its own, carrying on the layered melodic material from before, but then abruptly shifting into a new rhythmic passage built from chords not derived from the ongoing sieve. A return of the woodwinds seems to negate the new material, but the harpsichord enters again, and after another brief melodic fragment, it switches definitively to the new material. The music is filled out with a high chord in the strings, an unusual, sustained sonority in the woodwinds built from multiphonics (reminiscent of the opening chord, with the piccolo/flute split tones), and rhythmic ostinato material in the brass. This carries through to m. 42, when the full ensemble joins the brass in a rhythmic punctuation of the soloist's ongoing ostinato activity (the pitch content being held static while the rhythms are varied and elaborated).

At mm. 45–46, there is a brief respite from the predominantly rhythmic activity, with the full ensemble playing a legato descending line while the soloist takes a break, each instrument moving in parallel along a new pitch sieve. The previous material returns, this time with the whole ensemble joining the harpsichord-brass ostinato patterns. There are a number of variations, most notably the pitting of the ensemble against various subsets such as the harpsichord alone, keyboard with brass, and so forth. Another melodic passage is inserted at mm. 57–58, this time split into three layers: woodwinds, brass, and strings. The diverging scalar contours are delineated by the use of different sieves and polyrhythms. A third melodic entity is introduced at m. 59 (returning at m. 62 to finish the section), this time granting each player linear independence and blurring the rhythmic drive with geometric (stochastic) notation.

At m. 63 the harpsichord jumps back in with chordal, rhythmic material, punctuated by the winds, but there are significant differences in the texture. The harpsichord opens out from the four chords of the previous section to a much larger collection more widely dispersed (although there is still a great deal of repetition). It also plays in polyrhythmic relationship to the winds, widening the scope of the rhythmic patterns. The strings, from mm. 63 to 69, unfurl a slow, ascending glissando, splitting into two as the higher strings remain at the point of ascension while the cello and double bass descend. In addition, the high woodwinds pass off a repeated-note riff between themselves, this sonority giving particular emphasis to an open fifth, *A5–E6*. This diad is then passed on to the strings at m. 76, after brief emphasis of a midrange cluster in the full ensemble. This cluster returns at m. 80 to close the section. There follows a brief episode for the harpsichord, playing a bluesy ostinato pattern supported by sustained strings on the *A–E* dyad. After six measures, the strings drop out and the soloist begins to break out of the dance-like rhythms with fast scales. As the brass enter with low punches and the high woodwinds with an articulated cluster, the harpsichord finishes off with a fast descending passage, followed by the woodwinds. Another brief episode follows on, as the woodwinds land on a low, sustained cluster. The harpsichord contributes a couple of runs and trills, touching off a flurry of runs in the full ensemble, first layered and then synchronized.

In the sixth section the fast ensemble runs are replaced by a new ostinato-type music in the harpsichord, using a new sieve and holding the range to within the span of a four-note chord in the right hand and a five-note chord in the left. The rhythms are diffuse to

begin with, but over the course of the passage they become more defined, with chordal accents gradually displacing the melodic ornamentation. Occasional fast runs break out of this texture, and these are echoed at m. 106 by the strings and at m. 113 by the woodwinds. The overall sonority is filled out by intermittent glissandi in the strings and by the unstable sustained sonority in the woodwinds from section three. A final moment of sustained woodwinds and strings leads to the next section.

A lyrical, rather plaintive three-part brass phrase is heard, built from the pitches of the opening chord. It is followed by a chordal statement of this pitch set in the winds and harpsichord, gradually pulling apart into a contrapuntal texture, though still banded to a range of one octave. A sudden expansion of the register and a gathering of the instruments back into rhythmic synchronization leads to a return of the complex layers of ostinato material of the fourth section. The woodwinds, brass, strings, and harpsichord propel four layers of interlocking accents and disjunct chords through irregular patterns of repetition. The tempo gradually slows, somewhat in the manner of *Keqrops*, until a final fermata gives way to silence. The closing section is reserved for harpsichord alone (again like *Keqrops*), and consists of a mixture of the opening chordal sonority and wider-ranging two-part melodic material drawn from the *Serment* sieve.

The dominant feature of *À l'île de Gorée* is the rhythmic ostinato, in all its various guises. The driving pulse and tone of the harpsichord lend the music a Baroque air, at least to an extent. What is especially fascinating about the music is the way in which the other elements intervene, casting different lights on the material. The alternation and superposition of pitch sieves adds an additional layer of comprehensibility, with restricted, or recognizable, pitch collections occurring at key points. Xenakis's sense of timbral balance is, as usual, remarkable, with the harpsichord being shown in all its clarity and rhythmic precision. The fragile nature of the woodwind multiphonics, not common in Xenakis's music, complements very well the rich, though dynamically restrained, spectral content of the harpsichord. These sonorities would return in his next ensemble work, *Jalons*, completed later that same year.

Keren

By 1986, Xenakis had composed a whole series of solo works for strings, keyboards, and percussion, but never a wind piece. The trombone, with its ease in playing glissandi, seems a natural choice (although the glissando does not actually play a major role in this piece). Perhaps his acquaintance with native Israeli Benny Sluchin, trombonist of the Paris-based Ensemble InterContemporain, put the composer in mind of the featured brass of his earlier Jerusalem commission, *N'Shima*. Whatever the case, in this year Xenakis composed his first-ever wind solo for trombone, commissioned by Benny Sluchin and premiered at the Musica Festival in Strasbourg that September.

Keren is Hebrew for "horn," and there is an archaic character to the music, particularly in the modal melodies (again emphasizing the interlocking fourths of the pelog scale), and in the bugle-like octaves that punctuate the music. The work is built in mosaic fashion, with short fragments of different materials being pieced together to create larger phrases and sections. There are eight sonic entities in *Keren* (see table 12); some are closely related, such as the pedal tones and the octave *B₂s*, as the low pedal *B₁l* often leads to octaves.⁹

The two-layered material is related to the ostinato entity, distinguished by the superposition of two fixed patterns held to separate registers (in terms of pitch

Table 12. Sonic Entities in *Keren*.

double layer
multiphonic/flutter tongue
ostinato
single note
glissando
B \flat octaves
pedal tone
melodic (modal: sieve based)

ambitious). The single notes, usually accented and sustained, are sometimes integrated into melodic structures, but are also used as transitions between entities.

Along with the melodic writing, the sieve patterns of the ostinati, and the heralding power of the octaves, *Keren* is above all an exploration of the timbral possibilities of the trombone. The various passages of low pedal tones are one aspect of that (particularly in contrast to the extreme high register of some of the melodic phrases, linked by the four levels of the B \flat octaves), as is the use of flutter tonguing and simultaneous playing-singing (producing a rough, vibrating tone). Mutes are used in conjunction with glissandi, adding a metallic edge to the sliding tones.

A score demanding, as one might expect, the utmost in technical assurance from the performer, *Keren* is also highly expressive in a way that implicates the capabilities of the instrument. Its inherent character could not be easily transcribed for another instrument. After *Sequenza V* (1966) by Luciano Berio, this piece has become one of the benchmarks for trombonists with an interest in contemporary music. Xenakis, never to write another wind solo,¹⁰ would return twice more to the trombone, in *Troorkh* (1991), with orchestra, and *Zythos* (1996), with percussion ensemble.

Horos

Commissioned for the inauguration of the Suntory Hall in Tokyo, *Horos* (1986), for orchestra, is something of a landmark, as the title (Greek for “landmark”) is intended to suggest. In this piece, Xenakis introduces a completely new compositional technique affecting pitch structures, rhythms, and orchestration. Ever interested in scientific and mathematical innovations, he had long been a reader of journals such as *Scientific American*. In reading about the mathematical technique for modeling self-organization and “chaotic” states in dynamical systems known as “cellular automata,” he became fascinated with the possibility of applying this to music.¹¹ A simple cellular automaton consists of a sequence of nodes on a line, each of which may be given a value of 1 or 0. Each node evolves in discrete time steps according to rules concerning the values of its nearest neighbors (see fig. 27). Depending on the configuration of the rules (the behavior

of each of the eight neighbor combinations is arbitrary), the automaton will settle onto a homogeneous state (such as “saturated” or “empty”) or will evolve into a self-replicating pattern resembling a fractal.¹²

In *Horos*, the most obvious translation of this procedure into music is the brief passage at m. 10. The pitch field opens out from a central note to create a pattern similar to the numerical cellular automata. No doubt for musical reasons, Xenakis does not apply the rules consistently, although the structure remains vertically symmetrical (see fig. 28). Perhaps most interesting is the ever-recombining orchestration, changing with each chord. This kaleidoscopic approach to instrumentation is applied in various passages, generally less systematically than here. This type of *Klangfarbenmelodie*, applied to chordal sonorities, constitutes one of the piece’s basic compositional elements. The opening provides another example, applied in more of an isorhythmic fashion, the sonorities being

Cellular Automaton (1-dimensional)

rules:

0	0	0	0	1	1	1	1
0→0;	0→1;	1→0;	1→1;	0→1;	0→0;	1→1;	1→0
0	1	0	1	0	1	0	1

example (17-limit width, 16 iterations).

0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0			
0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	1			
0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0			
0	0	0	0	1	0	1	0	0	0	1	0	1	0	1	0	1			
0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0			
0	0	0	1	0	1	0	1	0	0	0	0	0	0	1	0	1			
0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0		
0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1		
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1		
0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	
0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	1	0	1		
0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	1	0	1	
0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

Figure 27. Numerical example of a cellular automaton.

A(6)–B(2)–C(2)–D(8)–E(10)—F(6–E(8).

The fanlike progression of six chords cycles three times from A to F and back again, breaking off in the midst of the third cycle to shift to the automaton of m. 10. Paired with this progression is a set of durations, repeated three times with some variation. The overall timbre of these shifting sonorities is volatile, constantly changing. As Xenakis once commented, “For me the sound is a kind of fluid in time” (Varga 1996, 200). At the same time, there is something ritualistic about the formal process, recalling similar chordal passages in the music of, for example, Olivier Messiaen. The pitch sieve remains consistent up to m. 19, providing a “back lighting” of harmonic coherence to the complex and fast-moving timbral progressions.

True to its telluric character, *Horos* is more monothematic than most of Xenakis’s music. Much of the score plays out in the light of the unusual opening. There is, for example, very little purely melodic material; most linear contours are harmonized by clusters of close, sieve-based harmonies. With the exception of one brief passage of stochastically distributed phrases decorating an otherwise sustained texture at mm. 23–27, the shift to a linear emphasis arrives only at the end. And it only arrives after a grand climax, close to three-quarters of the way through, in which the entire orchestra is roused into fast scalar runs, each instrument imitating its neighbor in single-note succession, creating a resonated, fused sonority of bewildering density and uncommon energy.

The passage following on from that strongly recalls the central, *legatissimo* section of *Keqrops*, particularly the eight polyrhythmically layered canonic lines in the oboes and clarinets, here built from a sieve-fragment of eight pitches spanning just over an octave ($B\flat 5-A5-G\flat 5-F5-D\flat 5-C5-A\flat 4-G4$). The other groups of winds enter with overlapping phrases of similarly polyphonic bundles built from the opening sieve, creating a textural continuity rather like the earlier piece. The final section carries on from this, but expands the polyphony to encompass the entire orchestra. Each of the twenty-three layers draws out a slow melody, this ponderous sonority being rippled by faster outbursts distributed among the instrumental groups. A final gust by the whole ensemble leads to the concluding trilled chord.

In retrospect—and this is where Xenakis’s mastery of the nonlinear form comes into play—the final section resembles the brief interlude early on (mm. 23–27), in which a sustained sonority is adorned by brief melodic flutters throughout the orchestra. At the time of occurrence, it appears to be a brief detour from the layered chords that begin at m. 19 and pick up again afterward. A two-chord rhythmic ostinato in the strings is set against interlocking sustained chords in the winds, leading on through the main first part, shifting to block chords at m. 40 and then into layered chordal or cluster contours thereafter. In a sense, the music comes full circle in the section beginning at m. 82 and leading to the climax. The various layers of clusters, chordal passages, or block-string glissandi become increasingly subject to the turbulence of faster material—scalar contours played in parallel by groups of woodwinds, brass, or strings. The unusual opening, with its cellular proliferation of instrumental combinations, is reflected at the end in the meandering voice crossings of the twenty-three-layer counterpoint and the kaleidoscopic distribution of faster outbursts.

Horos is a landmark in that it represents a new approach to the medium of the symphony orchestra. The convenient groupings of instruments according to family are

not given up entirely, but are placed within a richer timbral context in which ever-changing combinations of instruments create vibrant new colors. Xenakis continued to mine this new vein, although he would make little direct use of the cellular automata technique. In the meantime, though, he turned away from the orchestra to fulfill two important commissions for smaller formations.

Akea

In the summer of 1985, Xenakis spent several weeks in residence with the Arditti String Quartet and pianist Claude Helffer (among other musicians) at the Centre Acanthes. It was perhaps natural, then, when approached about a commission for the 1986 Festival d'Automne in Paris, that he would think of bringing these five players together. There is little that is traditional about Xenakis's contribution to this rather Romantic genre, as there is little that is traditional about these particular musicians. *Akea* is nonetheless a surprising piece for those who were awed by the breathtakingly virtuosic *Tetras*.

Right at the start, the word that comes to mind for *Akea* is *stark*. (*Akea* is Greek for "remedy," a baffling referent). A collection of sustained chords in the strings sets off a sequence of arpeggiated chords in the piano, each one being derived from the same pitch sieve, creating an effect of stasis even while each chord is slightly different. A grinding bridge noise at mm. 5–6 triggers an air of expectancy, given the prominent role that same sonority plays in *Tetras*, but in fact, this is its only appearance. The strings shift registers from low to high and back again, but the first substantive change of texture occurs only with the brief, solo viola phrase at m. 8, fully one minute into the score. From there, the chords start to pull apart into a counterpoint. The piano alternates chords with short melodic phrases or fast runs, and the strings play lines built from the opening sieve (the piano's notes draw from a new one), each instrument sticking to its own uniquely configured octave range. A rising scale in the piano, from the lowest note to the highest (bifurcating into two diverging lines at the midway point), sweeps the strings away and leads to the next section.

At m. 21 the piano launches into a dancelike ostinato pattern of five chords. The two dyads of each hand begin the pattern together, following the progression: 1–2–3–4–3–5–4–3. Thereafter, the two hands diverge, first of all according to a layering of two patterns (right hand: 1–2–3–4–3–5–4–3–2–3; left hand: 1–2–3–4–3–5–4–3), and soon thereafter according to a more random process of variation. The accents are also distributed in groups of twos and threes, each hand being treated independently. The other element that forms part of the pattern is the occasional double-time repetition of dyads in one hand or the other. The rhythmic propulsion pushes the music forward while the harmonic organization circles around the limited material according to interlocking patterns and permutations. The strings interject with their own chords, built from a nearly complementary sieve, becoming more active at m. 30, just as the piano breaks out of its ostinato for a brief respite. The second part of this section is built from similar harmonic material, but the texture becomes more elaborate. The two hands of the piano are layered rhythmically as well as chordally, and the strings each play similar ostinato patterns built from four double stops derived from the chords heard in the earlier interjections. Each proceeds at a different tempo (notated using polyrhythms). Finally, at m. 36, this music breaks into a rhythmically unified single chord, combining the piano and the quartet.

After many reiterations and some timbral variation, the piano sets out with some melodic figures reminiscent of the arborescences of earlier scores, here limited to two strands. The strings respond in kind, followed again by the piano, finishing up the brief passage with reiterated chords, piano first, this time, followed by the strings.

At the end of m. 45, a dense polyphonic passage for the strings begins, carrying on all the way to m. 59 with a return to the previous ostinato chords in one or other instrument between mm. 48 and 53. The piano contributes three sequences of tightly voiced chords along with wide-ranging melodic passages. The last of these, beginning in m. 57, carries into the summation of this section, in which the strings at last join together for a quick passage of fast scales played in parallel (the piano plays a counterline). The transitional passage that follows mixes sustained chords using the fall ensemble with short fragments of linear material, either parallel scale contours or contrapuntally conceived melodic phrases.

At m. 65, the scalar material opens into a longer passage for the quartet, in which parallel movement is mixed with layered contours, all built from the sieve of the opening piano chords. This passage finishes up as the scales close in to just three notes (for each instrument), creating a brief reference to the ostinato material from earlier. At the same time, the piano enters with a wide-ranging chordal passage layered between the hands to create two rhythmically independent progressions. The harmonic identity of this material is obscured, with no single sieve used. The strings enter at m. 75 with their own chordal progression, and by m. 81 the music begins to thin, with the piano playing partial reiterations of one twelve-note chord (recalling the varying presentations of the opening sieve chord) and the strings sustaining (and reattacking) a four-note chord that overlaps and fills out the piano's harmony.

Akea closes with a ponderous passage of restrained four-part counterpoint in the strings. It is extremely rare for Xenakis to give an expressive indication, but here he notes, with perhaps a degree of irony, "avec chaleur pessimiste" ("with pessimistic warmth"). The first violin and viola utilize the sieve from the opening piano chords, while the other two draw on the sieve from the ostinato section. The registers only partially overlap, so the effect is to broaden the range, harmonically. The piano accompanies the strings with a series of widespread chords, but joins the first violin for one brief ascending run that distantly evokes the fleeting union of violin and piano at m. 143 in *Dikhthas* (1979). The music closes with a series of long-short iterations of a dissonant, ensemble chord. After a long fermata, Xenakis notates a full measure of silence, underlining the austere tone.

For the audience at the premiere, coming as it did at the end of an all-Xenakis concert and right after *Tetras*, *Akea* was something of a shock. Instead of trying to outdo the brilliance of the earlier quartet, this piece looks inward, drawing upon more fundamental musical elements (such as harmony) to convey the expressive tone (there isn't a single glissando in the entire score). In retrospect, *Akea* signaled a more reflective period—or rather, stream—in the composer's output; for, as usual, Xenakis would not be pigeonholed.

Jalons

Xenakis's next composition, *Jalons* (1986), for large ensemble, is decidedly more restrained than *Thallein*, his last work in this genre, but it is not somber like *Akea*. This was another festive commission, celebrating the tenth anniversary of the Ensemble InterContemporain, which had become, under the direction and advocacy of Pierre Boulez, the foremost ensemble for contemporary music in France, and indeed, one of the world's leading groups.¹³ *Jalons* ("signposts, or landmarks") was premiered together with Messiaen's *Petites esquisses d'oiseaux* (for solo piano, 1985), a marvel of exquisite colors and clarity. *Jalons*, too, is a work of vivid sonorities.

Perhaps most notable, and striking for being the dominant sonority right at the outset, are the sculpted, sustained sounds that fuse layered notes from the different instrumental groups: woodwinds, brass, and strings. This entity frames the piece as a whole, and divides it into two parts. After a brief modulation of the sonority by a slow glissando undulation in the cello and double bass at mm. 11–13, the texture shifts to a sustained, iterated cluster in the high woodwinds. Because of its distinct attacks, and the addition of short, high, articulated glissandi that fill out the register as the strings enter one instrument at a time, this sonority can be seen as a transitional entity, providing a link to the static, rhythmic pulsations occurring soon after. First, though, as the string glissandi descend to the low register, the various low instruments (including contrabass clarinet and contrabassoon) take over with layered scalar contours. In this first instance of the sonority, the different instruments bounce back and forth between two parallel lines, creating contours of greater interior intervallic variety. This passage makes use of the opening piano sieve from *Akea*, although the contrapuntal density is such that harmonic identity is difficult.

At m. 40, the ensemble comes together for a statement of detached chords, harmonized in parallel. The passage also outlines a melody, but the sensation is more chordal. It is worth pointing out the orchestration of this block sonority, as it provides a link to the timbral mixtures of the sustained entity. The ordering of the ensemble, from top to bottom (each instrument playing one note of the same sieve as the previous passage) is :

fl	tp	hb	v1	v2	va	cl	c	tb	tu	vc	cb	cbcl	cfg
ww	br	ww	str	str	str	ww	br	br	br	str	str	ww	ww

Xenakis had adopted similar voicings in earlier works, including orchestral scores, for passages of this type. The effect is one of intensity and coloration rather than of harmony. The balance is obviously not equal; one hears the trumpet more clearly than the flute, for example. But the composer compensates by grouping the instruments, and the result is rather like mixing stops on an organ.

In any case, this passage is brief, ending on a sustained sieve cluster out of which grow layered pulsations on held notes, beginning with a few instruments then adding more until they are all in. The music switches back and forth between the fourteen layers of polyrhythms and moments of ensemble synchronization. At m. 47, the sieve chords return, cast in a different light. The attacks are now staggered, the flute in the lead (the

voicing is different this time). The effect is to enhance the melodic aspect of the music. As the rhythms are shortened the staggering of entries for each note starts to overlap, creating a more complex quasi-polyphonic situation. Sticking to the same sieve as before, this lengthy passage continues into m. 65, where the layered pulsations return, this time shifting briefly to another sieve. The chordal passage returns at m. 67, but this time the melodic character is emphasized through the slower durations and smoothly undulating overall contour, even though the attacks are synchronized.

There follows a lengthy passage of sustained sonoristic music, similar to the opening. Here, though, the emphasis is on distorted sounds, particularly in the low register. The texture is not uniform, there being a number of additions such as string glissandi and sporadic melodic activity in the woodwinds or the strings. The squawking tones in the low instruments are mixed with grinding noises and high shivering harmonics in the strings, and multiphonics in the woodwinds. At m. 89, the balance in favor of mixtures of sustained sonorities shifts to one of more equal distribution. The harp is highlighted here for the first time, playing melodic, chordal, and scalar materials. Other instruments contribute melodic phrases, often bundled polyphonically, sustained notes both high (string harmonics) and low, glissandi, and fast scalar runs. The material is loosely chromatic until a melodic fragment in the viola surfaces at m. 97, emphasizing the modal quality of the sieves. There is a layering of material through this section, such that a single sieve is not privileged. By m. 106, the music starts to settle onto two sonic types: the narrow ostinato (made much of in *Akea*), and the scalar runs. The scales win out by m. 113, and the main sieve returns to prominence, paired with a complementary one. A final descending run for the full ensemble leaves off with ostinato material in the strings.

The next section is built from intermittent ostinati, chordal material, melodic phrases, and sustained sonorities. By m. 133, a sustained harmony in the brass and strings triggers a layered passage of chordal counterpoint. Seven groups of instruments (high and low woodwinds, brass, tuba, harp, high and low strings) carry on rhythmically interlocking or juxtaposed passages resembling ostinato patterns. The tempo slows drastically as the passage closes on a final sustained chord. From there, the piece finishes with a section of sustained sounds, including low distorted ones again. The music dies away with a high mixture of violin tones and piccolo multiphonics, the latest in a long line of beguiling high-register endings.

What is important to note in *Jalons* is not that it can be divided into seven sections, or that there are six basic sonorities. Rather, the connections between formal entities should be emphasized. Many passages that might seem contrasting are in fact variations on one or more aspects of an earlier texture. The blocks of rhythmic pulsations, for example, can certainly be heard as belonging to the category of sustained sonorities. And the penultimate section of chordal counterpoint could easily be related to the layered rhythmic pulsations, and even to the narrowed scope of scalar material that produces ostinato-type patterns. As the mixtures of instruments fuse to create new timbral colors, the various types of material spark connections between their proper definitions. The sonic signposts act as attractors, and the result is a highly compelling creation. The EIC has performed *Jalons* on numerous occasions (and has recorded it), and the score has caught on with many other ensembles as well.

Tracées, Ata

The year 1986 may have been extremely productive for Xenakis, but 1987, the year he celebrated his sixty-fifth birthday, was no less so: he completed six pieces, for a total of twelve in two years. In addition, that summer saw a new production of his *Oresteia* (1966) and the creation of a new multimedia “spectacle” in Arles.

With characteristic concentration, this busy composer managed to compose two orchestral scores. The first of these, *Tracées*, is less than six minutes in duration, but is far from being an elegant miniature or brief tribute. In fact, it’s rather ferocious, filled with closely layered glissandi in the strings and rising “rips” in the brass. The linear contours indicated by the title are always presented in counterpoint. And, while the speeds vary a great deal, the lines are usually thickened by cluster or chord. There is a striking passage, between mm. 26 and 30, in which the low, growling sonority of *Jalons* is paired with the piano’s dramatic ostinato from *Keqrops*. The other passage where individual instruments play independent melodies comes at the end, although the texture is still extremely dense, with thirty-eight layers. The tempo is extremely slow, an increasingly common feature in Xenakis’s music. The metronome marking is the equivalent of MM 7.5. The final measure, a sustained chord with a few attacks on the timpani, should last thirty-two seconds if played at speed!

Xenakis had another chance to tackle the orchestral medium later that year with a commission for the Südwestfunk Radio Orchestra in Baden-Baden. *Ata*, at sixteen minutes, is a more ambitious piece, with a wider range of materials. Like *Tracées*, the sounds are unrelentingly intense, though the number of layers fluctuates. Toward the end, when finally there is a passage of melodic polyphony unencumbered by attached chords or clusters, there are twenty-two lines of counterpoint—hardly the epitome of transparency! In contrast to *Tracées*, though, *Ata* contains just three brief passages of string glissandi, heard each time in conjunction with other elements. The tone, like *Akea*, is somber: the title, from ancient Greek, refers to the “human folly that imprisons one inside oneself.”

Like so many of his orchestral scores, *Ata* begins with a lengthy passage for strings alone. As in *Lichens*, the music is contrapuntal and polyrhythmic, but unlike that score, each of the five layers is harmonized by chromatic clusters moving in parallel with the main line. There are two interleaved sieves used for the melodic material. The fact that the clusters are chromatic indicates they are intended for adding sonic bulk rather than harmonic coloration. Throughout, Xenakis treats this dichotomy as a central compositional factor, switching between thick clusters and harmonic chords. The other main elements used to shape the piece are the fluctuations in speed, or temporal density, of the different layers, and the number and degree of synchronicity between them. When treated independently, the orchestra is most often divided into high woodwinds, bassoons and horns, trumpets and trombones, percussion (used sparingly), and strings. On occasion, the woodwinds and brass are treated as two families rather than three.

Ata can be roughly divided into eight sections, signaled by distinctive changes of texture. The opening passage for strings, closing on a long, high, trilled chord, ornamented by an ascending run in the high woodwinds, breaks off at the end of m. 9. The second section is longer and more intricate, structurally. Layered sustained chords in

the woodwinds are punctuated by fast melodic fragments in the brass (filled out by clusters) and high held chords in the strings. At m. 16, the whole orchestra breaks into fast interjections, like the brass just prior, around the continuing sustained contour in the bassoons. A brief passage of synchronized chords is followed by a return to the faster material, here stretched out into longer phrases rather than brief fragments. At m. 29, the texture is doubled up, with synchronized chords in the strings, brass fragments, and sustained contours in the oboes. A fast, descending sweep closes off the passage.

By contrast, the third section is relatively consistent throughout. The slow, chorale character is conveyed by harmonic progressions in three layers. At m. 40, these lines of counterpoint lock together, with only the horns and trumpets diverging slightly.

The fourth section returns to a more complex sonic counterpoint of five layers, each distinct in terms of instrumentation as well as rhythmic structure. At m. 63, the entire orchestra returns to material reminiscent of the woodwinds in section two. The overlapping, sustained chords are spread across twelve layers, breaking off for a brief interlude at mm. 68–70 which pits a chorale-like progression in the bassoons and horns against a counterprogression in the strings. After the initial texture takes up again, it quickly devolves into a combination of sustained layers of chords in the woodwinds and the counterpoint of the interlude. Obviously Xenakis has shifted his focus quite drastically. There are no flurries or outbursts, no wild glissandi, no strange sonorities nor plaintive melodies. There are just plays of density, degrees of sonic counterpoint, and timbral combinations.

A striking moment occurs at the shift to the sixth section at m. 76. The full orchestra locks in on a series of rhythmic articulations of a single chord (following Xenakis's signatory long-short iambic pattern), occasionally breaking into a twostep with a second chord. A whole range of rhythmic and timbral variations are brought to bear on this static harmonic material throughout the two-plus minutes of this section. The boldness of such a compositional gesture is certainly noteworthy, and, structurally, it acts as the "still point" of the piece as a whole.¹⁴ The expectation of harmonic change that is built up through that long passage is sufficient preparation for the one moment, already noted, of unadorned melodic polyphony. It quickly gives way, though, to a very fast interlude for strings alone. A sieve-based melody is played out in parallel motion, gradually expanding from an initial four-note cell to a range covering two octaves. As the strings retreat into a slower, chorale-like progression, the brass enter with overlapping chordal sonorities, at times more rhythmically synchronized. This material seems to signal the eighth section, but the fast string material reappears, then returns several more times in the woodwinds as well.

The final section is a mosaic of a number of different entities. The new material making an appearance here is the "cellular automata" entity introduced in *Horos*. It appears three times, in mm. 121, 126, and 131–133.¹⁵ Its final manifestation leads directly into the last statement of the overlapping, sustained chords, distributed across the entire orchestra (with interjections of faster material in various subgroups throughout this passage). In an interesting stroke of sonic networking, the material directly derived from *Horos* can be heard as relating to these overlapping chords, as each instrumental group shifts register and voicing to create a complex, everchanging timbral-harmonic mixture. The perspective on previously heard material is thus deepened, a sign of Xenakis's

profound sensitivity to the unique qualities of musical form, being a combination of linear and nonlinear elements.

Ata, which was composed at the end of 1987, is strongly related to *Waarg*, the ensemble work coming directly after, in 1988. Along the way from *Tracées* to *Ata*, however, Xenakis produced a diverse collection of smaller works.

à r. (hommage à Maurice Ravel)

For the 1987 Montpellier Festival in the south of France, Xenakis was commissioned to write a short piano work in honor of the fiftieth anniversary of the death of Maurice Ravel. Clocking in at just over two minutes, *à r.* is a brilliant miniature, “an obvious encore,” as Harry Halbreich notes in the foreword to the score (1989, i). There are just two types of material: quicksilver scales racing up and down the keyboard, the two hands usually proceeding independently, sometimes at different tempos; and closely voiced chords, sometimes sustained and sometimes iterated, gradually migrating downward from the upper middle register. In the details, however, the music is far from simple (and certainly not a breeze to perform). Xenakis cycles through a veritable compendium of sieves, rather than sticking to one or two. A number of these passages have been adapted from *Kegrops*, linking the two works (along with *Mists*, also containing some common material). And the chords, not necessarily derived from the sieves that immediately surround them, proceed according to a nonlinear progression, arriving at the eighth and final one only at the very end.

The glittering allure of Ravel’s piano music is cleverly evoked by Xenakis here, both in the runs and in the jazzlike voicings of the chords. *à r.* may not yet have caught on as an encore piece among the hordes of touring pianists, but there is no reason why it shouldn’t.

Taurhiphanie

A few weeks before the premiere of *à r.* in Montpellier, Xenakis was down in the south of France for another premiere, this time in the historic Provençal town of Arles. He had been invited to present a multimedia event in the Roman arena commonly used for bullfights. It was a condition of the commission that the main attraction of the event, aside from the music, would be the presence in the ring of live bulls and some of the famous white horses of the nearby Camargue region. The animals would create dynamic stochastic patterns to complement both the patterns of lights projected down into the ring and, of course, the music.

For this spectacle, Xenakis included some of his percussion music—*Idmen B* (1985), *Pléiades* (1978), and *Psappha* (1976)—performed by the twelve players of Les Percussions de Strasbourg and Les Pléiades stationed high up around the seating area of the arena. In addition, he created an electroacoustic work, *Taurhiphanie*. To inaugurate a new version of the Unite Polygogique Informatique de CEMAMu (UPIC) computer system, by this time capable of producing sounds in real time, he and his team of technicians from the Centre d’Etudes Mathématiques et Automatique Musicales planned to broadcast the snorts and bellows of the bulls via radio microphones attached to the animals, and then, from a command post in a tower above the center of the ring,

“interact” with those sounds using the UPIC. Unfortunately, technical difficulties were impossible to overcome, so the bulls were not amplified, and a taped version of the electronic sounds was presented in conjunction with some live, improvised interjections on the computer system. Some of the sounds for the tape were generated from samples of the bull sounds gathered earlier.

As it turned out, the bulls and horses (present at separate times in the ring) were less than willing participants in the proceedings. No doubt the pounding percussion and amplified electronic sounds were frightening. The animals tended to cower in a huddle at one end of the arena or the other; the stochastic patterns were unfortunately rather pathetic.¹⁶

While this high-profile event may have fizzled, the computer-generated music that remains is certainly of interest. At just under eleven minutes in length, *Taurhiphanie* is slightly more substantial than *Mycenae alpha* (1978), and, with the UPIC’s technological improvements, it was able to be produced as an organic whole rather than as a succession of parts. The first five minutes are conceived as a continuous gesture, the layers of sustained sounds gradually rising until a highpoint is reached at the 4’22” mark. At that point, the sounds start to descend again until they are interrupted at the 5’28” mark. After a series of shorter, disruptive gestures, a sustained sonority takes over at the 5’57” mark, featuring some stable intervals—another “still point.” By the 6’45” mark the texture begins to fracture again, with a variety of sonorities making brief entrances. The range of timbres is relatively wide, for a synthesized score, though not as rich as studio works such as *La Légende d’Eer* (1977). A break at the 8’00” mark prepares for a return to the bands of sliding sounds from the opening section, but there are dramatic interjections by more concentrated, sweeping sounds that heighten the intensity of the passage. As the music nears its conclusion the sustained sounds begin to diverge, some migrating higher, some lower. The piece ends rather abruptly.

While there is a certain roughness to *Taurhiphanie* that might indicate a lack of finesse in the shaping of certain details, there is nonetheless an assurance and cohesion that carries the music beyond the limitations of its production. When the somewhat lame presentation in Arles has been long forgotten, the music will live on. Xenakis, in any case, was preoccupied with another event coming up, during that busy summer of 1987.

Kassandra

In the ancient village of Gibellina, Sicily, not far from where Aeschylus was buried (one reason Xenakis agreed to participate in this project), an outdoor staging of the *Oresteia* was presented in August 1987. It was not the entire trilogy by Aeschylus, but rather, the version Xenakis had originally intended for concert performance (the suite). That the producers would choose to build the work around the music rather than the original drama speaks to the reputation Xenakis was by then enjoying.¹⁷

For this occasion, the composer contributed a new score, to be inserted in the middle of the first movement, *Agamemnon*. *Kassandra* is entirely different from the earlier music. First of all, it reunites the soloists of *Ais*, baritone Spyros Sakkas and percussionist Sylvio Gualda. Xenakis exploits the extraordinary range of the singer by splitting the dialogue between Cassandra, the Trojan prophetess (who in this passage foresees the murders and tragedy about to befall the family of Agamemnon), and the chorus of elders

from Argos, the former in the high falsetto register, the latter in the low baritone range. The percussion, restricted to six drums and five woodblocks, punctuates the text and offers a kind of abstract musical commentary on it. One striking thing about *Kassandra* is that the vocal part is notated neumatically rather than with precise pitches. The two parts of the dialogue are indicated by treble and bass clefs, and for each, the line is drawn graphically within the staff, with the text being placed proportionally in reference to vertical stems marking the beats or subdivisions (see fig. 29).

The baritone is required to play a psaltery, in imitation of the ancient Greek lyre. It is tuned, according to the foreword to the score, “in six adjacent just fourths each containing two intermediate pitches to form a non-diatonic, non-tempered scale. The baritone is to tune the movements of his voice to one of the tetrachords that

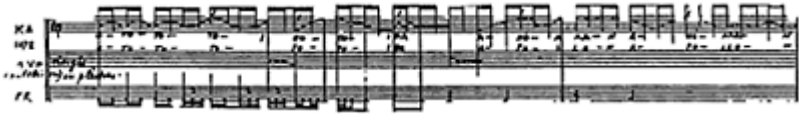


Figure 29. *Kassandra*: Example of “neumatic,” quasi-indeterminate notation.

he selects according to the sequences of the text and their character” (Xenakis 1987b). The psaltery is played sparsely, and is notated in the same graphic way as the voice. The resulting music is certainly strange, but represents a remarkable attempt to render the ancient text in a manner as free of traditional clichés of presentation and elocution as possible.

The Gibellina production was a great success; the beauty and historical resonance of the setting saw to that as much as the music and theatre did. Xenakis would return to the *Oresteia* one more time, in 1992, contributing a new piece for a production in Athens.

XAZ

In the meantime, Xenakis had one more commission to fulfill in 1987, after his eventful summer. This one, too, was an unusual project. He had never used the saxophone in a piece before, not even to add weight to orchestral winds (as Berio had done, for example). He was not at all attracted to the jazzy stereotype of the instrument, but may have been fascinated by the quirky genius of the man, Adolphe Sax. In any case, the Rascher Quartet, based in Germany, had evidently been persistently requesting a score from Xenakis. As he noted in a later interview, “They were so nice! And they kept on asking me, for a long time. Finally I said yes” (Varga 1996, 190). They must also have spent some time demonstrating the possibilities of the instruments, for the piece that Xenakis came up with is highly idiomatic and very assured, a tour de force that has quickly become a mainstay of the saxophone quartet repertoire.

The title is obviously a mirror of the word (name) *sax*. It is also a compressed anagram of the composer’s own name: XenAkiS. (Such word games would become common for titles of later works.) The music is most closely related to *Tetora*, the string quartet to

come in 1990. Xenakis was no doubt attracted to the relative homogeneity of the ensemble, particularly when played with a pure, vibratoless tone. He takes advantage of this in numerous passages of resonated melodies and tightly voiced harmonies. The main pitch sieve used in *XA2* is a transposition of the *Serment* sieve, with its Javanese modal resonances, though its complement also makes an occasional appearance, along with infrequent chromatic passages. A different approach is taken for two chordal passages, in which a set of harmonies, apparently constructed with an ear for intervallic content and registral mixture, is presented in various orderings. The effect is similar to the “automata” passages of chordal and timbral mixtures in *Ata* and *Horos*, without being constructed from a central axis of symmetry.

While the saxophones are capable of glissandi, Xenakis avoids this sonority, no doubt because the bending of pitch is so strongly associated with the blues inflections of jazz. He does, however, make use of other extended techniques. Multiphonics intensify two of the slower, sustained passages, and neighboring microtones are heard right at the beginning, distorting the pelog sheen of the closevoiced harmonies. The high, altissimo register is employed extensively, with little regard for the extreme difficulty of producing a clear, consistent tone, particularly for the baritone. Perhaps the Rascher Quartet had made the mastery of this treacherous register a particular feature of the group. Generally, Xenakis pushes the lower instruments up into the stratosphere in the passages of tightly voiced, interlocking lines, as they happen to arch into the upper range. At the end, a quiet, rather unstable sonority is created through the use of sustained harmonics, with the desired partial being specified as one would for string instruments. This vaporous, reflective ending balances the fleeting detunings of the opening, in some sense, and provides an antidote to the more buoyant, at times aggressive, faster passages.

In terms of formal structure, *XA2* is quite fluid and episodic. The modal flavor of the opening returns in various guises, both melodic and harmonic. The quartet is for the most part treated as an integrated, homogeneous entity. The first real counterpoint does not occur until m. 19, 1–3/4 minutes into the piece, when the contours of the fast, thirty-second-note runs begin to diverge. At m. 40, close to the 3'30" mark, the instruments play rhythmic counterpoint as well, in a loose, legato passage notated in the stemless, geometric style that enables the music to float above the implied pulse. Then, it is not until m. 55 that the first polyrhythms appear, as the four up-tempo melodic contours pull apart then lock back into synchronization again. Interspersed in between the faster material are passages of sustained sonorities, either chordal or colored (by multiphonics, trills, etc.).

An exciting, brilliant work, then, for a relatively novel instrument (at least to the sound world of this composer). *XA2* was followed by *Ata*, an altogether more serious, abstract study of orchestral density. The upbeat exuberance of this quartet would resurface but rarely in the years to come.

Waarg

The year 1988 was the twentieth anniversary of the founding of the London Sinfonietta, one of the foremost new music ensembles in the world. As part of the celebrations, Xenakis was commissioned to write his third composition for the ensemble. *Waarg* (“work”) is serious in tone, perhaps reflecting the no-nonsense title, and carrying on from

Ata in many respects. Most of the piece is thickly scored, either through the use of cluster chords or layers of contrasting material.

The opening, however, belies the tone of the rest. A lone pitch, a sustained *E4* lasting over one minute in duration, is passed from one wind instrument to another, the dynamic fluctuations and changes of instrumentation creating a flowing spectral progression. Two brief melodic-harmonic flutterings widen the scope of the music, preparing for the primarily harmonic textures to follow. There are a few moments of suspended activity that recall the opening, where a chord is sustained and the rhythmic flow interrupted, but they are rare. Rather, once the rhythmic and contrapuntal motion is set off by the trombone at m. 12 with a pulsating neighbor-tone figure, it rarely stops for long. There are, though, a number of fermatas and numerous shifts in tempo that diffuse the sense of relentless pulse that is sometimes a characteristic of Xenakis's music (as in his next piece, *Rebonds*). The formal structure of *Waarg* is quite fluid; there are few passages in which a single sonority is carried on for any great length of time (even the sustained opening is broken into two smaller entities by the addition of neighboring harmonic tones). Rather, smaller units are presented then replaced by something else, or an element in the antecedent phrase will serve as a transition to the next passage.

As an example, the trombone entry at m. 11 cuts off the *E4* of the opening along with the chord that had accumulated around it. The high *B♭4* of the trombone leads into the neighbor-tone pulsations already mentioned. It also, however, happens to be the same pitch as the highest articulated note of the expanded material of the previous passage, establishing a connection that smoothes the transition to the next section. The rhythmic momentum created by the trombone carries into the next brief passage, in which the winds and strings play off each other in a counterpoint of contours, rhythms, timbres, and articulations (the strings play glissandi, one of only two brief appearances).

The activity quickly subsides, however, as the durations of the wind chords become extended. As these sonorities are elongated, they bring to mind the opening. In the differing durations of the individual components of the chord, these sonorities prepare for the next passage. It is built from an interlocking chordal progression (woodwinds, brass, and strings being treated as the interleaved parts, with occasional examples of other mixtures) in which each instrument holds its note for a different duration. There is little rhythmic drive to this passage, although a brief recall of the neighbor-tone ostinato occurs in the middle, at m. 20, this time in the oboe. A flurry of rising scales leads to a cadential tutti chord, followed by a pause. Instead of launching a new section, however, this break is followed by a return to the sculpted chords of before. It is only at m. 32 that the texture shifts.

This new section, built primarily from scalar material of different configurations, lasts until the next fermata, at the end of m. 45. It had already been prepared, though, by the brief outburst at m. 25. Along with the scalar contours, this section, put together as a series of shorter, contrasting passages, introduces the counterpoint that dominates much of the rest of the score. Each layer consists of blocks of instrumentally distinct contours, each based (for the most part) on a complementary, or contrasting, sieve. A strange little interlude at mm. 46–48 (including a naive-sounding melodic fragment for the flute and oboe that is a timbral reminder of the opening) is followed by a more substantial section in which various strands of scales, chords, and layered melodies overlap to create an ongoing sense of forward motion. This section, which lasts for close to three minutes,

contains numerous shifts, but the ongoing contrapuntal nature of the music continues. At m. 70, the full ensemble lands on a sustained chord, the durations of the individual components again being varied to lend a sculpted, more dynamic quality to the sonority. The thinner texture that follows contains slow scale figures, resonated by sustaining the succession of notes as they are introduced. A similar effect was first heard at m. 32, leading into the previous section.

There follows another extended section of layered sonorities, shifting often but again carrying forward the momentum. After two minutes, a sustained chord provides another moment of repose. The interlude that follows plays off fast ascents in the brass against pizzicato/staccato “stochastic” clouds in the strings and woodwinds. This unique passage, more focused in its colors, is followed by a third contrapuntal section, the first passage to treat the instruments individually rather than as blocks. The intensity is further increased by splitting the parts into two streams so that each instrument gives the impression of playing two lines at once. The difficulties of jumping quickly back and forth between registers is further intensified by alternating between legato and pizzicato/staccato phrases. The full ensemble comes together at the end of this passage, playing sweeping scales up and down.

A brief interlude of low chords played in alternations of measured staccato and flutter-tongue/tremolo articulation leads to a passage of block polyphony, with the strings pitted against the brass, woodwinds, and a further layer of bassoon, tuba, and double bass. A fermata provides a quick breath before the final passage. This, a slow chorale in two layers for high woodwinds and strings, is similar to the woodwind and string music in the central part of *Alax*. Here, it closes the piece on a restrained note.

Waarg is very different from *Thallein*, the brilliant tour de force written for the London Sinfonietta in 1984. Still, it is an engaging work, and, like *Jalons*, many groups have taken it into their repertoire. The other score Xenakis completed in 1988 has also become a mainstay of the repertoire, this time for solo percussion.

Rebonds

Rebonds was written for Sylvio Gualda, Xenakis’s performer of choice for works involving solo percussion, and premiered in July 1988 at the Villa Medici in Rome. This piece is less utopian than *Psappha* in its demands, but is, like the earlier work, a study in regularity and irregularity—of pulse, pattern, and form. It, too, calls for a restricted palette of instruments, in this case seven drums and five temple blocks. Like *Pléiades*, *Rebonds* takes a multimovement form, in this case two instead of four movements. Xenakis allows either order to be used; Movement B tends more often to be performed first. This is because movement A, being a very gradual winding up of density, makes for an exhilarating close, particularly with its dramatic, declamatory conclusion after the long buildup. The opening of this movement, with its simple, repetitive pattern strongly emphasizing the pulse, reflects the end, as if, after the whirlwind of activity in between, the “beat goes on.” Over the course of the movement, the subdivisions of the beat are gradually filled in and the density increases as triplet, double-time, and even quadruple-time figures make their appearance and increasingly dominate the texture. The polyrhythms are never too complex, but the speed at which the two layers of pulsations must be played reaches a formidable rate.

What is particularly fascinating in this movement is the relative continuity of the main formal process, the *accelerando* (in terms of density, not pulse). The other movement of *Rebonds* is a more discontinuous manifestation of a structure built upon repetition and variation. The overall form is delineated by alternations between the drums and the woodblocks, the two being combined in the final section. Within these blocks, there are variations between material built from durational patterns, regular iterations with accent patterns, double-time pulse patterns, and rolls.

The opening provides an interesting example of how layered processes combine to create a complex structure of accents and patterns over top of a relentlessly regular pulse. The upper bongo articulates the pulse, adding accents and emphases (by means of a double grace-note figure, or paradiddle) that begin with repetitions of a 5–3 pattern, shifting to a 4–4. At m. 6, the paradiddle, which had marked every other beat incessantly to that point, shifts by one sixteenth-note. The 4–4 becomes a 4–3, and then Xenakis inserts one 3–5 pattern before continuing with the 4–4. At the same time, the other drums articulate a more elaborate pattern: 6–2–3–2–1. This cycle, which lasts 3–1/2 beats, does not coincide with the bongo pattern, going out of phase by the second iteration of the pattern. With the third cycle, the pattern is varied, with the 6–2 becoming 5–3, and then, by the fifth cycle, becoming compressed. The longer duration at the beginning of the pattern is reduced to 4 from 6, and the other durations are varied as well, with the result that the overall duration of the cycle becomes unsteady.

At m. 8, there is a break, with the larger drums briefly taking over the sixteenth-note pulsations. When the original material returns, the drum pattern continues, but is quickly destabilized. In the later sections, the patterns are even more variable, although there is an overall tendency for the accents and paradiddles to increase their rate of occurrence. The latter half of the movement is a complex mixture, passing off and layering the rolls, double-time patterns, and so on.

Rebonds may be less manic than *Psappha*, but is nonetheless an engaging study of the primal energy of pulsation, the mesmerizing quality of the drumming being balanced by the processes of variation layered on top of the beat. Xenakis carried on his rhythmic concerns into 1989, with two more scores featuring percussion.

Okho

The year 1989, being the bicentennial of the French Revolution, was a year of numerous celebrations, with many commissions awarded in France for special concerts and other events. Xenakis marked the occasion modestly, with a percussion work for Trio le Cercle, commissioned by the Festival d'Automne. Perhaps it was unintentional, but the fact that *Okho* is scored exclusively for three African djembés might be read as an oblique political statement about colonialism (there was, though, no such commentary in the press).¹⁸ In any case, these hand-played drums are wonderfully rich and resonant, and are capable of producing a range of tones depending on where the hand strikes the skin, the type of attack, and so on.

Okho is clearly sectional in design, each being distinguished by the type of material and the tempo. While the piece falls into four main sections (perhaps five, if the lengthy first part is subdivided into two), two of them contain contrasting material so that there are in fact six compositional entities employed. The first and last sections cut back and

forth between two types of material, making for more complex substructures. The second section also contains contrasting material, briefly, at the end, although the tempo remains the same. In fact, this brief passage, falling more or less at the central point of the form, lets go of the ongoing sense of pulse, being made up of rolls with fingernails, silences, and intermittent attacks on the large drum. It is another “still point,” distantly reminiscent of the dramatic long silences in the middle of *Psappha*. The third section contains a shift to a faster tempo, but in fact, the material remains the same; the switch serves to intensify the music rather than provide a structural contrast.

There are some reminders of *Rebonds* in the variational processes brought to bear on simple patterns. The opening, for example, begins with one player repeating a simple 3–2 pattern. The other two add accents to create a regular triple grouping, enhanced by the pattern of accents superimposed onto the solo part. Both layers of patterns are soon subjected to variation, becoming synchronized by m. 6. After that, the second and third players imitate the first, each playing the 3–2 cycle at a slight delay. While there are numerous variations, of drumming pattern, accent, and density of players, the pulse continues throughout. The contrasting material, first cutting in at m. 25, is more fluid, with changing rhythms and occasional polyrhythms articulating the temporal flow rather than the regular ticking of the other material.

The second section returns to the iteration of the pulse, this time somewhat faster (the equivalent of MM 320 rather than MM 240). Attention is drawn to the glissando sound that is passed from one player to another. This is achieved by sliding the hand across the head of the drum while striking it with the other—the “talking” character of these drums that is so idiomatic. The pulse is gradually subsumed into this sonority, then dropped altogether for the sparse passage discussed above.

The next section resembles the first, although the drumming patterns include double-time figures and there is a timbral play between striking the drum with the palm or fingernails underlying the rhythmic interplay. At m. 104, the tempo jumps from MM 66 to MM 92, further heightening the saturation of the pulse by the double-time playing. The section closes off with a drop in density, and a shift in timbre by switching from fingernails to the flesh of the fingers.

The first entity of the final section resembles the contrasting material from the first section. The pulse is not articulated in a continuous manner, and there are brief figures of triplets, other polyrhythms, and faster subdivisions that all together create a rather furious texture. Intercut with this are two brief passages of regular pulsations that gradually go out of phase, with each player shifting to an independent tempo (the ratio is 75:85.7:96). The synchronized pulse returns at the end of the second passage and then in the final bar as a dramatic conclusion.

At 13–1/2 minutes, *Okho* is less ambitious than any of Xenakis’s earlier percussion ensemble works. Nonetheless, it is a fine work, taking advantage of the timbral and technical characteristics of the djembés while at the same time pursuing the composer’s own concerns regarding pattern, pulsation, and the continuum between regularity and irregularity.

Oophaa

Following on from *Okho*, Xenakis returned to the unusual combination of harpsichord and percussion, reuniting his favored performers, Elisabeth Chojnacka and Sylvio Gualda. Like the previous piece, the title *Oophaa* was created for the sound of the phonemes. The composition premiered at the 1989 Warsaw Autumn Festival, another venue that has been highly sympathetic to the composer over the years, presenting a great number of his works. Xenakis has been a frequent guest in Poland, and gave a series of lectures there in 1984.¹⁹

Where *Komboi* (1981) is wide-ranging, *Oophaa* is concentrated and hieratic. The percussion is limited to a set of drums and the Harry Partch-like ringing sonority of the ceramic flowerpots first used in *Komboi*. The harpsichord is mostly limited to three layers of registrally distinct chords, built from a pitch sieve that shows a predominance of major seconds. In mosaic-like fashion, the score proceeds in segments as the different blocks of material are layered and sequenced. The long first section is built on eight chords from the lower register of the harpsichord, accompanied by the meandering, ebb-and-flow phrases of the flowerpots. Xenakis cycles through the chord progression following an irregular pattern. Seven of the chords are parallel to each other (though the intervallic content changes according to the composition of the sieve); the eighth, which is introduced later, is of a different structure. When the other registral layers are added, there are similar collections of chords treated in the same general way.

Xenakis includes several solo passages, for one or other of the two, with the harpsichord being paid greater attention. The most dramatic moment for the percussion comes in the third section, where a switch from hands to mallets allows the performer to play out the solo passage. The most significant change in the harpsichord part comes at the very end, where thick six-note chords descend by stepwise motion (following the notes of the sieve) from the highest register to the lowest. The piece ends with an alternation of two low chords together with fast pulsations on the flowerpots.

There is a unity to the overall sonority that comes from using a single sieve almost exclusively (there are some additional notes included in a few of the middle passages). This kind of harmonic transparency is found in certain passages of *Komboi* but does not hold throughout. The restricted range of textures used in *Oophaa* certainly narrows the focus, but also allows the listener to perceive details of rhythm and harmony that would simply not be possible in the earlier, more complex duo. This concentration on the inner structure of harmonic and timbral sonorities is also a feature of *Échange*, one of two concertante works Xenakis would complete in 1989.

Échange

The Asko Ensemble, based in Amsterdam, has long been dedicated to the music of Xenakis.²⁰ Harry Sparnaay, longtime member of the ensemble and one of the world's foremost bass clarinetists, persuaded the composer to write a work for himself and the ensemble, which they premiered in April 1989. There is little of Xenakis's repertoire to relate the piece to, given its unique place in his output as the only concertante work featuring a woodwind instrument. The richly sonorous quality of the bass clarinet,

together with its extended range, makes for an obvious comparison with the cello, but in fact, *Epicycles*, for cello and ensemble, composed shortly after *Échange*, is very different. Where the bass clarinet piece is resonant and harmonic, by and large the cello score is linear and contrapuntal.

Échange begins with an expansive melody in the low register of the bass clarinet, resonated by the other low-range instruments of the ensemble. Right away, Xenakis draws the listener into the special sensuousness of the solo instrument, just as the opening of *Waarg* basks in the spectral characteristics of the upper woodwinds. The music wends its way between solo or solo-accompanied passages and others for ensemble. The opening, for example, includes solo melodic phrases interspersed between drawn-out harmonic sonorities. As the higher instruments enter with punctuating chords, the spotlight shifts away from the soloist, but only briefly. At m. 15, a higher melody in the bass clarinet is resonated by various instruments, leading into a passage of chordal counterpoint with the soloist leading one group (bassoon, lower brass, double bass), answered by a second consisting of high woodwinds, trumpet, and strings. What is noteworthy here is that the chords are not harmonized in parallel motion, as Xenakis had often done before. Instead, the voicing changes with each chord, creating an even richer harmonic environment. The ensemble comes together at mm. 19–21 in a tutti passage, a harmonized descending line that opens out to a pair of widespread chords.

The cadenza that follows, lasting over 1–1/2 minutes, is lyrical rather than virtuosic. Most of the melody is built from a segment of the opening sieve spanning not much more than one octave, *A2–B3*. Eventually, though, it falls to finish on a low *C2*, which is sustained and then broken up into a multiphonic, something the bass clarinet is particularly good at. That this passage comes in the first half of the piece may seem unusual, but it actually works very well. The soloist continues to be featured throughout, including one more brief solo passage. The more continuous involvement of the full ensemble allows for a structural momentum to be built up that does not rely upon the traditional expectations of the concerto form.

The section following the cadenza features the block counterpoint of the previous section, but additional melodic fragments are scattered between the bass clarinet and a few other instruments. The solo instrument continues to follow its own path, playing widespread melodic phrases built from the complement of the main pitch sieve. The ensemble, at first neatly grouped into two, as before, gradually unravels into a number of layers before coming together at m. 43 to provide a foil to the continuing line of the soloist. The ensemble briefly drops out at m. 46, leaving the bass clarinet to lead up to what is, for Xenakis, an extraordinary, unprecedented gesture: a major triad, played *fff!* This chord may have been suggested by the rich spectral character of the bass clarinet tone; in fact, the triad includes additional “partial” notes in the high instruments. Be that as it may, this moment is surely indicative of an impish sense of humor that does not often surface in his music.

The dancelike passage for ensemble that follows, again built from shifting chordal voicings, lightens the ponderous tone of the music in a different way, and when it peters out it leaves the bass clarinet trading off brief flurries with a succession of other instruments, reminiscent of mm. 34–36, but here more exuberant. At m. 64, a new section begins, in which the soloist spins long, smooth melodic contours, but split into two independent lines. The player is required to alternate rapidly between different registers,

although as the lines unfold, they do sometimes converge into a common region before diverging again. The ensemble accompanies this material with tutti chords, freezing onto a single, iterated harmony as the bass clarinet lands on its lowest note, *B \flat 1*, sustained for several measures. A brief interjection of low multiphonic sounds (the soloist together with the tuba) paired with bridge noises in the strings, leads to a long series of tutti articulations of a high-pitched sonority. A final, widespread chord closes the piece, with the instruments dropping out by group, leaving the high strings alone, an echo of so many other Xenakis endings.

Échange has proven popular. The solo part, while demanding, is not unapproachable. The rich timbral and harmonic basis of the music is seductive. The soloist, as one would expect, is active and featured throughout most of the piece. In a sense, though, it is the rich sonority of the bass clarinet itself that underpins the main textural premise of the composition.

Epicycles

Epicycle, a term from Ptolemaic astronomy, means, in a general sense, “one process going on within a larger one.” The revolutions of the moon around the earth, which in turn orbits the sun, is one example. The idea of transferring this concept to music is relatively obvious; ongoing material in one layer can encompass or overlap smaller gestures in other layers. Xenakis also interrupts one sonority by another and then returns to the original one thereafter. For much of the score, the solo cello acts as the prominent voice, with satellite activity going on around it. Like *Échange*, there is little in the way of extended techniques or sonorities for the soloist. The cello is treated as a melodic instrument (evoking the viola da gamba with its pure, vibratoless sound), and is limited to the low and middle registers. The greatest technical difficulties come in the passages in which two lines are presented simultaneously (the player alternating between the two), the registers often diverging considerably (a technique also used in *Nomos alpha* [1966]).

Epicycles contains three solo passages for the cello, dividing the form into roughly equal parts. The material for these solos overlaps the surrounding passages, true to the notion of the title. The cello lines are built from smooth melodic contours; the sieve (and its complement) used throughout contains a preponderance of major and minor seconds. This lends the music a modal flavor, enhancing its “early music” character. Harmonically, Xenakis built the piece upon the contrasting qualities of the pitch sieve and its complement. They are sometimes deployed simultaneously, as in the beginning where the melodic phrase in the cello is pitted against wind chords built from the complement. Throughout, the cello part, when playing at the same time as the ensemble, orbits in and out of synchronization with some or other of the instruments. The opening phrase, for example, closes in m. 2 with the oboe joining the cello for the final five notes. When the cello enters again at the end of m. 3, it moves in rhythmic formation with five other instruments, the *ff* melody of the soloist being harmonized by the others at lower dynamic levels (as in *Échange*, the voice-leading is not parallel but more complex). The third cello phrase is again a solo, much more extended, leading into the first cadenza section. At the end of that passage, having landed on a low, sustained note, the intricate melodic passagework is passed to the ensemble, first the oboe, then the horn (in

counterpoint), the bassoon, then four more instruments, and finally, the whole ensemble playing in counterpoint at m. 17.

The second main section begins after a pause at m. 21. Here, the narrow, straightforward cello melody (built from the complement of the main sieve) continues for well over one minute, at times alone and at times harmonized in parallel with the low brass and bassoon (the inclusion of the tuba here, as in *Waarg* and *Échange*, adds a darker, more emphatic tone to the brass sonority), or the low strings. The evocative character of this passage is reminiscent of the brass “chant” material in *Alax* (1985), although the music is less plaintive and dirgelike. As the harmonization is expanded to include the full ensemble at mm. 28–29, the cello becomes submerged into the texture and a solo flute emerges. The narrow range of its melody, limited to just four notes spanning the interval *C#5–G#5*, is also modal in quality, and is gradually filled in with counterlines in the clarinet, oboe, and muted trumpet. The parallel harmonizations from the previous passage continue, intermittently, but the cello shifts to a slower melody in the same register as before, this time switching back to the main pitch sieve. A brief tutti passage oscillating between two chords interjects at mm. 37–38 before allowing the previous material to proceed. This interjection occurs twice more, in fragmentary form, the final such gesture serving to close the section.

The third part begins with the solo cello playing a flowing melody that spirals around the same middle register as the previous melodic material had done, the range gradually expanding downward until it spans a tenth. The cello leads into—or rather, is superceded by—a passage of block counterpoint rather like the ensemble music at m. 16 of *Échange*, the instruments here being divided into three groups: high winds, low winds and double bass, and strings. The cello starts in on a new melody, again looping out from the middle register (using the complement sieve this time), treated to more varied rhythms than previously. The high-low chordal punctuations by the ensemble occur in two segments, enabling the cello to continue on unaccompanied in between. As its material reaches its zenith, the melody bifurcates, with the span between them having grown to a distance of over two octaves. With a sudden shift to cello double stops, the ensemble chords reenter. The cello finishes this section off on its own, though, and, after a short break, the concluding passage begins. A descending progression of chords, each one being a newly orchestrated voicing, leads to a lengthy statement of a single chord reiterated over three measures. The iambic long-short pattern gives way to layered polyrhythms before breaking out into thick linear counterpoint. The two short passages of this material, similar in style to mm. 17 and 20, are framed by held notes in the cello: *C#2* at m. 82, and *E2* to conclude. A strange ending, but appropriate, considering the relative austerity of the music.

Échange and *Epicyles* were written in close proximity. Both were premiered in the spring of 1989. For all the shared characteristics—the tone of restraint, the block ensemble counterpoint, the modal nature of the sieves used, the extended passage on one iterated chord near the end—they are very different pieces for belonging to the same genre. The sonorous richness of *Échange* is absent in *Epicyles*, although the melodic-polyphonic emphasis of the cello work engenders a musical character equally engaging. It is remarkable that after composing just five concertante works (counting *Aïs*) in his first thirty or so years of composing Xenakis would suddenly compose four between 1988 and 1991. (Seen from another perspective, six of his twelve works of this genre

were written between 1986 and 1991.) And in 1991, another pair of concertos would be completed, this time involving orchestra rather than ensemble: *Dox-Orkh*, for violin, and *Troorkh*, for trombone.

Voyage absolu des Unari vers Andromède

Concurrent with work on *Échange* and *Epicycles*, Xenakis produced his most ambitious UPIC creation, commissioned for the inauguration of the International Exposition of Paper Kites in Japan. *Voyage absolu des Unari vers Andromède* extends the image of a kite soaring through the air to a cosmic voyage through space in the direction of the Andromeda galaxy. While the music is not exclusively programmatic, it is quite easy to imagine traveling through space encountering various “episodes” along the way.

The textures in *Voyage absolu* are conceived on a broad scale, even if the duration (over fifteen minutes) is still nowhere near the breadth of *Persepolis* (1971) or *La Légende d’Eer* (1977). And, while the range of electronic timbres is wider than *Mycenae alpha* (1978), and even *Taurhiphanie*, it is still limited in a way that seems unnatural, given the richness of the composer’s sonic imagination in his other music. Be that as it may, the layering and flowing contours of the sounds are often impressive.

The piece is structured in two parts. The first, lasting until the 8’40” mark, is the more turbulent, with numerous sonic scrabblings and short dramatic gestures surrounding more ongoing layers of arching contours. One striking texture occurs at the 4’48” mark, where a percussive noise pulsation briefly sets up a regular beat that might go over well at a techno dance club. In programmatic terms, the first half might represent the adventures of the voyage—jockeying through asteroid patches, and so on. The second part is much more serene, with the sustained sounds undulating more slowly. Here, the added sonorities are less prominent in the mix, although there are many discrete gestures heard in the background. The sonic arcs evolve both higher and lower, and there are also welldefined episodes in which the timbres and density clearly change. The music at 10’38”, for example, is quite sparse, although by the 11’30” mark it starts to build up again. The final few minutes encompass a gradual ascent into the high register.

It is difficult to imagine where one arrives at by the close of *Voyage absolu*; the ecstatic, suspended state of the music suggests an “arrival” of some sort, perhaps through inner reflection. Xenakis would produce one more work on the UPIC, with difficulty,²¹ but this piece stands as a testament to his ongoing commitment to the computer music system that any child can operate with ease. Thereafter, his attention in the computer music domain would be primarily taken up with the development of a new method of synthesis and algorithmic composition entirely based upon stochastic functions.

Knephas

Maurice Fleuret—musician, critic, organizer, and administrator—had been a vital supporter of Xenakis in France; he had also become a good friend. (Recall that in 1982, *Pour Maurice* had been a fiftieth birthday tribute to Fleuret). So, when Fleuret died in 1990 at the age of fifty-eight, Xenakis was profoundly moved: “He has gone, too soon. He, so radiant, has left his friends with a heavy, throbbing sadness” (Xenakis 1993). The title of his memorial, *Knephas*, means “darkness,” or—better, in French—“obscurité.”

The text is based on phonemes, this time with no source given. A work for mixed voices, the first since *Idmen A* of 1985, it was composed for the New London Chamber Choir, who had given many dedicated performances of Xenakis's earlier choral music.

The score calls for a minimum of thirty-two voices, and here Xenakis unveils a new approach to choral writing. The music, not more expressive or emotional than his other scores from the same period (which is perhaps to say that strong emotional intensity underlies them all), is constructed from four types of material. The first, introduced right at the beginning, is an accented chordal entity, usually tightly voiced as clusters. The chords do change, but there is less a sense of harmonic progression than succession or juxtaposition. In other words, the emphasis is on the individual sonority rather than on a sense of phrase. A second, related, entity is the "chorale," a series of chords that *do* progress in a linear fashion. The third entity is an extension of the chorale, a counterpoint of chordal progressions. This texture only occurs in one section, but it stands out by its complexity and rhythmic momentum. The fourth type, newly introduced in this score, is a kind of resonated melodic writing by which individual members of the choir sing, and sustain, successive notes of a phrase. The result is a narrow (or wide, depending on the phrase) band of sound, constantly renewed, with each note adding a new pitch and, to some extent, a new timbre (individual voice). According to the composer, "the voices should be selected according to affinity in tone color and closeness in musical comprehension, like the toes of a human foot" (Xenakis 1993). This entity also encompasses more than one melody, creating a kind of counterpoint that, depending on the pitch structures and registers, widens the sustained band of sound or produces independent streams.

Knephas is built primarily from this fourth entity. After the opening chordal passage for women's voices (with the men's added toward the end), the resonated melodic texture begins. The women's voices are featured all through this section, which lasts for the bulk of the ten-minute piece, with melodic strands being assigned briefly to the tenors at mm. 19–24 and then to the male voices at the end of this section (mm. 63–68). Throughout, though, the melodic music is punctuated by accented chords, and occasionally by more extended passages of chordal progressions. One chorale phrase, at m. 58, prefigures the concluding passage. Much of the melodic material, and the chord progression as well, is based on the same pitch sieve used in *Epicycles*. Xenakis is not bound by it, though, as he often changes particular pitches, or constructs chords based on intervallic considerations that go beyond the structure of the sieve. In the passages of resonated melodies in which two or more are superposed, he usually assigns pitch sets that differ slightly, presumably so that the individual strands can be better perceived when set in the same general register.

In the passage of chordal counterpoint that follows the main section of resonated melodies, Xenakis departs from his sieve to follow a different procedure. The choir is divided into four groups, each made up of four voices (two groups of women and two of men). The progressions are built from a fixed set of ten closely voiced chords, the whole collection spanning the full range of the choir. Thus, while there is a great deal of activity and sonic intensity, there is also a static, hieratic quality to this passage characteristic of portions of many of Xenakis's later compositions. Lasting over one minute, this music transitions smoothly into a final resonated melody featuring the men's voices.

The return to material built from the earlier sieve links this passage with the final chorale. The choir is more traditionally voiced here rather than being limited to tight clusters. The voices move more or less in parallel motion, the intervals changing according to the sieve, along with a few voicing changes. The diatonic nature of many sieve segments emphasizes the traditional character of the chorale, although the music is certainly not tonal, and nor are the four-note chords particularly consonant. In the context of the whole score, however, built primarily from clusters and tight sonic bundles, this final moment is a revelation. Given the impetus for the piece, the memory of a close friend gone, it serves as a kind of epitaph.

Tuorakemsu

Xenakis had another occasion to pay tribute to a friend and colleague in 1990, but this time a living one. *Tuorakemsu*, a brief orchestral miniature of less than four minutes duration, was composed for a concert in Tokyo celebrating the sixtieth birthday of Toru Takemitsu, an acquaintance from Xenakis's first trip to Japan in 1961. While much of the score is typical of the composer—sieve-based textures (a section for the strings from near the end is strongly reminiscent of *Jonchaies*), thick chordal counterpoint pitting woodwinds against brass against strings, rhythmic layering—the middle section is utterly unlike anything else Xenakis had written. A trio of cor anglais, bassoon, and horn sound a plaintive, modal counterpoint built entirely from a diatonic scale (“white notes”). The phrasing is fluid and expressive; the “affect” is similar to pretonal music in its lack of harmonic tension or progression.

Eventually the high strings enter with a narrow line built from articulated glissandi. This sound echoes the high, sliding line of the hichiriki of the traditional Japanese gagaku ensemble. At that moment, it becomes clear that the modal music of the wind trio is linked to the Japanese musical tradition, albeit in a rather oblique way. The tribute to Takemitsu, who was among the Japanese composers Xenakis had encouraged early on to explore their native musical heritage, is woven into the music. The piece does not attempt to imitate Japanese music (just as the earlier “Japanese” score, *Nyuyo*, did not), but proposes a unique rapprochement between the East and the West, rather as Takemitsu has done in some of his scores. While *Tuorakemsu* is a relatively minor work, it is certainly of interest.

Tetora

It is appropriate, though certainly arbitrary, to close another phase of Xenakis's output with a string quartet. As *Tetras* (1983) epitomizes many of the concerns leading into the 1980s, *Tetora* incorporates a number of characteristics found in the music leading into the 1990s.²² Compared to the earlier quartet, this one is much simplified in terms of texture: the tempo and pace of events is slower, pitch-based melodic contours are more prominent, the intervalllic qualities of the sieves strongly color the expression of the music, and chordal passages are organized in a tightly controlled though unpredictable manner.

Tetora means “four” (in the ancient Dorian dialect), as does *Tetras*, but there is in fact much less homogeneity in the later piece. The quartet is often divided into two duos,

distinguished by register, and there are numerous solo, or soloaccompanied, passages as well. There are no glissandi, no grinding noises or other effects, no trills, tremolandi, or microtones, and very little use of polyrhythms. The music is structured according to the predominance of melodic or harmonic/ rhythmic material. There is a great deal of fluidity within these domains, and a fair amount of convergence or juxtaposition as well.

The melodic material can be subdivided into six categories: (1) solo; (2) twopart (or more) counterpoint; (3) resonated, where individual notes of the solo melody are sustained by the other instruments; (4) distributed, where each note of the melody is played by a different instrument—hocket-like; (5) chorale, where one line is prominent, but is supported by parallel-moving chords; and (6) accompanied (by harmonic or ostinato material). The opening passage of *Tetora* (mm. 1–21) is entirely melodic in orientation, but the structure, in terms of changing sub-entities, is quite intricate. The melody itself proceeds very smoothly, with the one major shift of register (going into m. 9) being linked to the switch from first violin to second. This dichotomy between a relatively stable line and a rapid succession of textural variation carries through much of the melodic material, creating a sense of formal fluidity and continuous development that contrasts with the block-like structure of many other compositions.

The harmonic material can be distinguished by the degree of rhythmic synchronization, ranging from tutti chords to two-part structures (usually pitting the violins against the viola and cello) and four-part ones in which each instrument plays double stops, often within a layered ostinato setting. Registral contiguity is another important factor in characterizing the harmonic material. The first such passage, for example, taking over from the melodic material at the end of m. 21, is very disjunct, the tutti chords jumping up and down by as much as two octaves. By contrast, the next chordal passage, coming after a short melodic interlude at mm. 25–26, is highly contiguous (again featuring a synchronized rhythmic structure). With such progressions, the harmonic entity starts to merge with the melodic “chorale” entity, the distinction generally being that the main impetus for the passage is either linear or vertical.

While *Tetora* proceeds as an alternation between melodic and harmonic passages, the variety of rhythmic structures generally associated with the chordal material gradually begins to dominate the music. The final extended passage of melodic material occurs at mm. 86–100, carrying the music to the 11'00" mark of its over-sixteen-minute duration.²³ This section features two-part counterpoint, shifting from first violin and viola to viola and cello, with high, punctuating chords being added at m. 91.

At m. 101 each instrument plays an irregular cycle of double-stops according to an independent rhythmic structure, including polyrhythms. Given the very slow tempo, the aim is to create a floating rhythmic counterpoint rather than layered tempi. At m. 109, the players are synchronized for a brief passage of tutti chords before sliding back into nebulous contrapuntal material. At m. 115, however, the quartet comes together in a clearly structured, two-part texture built from multiples of the basic sixteenth-note pulse. In this section, the violins are more active than the lower pair, but the two parts interlock to create an ongoing pulse (shifting from 16th-notes to 8ths at m. 116, and thereafter the rhythmic pattern is somewhat more irregular). The whole passage is divided into segments, and each pair draws upon a set of chords for each segment, usually four for the violins and three for the lower duo (the viola and cello play an ostinato on one chord in the first segment at mm. 115–16). These segments are distinguished by changes in the

pitch sieve from which the chords are drawn, or rather, by transpositions of a single sieve. The underlying unity of the passage is difficult to hear, but the sense of harmonic progression, segment by segment, is quite apparent. Finally, at m. 128, this material leads directly into the final passage.

This section is similar in construction to the previous one, being built from irregular progressions of a limited set of chords for the two duos, this time six for the violins and five for the viola and cello. The pairs are brought together rhythmically, though, and the pattern of durations is derived from a sieve (see fig. 30). Xenakis treats this sieve simply, repeating the cycle of durations and then reversing it. The addition of a 3+1-1-1 segment in between the second and third statements of the set allows for a palindrome to be created as well, something not readily perceivable by the listener but which lends a certain elegance to the structure. While this passage is decidedly harmonic rather than melodic, it should be noted that the chords of the upper pair are contained within narrow range (and are narrowly voiced), resulting in quite a smooth progression. The clustered sonority precludes the projection of a clear line, but a certain melodic sense is conveyed nonetheless.

The attention to structural details, as evidenced in this final passage as well as in the intricate succession of melodic textures in the opening section, are what makes *Tetora* a worthy successor to *Tetras*. While the earlier quartet is far more

chord: upper strings	A D F C E E A C D B E F C D D B E A E F B D C A
chord: lower strings (ordered high to low)	E A C B B A C E B C B C E A B B E E E D B B E C
duration:	3 1 1 3 1 1 2 3 1 2 1 1 3 2 2 2 2 1 1 2 3 2 2 2
	P - >

chord: upper strings	A F C F D D A C B D D A E E B C A A E E B F A D F E C F E
chord: lower strings (ordered high to low)	B D B C A E B E C B A E A B C E B C A E B D B E C B B D E
duration:	3 1 1 3 1 1 2 3 1 2 1 1 3 2 2 2 1 1 1 1 2 3 2 2 2 3 1 1 1
	P - > 2 (P) 3(R)

chord: upper strings	A F B C C B A F B B D E D F E B D E F B C F A E F B
chord: lower strings (ordered high to low)	E E D B E D C C D B B E E E E C B E C E E C D E C C
duration:	2 2 2 3 2 1 1 1 1 2 2 2 3 1 1 2 1 3 2 1 1 3 1 1 3 (5)
	2 < - R

upper chords:	A	B	C	D	E	F	total:
number of occurrences:	13	13	11	13	15	14	79
cumulative duration:	22	26	24	21	24	26	143
lower chords:	A	B	C	D	E		
number of occurrences:	7	22	17	8	25		79
cumulative duration:	10	42	34	12	45		143

Figure 30. *Tetora*: Table showing organization of chord progressions and durations of final section, mm. 128–37.

dazzling, this one contains a lyricism that is remarkably strong, as well as an obvious affinity for the sonorities of the string quartet. Even if the music is shorn of many of the elements that made the earlier score so compelling, the formal depth and sureness of tone make this a substantial addition to the quartet repertoire. It has the added distinction of being within the realm of performance possibility for many more groups than the Arditti String Quartet. And this concern for wider accessibility is a major factor in the stylistic changes Xenakis's music underwent through the 1980s.

8

The Late Works

Abstraction and Intensity

As Xenakis approached his seventieth birthday in 1992, there was a flurry of celebratory activity. Though suffering from ill health,¹ he marshalled his energies to produce, within the space of approximately one year, five major orchestral scores. For our purposes, this peak of activity serves to launch the final period of his career, leading to 1997, the date of his last composition. There is still a great deal of variation to be found in this music, in spite of a general sense of restraint and relative simplification.

Kyania

Xenakis spent virtually every summer of his life on the Mediterranean.² When a major commission came along in 1991 from the southern French city of Montpellier, he was undoubtedly inspired by his love of the sea to compose one of his most substantial orchestral scores. The title derives from the color cyan, a bluish, ultramarine hue that might well describe the waters of the Mediterranean. The brass are prominent throughout much of the piece, a timbral feature that may also have taken inspiration from the title. The predominance of thick textures involving the full orchestra or brass and strings—immense “chorales” or involved contrapuntal passages—suggests the slow, powerfully roiling currents of the sea.

These interacting currents or streams manifest themselves in numerous ways in *Kyania*. The opening introduces two entities: a low-register, slow, cluster melody in the bassoons and horns, and scale passages, again harmonized in clusters, first in the flutes then layered with the oboes and passed on to the strings followed by the trumpets and trombones. These materials, intercut and overlapped, are punctuated by two other interjectory elements that become important later on: quick melodic fragments (again voiced as clusters), and isolated chords involving different groupings of instruments. These attacks are expanded to include the full orchestra at m. 11, and again at m. 14. The latter chord marks the end of the first section.

The second short section contains a more traditional manifestation of linear counterpoint—in this case, four voices scored for brass. The pitch organization is not recognizably rooted to a single sieve although there is a loose connection, notably in the trumpet part, to the scale passage of the first section. The harmonic sound world is relatively dissonant, punctuated by widespread chords in the strings and winds, this time

at a fairly rapid rate of one or two per measure. A full tutti chord closes this passage, too, succeeded by a short interjection of rapid cluster figuration in the woodwinds, passed on to the strings and brass. Xenakis here introduces a variation that will lead to more substantial changes later on. The woodwind fragment, less a shaped melodic phrase than the earlier interjections had been (and as is the string-brass figure just after), is basically an alternation between two cluster chords. The music returns to the opening sonority of bassoons and horns, this time varied by splitting the ensemble into layers to pursue independent melodic and rhythmic trajectories. The alternation of this layer with fast fragments or tutti chords continues, though these gestures are expanded and are also retooled to incorporate the oscillations of the woodwind interjection of m. 20.

This recall/variation of the opening passage highlights the timbral dimension of the musical structure; for even though the materials from m. 21 are mostly quite different, the music is clearly related because of the distinctiveness of the instrumentation. *Kyania* is certainly organized as much by timbral differentiation as anything else. It is this element, in fact, that makes possible the thick chordal, or cluster-chord, counterpoint, including the remarkable passage later on (mm. 55–60) in which there are six independent layers. At m. 32, though, before that passage is reached, a four-part contrapuntal texture is unfurled, built from slow melodic contours, each harmonized in close voicings (not clusters, as a contrast). The timbral definition of the layers—oboes and cor anglais, bassoons, horns, trombones and tuba—is aided by registral separation, with some small overlap. The overall sonority, mixing double-reed instruments with brass, is clearly an extension of the bassoon/horn combination.

At m. 43 the music opens out, individual instruments of the orchestra entering to build up a complex linear sonority of 25 voices, again more chromatic than modal. Abruptly, this passage is cut off at m. 48 by a brief reference to the cellular automata material found in 1986's *Horos* (m. 10) and 1987's *Ata* (m. 126).³ There is then another sudden shift to the next section, which begins with a high melodic phrase in the cellos (harmonized as a cluster), then jumping to a two-part chordal counterpoint in which the cellos are joined by the violas, trumpets, and bassoons, pitted against the trombones and violins. At m. 55 the counterpoint, as mentioned before, expands to six layers: oboes/clarinets, horns, trumpets, piano, upper strings, and cellos. The melodic contours, with the exception of the ostinato-like upper string layer, tend to be rather disjunct. The lines are harmonized with chords of differing intervallic content, leavening the density of the passage over what it would be if all six layers were chromatic clusters.

At last, by m. 61, the different currents that have been carrying through the music so far join forces for the first tutti passage. Thick chords move in parallel under a sieve-derived melody. Significantly, the opening phrase segment is a direct quote from *Horos* (m. 41). The strings alone then carry on the monolithic character of this passage with a lengthier statement of a narrow-ranged melody thickened by a giant forty-eight-note cluster. Although the strings do continue, with occasional breaks, the horns and trumpets enter at m. 70 with contrapuntal material similar to that of mm. 14–20. At m. 80 this layer expands outward with rhythmically layered lines, one for each of the thirteen brass instruments (resembling the concentrated linear music of mm. 43–47). As in earlier sections, this passage is interrupted at mm. 86–87 with a chordal phrase fragment that signals the definitive shift to tutti brass chords at m. 90, carrying right through to m. 98.

Along with the intermittent phrases of string clusters, the woodwinds also intervene, in the manner of earlier fragments.

A second monolithic section follows at m. 98, this time launched by the strings, with the full orchestra entering two measures later. It might be tempting to assign pivotal structural value to these tutti sections. It makes more sense, however, to hear the music in terms of ebb and flow. The various materials appear, give way to something else, returning later in varied form.

In the next section, from m. 103, both the contrapuntal and chordal material are transformed and combined. The strings play rising scalar lines, rhythmically layered. By m. 116, the lines start to fall, then fracture into mixed contours. In the meantime, the winds play sculpted harmonies, individual entrances and exits being staggered to shape the chords over time. The passage ends with rude flutter-tongue chords in the brass and a layered mixed-contour texture in the woodwinds that resembles the later manifestation of the string entity.

At m. 127, the strings lead the orchestra back to the tutti chordal entity. Here, though, the strings do not play clusters, but single or double notes for each of the five instrument groups. This is the most extensive single-entity section, and there are a number of defining shifts of register, inherent tempo, and so forth. The entire orchestra plays a descending scalar passage—for example, at m. 136, as the music drops to a lower register for the following segment. At m. 142 the monolithic nature of the chordal sonority begins to fragment, with different instruments breaking off from the mass to launch independent melodic lines. There are, nonetheless, continuing interjections, this time (as an inversion of the earlier passages) the tutti chords. As the counterpoint continues in the winds the strings carry on with chordal material, the rest of the orchestra joining in one last time at m. 151. A brief passage of sculpted chords forms a coda, with the music ending on a full-orchestra chord giving way to a long string cluster that gradually fades away to nothing.

Kyania, then, is a score that deals with counterpoint on many levels. There are the usual linear sonorities, but also successions of contrasting sonic entities and formal sections.⁴ As noted, the dispersal, then revision, of the different elements resembles the push and pull of ocean currents, the monolithic chordal element in a sense subsuming the others as a strong flow of water may draw other streams into its wake. At twenty-three minutes in duration, this is a worthy tribute to the sometimes murky, sometimes brilliant aquamarine hues and heaves of the Mediterranean. Xenakis would return explicitly to the image of ocean currents with *Roái*, the following year. First, though, he had a pair of concertos to write.

Dox-Orkh, Troorkh

Considering that the only orchestral concertante works Xenakis had written in his entire career had been for piano (along with *Ais*, for baritone and percussion soloists, perhaps), it is quite remarkable that within the space of a few months in the spring of 1991, he completed two major works featuring other instruments. *Dox-Orkh* was the first, and is scored for violin and orchestra, a commission for Irvine Arditti, already well-known as a champion of Xenakis's music. The premiere was set for the Strasbourg Musica Festival in the autumn of that year, with the BBC Symphony Orchestra conducted by Arturo Tamayo. *Troorkh*, for trombone and orchestra, was a Swedish Radio commission for

Christian Lindberg, and was actually premiered much later, in 1993 in Stockholm, with the Swedish Radio Orchestra under Esa-Pekka Salonen. The two titles are related: in ancient Greek, *orkh* means “orchestra” and *dox* indicates “bowed instrument,” while *tro* stands for “trombone.” There is, however, remarkably little in the music to relate the two scores apart from the relatively ubiquitous use of large cluster sonorities. Compared to the other works from this period, both *Dox-Orkh* and *Troorkh* are virtuosic, “personal” pieces rather than simply abstract studies of density, form, and counterpoint (though they are that, too).

Xenakis had already written a great deal of chamber music for the violin: the *Mikka* (1971) and *Mikka “S”* (1975) solos; *Dikhthas* (1979), with piano; the trio *Ikhoor* (1978); and the quartets *Tetras* (1983) and *Tetora* (1990). He was also well acquainted with the soloist Irvine Arditti, having worked with him on numerous occasions for premieres, concerts, and recordings. The solo part of *Dox-Orkh* is extraordinarily difficult to play, as one would expect in a concerto, but in a way that had been absent from the chamber concertante works such as *Epiclyde* or *Échange*. The violin proceeds through essentially four types of playing styles: (1) single-string continuous glissandi, at times articulated rather than smooth, replete with quarter tones; (2) pitched double stops, either sieve-based or chromatic; (3) double-stop glissandi; and (4) mixed double stops (glissando/held notes). There is relatively little switching back and forth between these entities, so the progression constitutes a clear layer by which the form is articulated, along with the sections delineated by changes in the orchestral material.

The other major contributor to the form is the dialogue between the soloist and the orchestra. There is a clear give-and-take between the two. The major exception occurs in the third section where the violin is paired with the horns, creating a rather poignant, “modal” sonority. In this passage, Xenakis takes advantage of his close working relationship with Arditti to adopt a kind of notational shorthand. What he intends is that the player will “sustain for as long as possible the notes preceding” the present one. Most often, this involves double stops. The simple melody of these passages becomes, using this technique, much more awkwardly rendered, and this may, to some extent, have been the point. The shorthand continues into the next section as well, where the violinist is asked to perform glissandi as well as to sustain the previously indicated pitch. Just sorting out the technical issues of what is possible in these passages would take an enormous amount of work on the part of the violinist, work the composer could have lessened by making more of the decisions himself. Still, different performers will come up with different solutions, so in that respect the part can be molded, at least somewhat, to the abilities of the soloist. Later, in the section of mixed double stops, Xenakis does specify exactly what the violinist is to play; the chromatic nature of the material makes this necessary, the music conceived more as successions of vertical intervals than as a “resonance” of a single melody.

Turning back to an examination of the piece as a whole, the dominant character of the orchestral writing is the use of clusters. The first section features the upper woodwinds playing phrases of relatively quick-moving, mixed-contour lines, entirely harmonized as parallel clusters. These passages are filled out at mm. 7–9 by the full orchestra, then again going into m. 15 to end the section. In its phrases spaced throughout this section, the violin solo plays continuous glissandi, the range and speed varying radically.

The second section, beginning at m. 15, fractures the woodwind/orchestral clusters into layers, either in groups or individual lines, alternating with tutti cluster chords, either in the strings alone or playing off the three instrumental families in a slow counterpoint. The violin continues its glissandi, but in a more articulated style. This section, which the orchestra decidedly dominates, closes with an eightlayered counterpoint of narrow clusters in the brass and strings, with the tuba anchoring the texture with a traditional-sounding bass line. The third section, as noted before, is more lyrical and transparent, featuring solo violin and horns, accompanied by, or alternating with, soft cluster lines in the strings. As the pace of the string material is notched up, the tempo doubles for the first part of the fourth section.

In this passage, featuring the brass in dialogue with the soloist, the clusters are refracted through a sieve, creating tightly voiced parallel chords whose intervallic content changes with each new chord. The violin counters the relatively active phrases of the brass with double-stop glissandi, again fluctuating a great deal in speed and span. In the second part of this section, the chromatic clusters return, playing off brass against woodwinds and strings. The cluster contours continue to be quite rapid in pace, as before, and, by m. 97, the soloist is silenced as the density of events increases in the orchestral groups.

At m. 104, just over two-thirds of the way through the score,⁵ Xenakis inserts an extraordinary little interlude for the orchestra alone, utterly unlike anything else. The orchestra is split into eight groups, each playing a fixed cluster (some of these clusters change position slightly as the passage progresses). A constant sixteenth-note pulsation is propelled along by ordered articulations of these clusters, creating a dancelike rhythm that is almost comic. The double bass cluster recurs most often, producing an essentially triple-meter feel, thrown off now and then by the insertion of a duple pattern. The metronomically paced progression from one orchestral timbre to another heightens the interest of the passage. Xenakis would return to similar processes in later works—notably *Dämmerchein*, in 1994.

This unexpected shift in the musical flow of *Dox-Orkh* highlights the composer's sense of humor and love of the unexpected. It also serves to change perspective in preparation for the following section, itself introducing new material. In this passage, the sculpted harmonies of *Kyania* return, trading off between the strings and the winds. The chords are built from a sieve (not the same as in earlier sections) rather than clusters, and these sonorities alternate with mixed double stops in the violin, who by contrast plays phrases built from chromatic or unstable pitch configurations. At m. 130, the soloist returns to the glissando style of the opening and the orchestra to the rapid cluster contours of the fourth section. This final section, the sixth, builds to an imposing orchestral passage, pitting string clusters against a counterpoint of wind chords. The brief closing gesture combines dissonant double stops in the solo violin with a counterpoint of slow-moving string clusters.

Dox-Orkh is a successful concertante work. The violin is treated in a highly distinctive fashion, contrasting with the large forces of the orchestra. The dialogical nature of the music circumvents problems of balance, as very often the soloist plays alone. At the same time, the ongoing development of both the orchestral and violin material adds a structural dimension to the music that is engaging in its own right, even if there is a natural attraction to the soloist.

Troorkhy on the other hand, features much more interaction and engagement between the soloist and the orchestra, no doubt because of the greater force by which the trombone can project its “voice.” It is, because of that, a more exuberant, energetic work. It is also strongly colored by the expansion of the timbre and character of the soloist through the orchestral trombones, and by extension, the brass section as a whole. The trombone is present during almost two-thirds of the piece, most often in contrast to, or in consort with, the orchestral brass. Compared to *Dox-Orkh*, the soloist plays completely alone relatively rarely. By contrast, the strings, here playing most often clusters or cluster glissandi (an extension of the sliding sounds of the trombone), are present for just one-third of the score, with the woodwinds playing even less than that.

The construction of *Troorkh* follows more of a mosaic pattern—a succession of short events—than a clearly defined blocklike structure. The solo trombone draws upon a wide range of styles (see table 13), but the succession of these entities does not shape the music as strongly as the violin’s material does in *Dox-Orkh*.

It is nonetheless possible to discern a progression and to gain a sense of the overall form on that basis, together with the succession of orchestral elements. Xenakis makes use of other harmonic formations besides chromatic clusters, and the shifts from one to another also help to articulate the form. The opening, for example, pairs a semitone melodic motion with a four-note symmetrical harmonic structure of two tritones on either side of a perfect fifth. The trumpets and trombones overlap, thickening the harmony (creating two superimposed

Table 13. Solo Trombone Entities in *Troorkh*.

narrow, hornlike ‘calls’
lyrical legato phrases
fast double-tongue runs
articulated glissandi
slow, narrow glissandi
low pedal tones
staccato rearticulations
percussive attacks
marcato melodic lines

diminished seventh chords, in fact) and leading to the entrance of the strings, who thicken the sound even further, superimposing three transpositions of the original chord, each separated by a whole step.

When the solo trombone enters at m. 5, a high plaintive call opening with a minor third, the brass quietly sustain each note of the solo line, filling out by the end of the phrase an eight-note sonority resonating its various open intervals. Clusters are not heard, in fact, until m. 11, and Xenakis continues to play off the density of this sonority with more open harmonic structures throughout the piece. A somewhat fragmented dialogue between the soloist and the brass, with occasional input from the strings, continues

through m. 16. At that point, the trombone launches into an extended passage of articulated glissandi, with chordal punctuations by the brass (joined at m. 21 by the woodwinds, in their first appearance).

The soloist is three times joined by brief glissando phrases in the orchestral trombones, creating a heterophonic texture. These momentary expansions of density grow in importance, and the strings join in with cluster glissandi at m. 25. After a pause at the end of m. 27, the orchestra having briefly taken over from the solo trombone, the glissandi resume, the orchestral trombones being joined by horns (playing mixed-contour lines rather than glissandi, but still adding weight to the brass sonority), and eventually by the trumpets as well. The strings, who by m. 36 play more extended passages of glissandi, provide more of a counterpoint than a heterophonic addition. Again, the orchestra takes over from the soloist, and at m. 40 the woodwinds finally enter on their own, signaling a major structural shift. In fact, there is a similarity between this passage with the overlapping entries of the different instrument families and the opening, though this new sonority is entirely built from clusters.

By this point the heterophonic texture of the brass breaks off from the solo trombone, continuing in dialogue, instead. The trombone's playing becomes more wide-ranging and dramatic with the addition of trills, staccato tonguing, pedal tones, and, in the third phrase (mm. 49–51), a fast, noisy, tremolo-staccato playing that leads to a sustained high *F*5. At m. 52, the woodwinds (with the addition of horns) take over the dialogue from the brass, playing phrases of interlocking clusters. The soloist, now muted, continues, playing glissandi primarily, again joined by the orchestral trombones in a variation of the previous section. As the woodwinds drop out and the other brass instruments enter, the dialogue essentially shifts to the interior of the music, with horns and bassoons being set against the rest of the brass. At m. 66, the strings again join in, briefly, with their own glissandi, this time without the added weight of clusters. Thereafter, between mm. 66 and 72, the orchestra is essentially broken into seven layers (flutes, oboes/clarinets, bassoons/horns, trumpets, trombones/tuba, solo trombone, strings). Each contributes short, overlapping phrases (with the exception of the lengthier passages of the soloist), the block sonorities of the nonglissando layers being voiced as varying harmonic formations rather than clusters.

To this point, the emphasis has been on solo line and sonority, along with harmonic variety and different forms of counterpoint, to the exclusion of rhythm or pulse. At a point in the piece similar to the unique, dancelike episode in *Dox-Orkh*, Xenakis adds a low regular pulse in the tuba. It enters at m. 71 underneath sustained glissandi in the strings. The solo trombone joins in at m. 73, elaborating the tuba's basic pulse and heralding short interjections of staccato, rhythmically layered material from various instrument groups including trombones, oboes, trumpets, horns, and clarinets/bassoons. The strings continue their glissandi, filled out with full clusters as before. With the soloist increasing the tempo of the staccato line and building to a high *F* once again, the winds enter, one group at a time from m. 79, playing fast, pulsating, rhythmically synchronized chromatic scales. These rising lines, harmonized in clusters, sweep up to a climax at the end of m. 80. This thrilling, dramatic gesture is reminiscent of the orchestral flurry near the end of *Horos*, though it is by no means a cadential gesture in *Troorkh*.⁶

Having reached the final third of the piece, the solo trombone takes a more dominant role right through to the end. The remaining music is divided into two sections, separated

by a fermata. In the first, a rather ponderous, marcato line in the trombone is gradually elaborated and intensified. Set against intermittent glissando clusters in the strings, and sustained clusters and other closely voiced harmonies in the brass, the trombone line in fact introduces the first explicitly modal material. The sieve includes the characteristic gamelan-like *pelog* segment, a minor second surrounded by major thirds, at the highest, most intense, part of the instrument's range.

After a short episode in which the strings continue their cluster glissandi and the woodwinds interject short phrases of thick, parallel clusters, the trombone begins a final burst of virtuosity, playing primarily fast, articulated glissandi. The brass and strings, on the other hand, intone a slow chorale divided into two layers, each harmonized by close voicings derived from a variant of the trombone's sieve in the previous section, transposed up a step. While the texture is thick, the flavor of the sieve is quite apparent, and its appearance at the end serves to widen the harmonic context for the symmetrical (and other) chordal structures and clusters. At m. 113, the woodwinds enter again with solid cluster blocks, rendering the rest of the orchestra mute. They then break off, leaving the soloist to wind down to a low pedal glissando that fades out. The strings sneak in on a long crescendo to lead the brass in a final chorale-type statement, broadened one last time by massed clusters.

The prominence of the brass throughout much of *Troorkh*, together with the frequent use of massed cluster glissando clusters in the strings at full-out dynamic levels, creates an enormous amount of sonic energy. This is a piece that should definitely be heard live! *Dox-Orkh*, too, benefits from being experienced in concert, particularly for the opportunity to better hear the dramatic shifts in density between the solo passages and those for clustered orchestral groups. In any case, both scores, while very different, effectively engage the concerto genre. The formal organization of the music melds with the dramatic considerations in ways that allow the single voice to project above, through, against, and in conjunction with, the imposing forces of the full orchestra. Considering that prior to this Xenakis had only taken on the symphonic concerto using the comparatively powerful piano as soloist, these two works represent an admirable achievement.

Having turned back to the orchestral medium after a relatively long absence of three years, Xenakis was just hitting his stride with *Kyania* and these concerti. He would go on to complete two more substantial commissions before the year's end. In the meantime, though, he was also occupied with developing a new approach to the creation of music by computer.

Dynamic Stochastic Synthesis

In the late 1950s and early 1960s, as Xenakis was developing his algorithmic approach to music composition on the basis of stochastic (probability) functions, he also speculated about the possibility of synthesizing new sonic waveforms on that same basis. He carried out some experiments during his tenure at Indiana University, and continued at the Centre d'Etudes Mathématique et Automatique Musicales (CEMAMu), in Paris. Later, though, his main preoccupation became the development of the Unite Polygogique Informatique de CEMAMu computer system, and the stochastic synthesis work was sidelined. It was

only in the latter part of the 1980s, with the loan of a minicomputer from Hewlett Packard, that Xenakis and his researchers at CEMAMu were able to return to this project. By 1991, they succeeded in developing a computer program that would not only synthesize sounds stochastically but would also implement macrocompositional procedures similar to those defined for the *ST* algorithm in 1962.⁷

On the synthesis level, the aim was to generate a waveform that varied continuously according to some stochastic function. In searching for the most efficient way to do this, Xenakis and his team eventually adopted a waveform cycle as the basic unit (rather than, say, a sample), simplified as a series of line segments rather than a curve (see fig. 31). The degree of change, both vertical and horizontal, from one point in a cycle to the corresponding one in the next is calculated according to a stochastic process. In this way, the cycle is varied both in its amplitude (vertical extent) and frequency (horizontal extent). If each cycle of a sonic

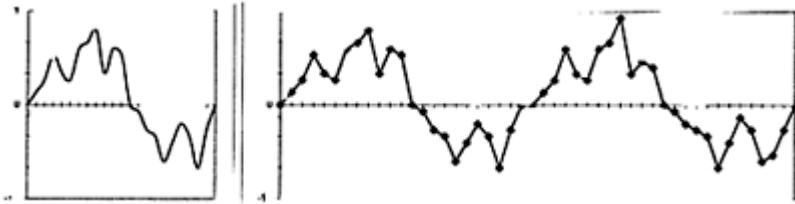


Figure 31. Waveform of audio signal.
(a) continuous representation; (b)
straight-line segments, varied from one
cycle to the next.

waveform varies radically, the resulting sound will be very unstable, or noisy. In order to obtain a range of timbres, a second-order process was set in place to control the boundaries, or degrees of possible change, for each operation. This process could be dynamic, effecting gradual shifts in the rates of change. On a higher level, processes were implemented in order to select the number of “voices” (waveforms) activated at any one time, their points of entry (in the score, so to speak), and the duration of each segment. With these basic tools it became possible to input control data so as to generate an entire piece digitally on the basis of stochastic functions, from the level of “instrument” up to “full score.”

Xenakis’s first compositional product from the new stochastic algorithm was *GENDY301*, presented at the 1991 International Computer Music Conference in Montreal, Canada. A newly generated work derived from similar control data was produced later that same year for the Journées de Musique Contemporaine in Metz, France. This work, titled *GENDY3*, is the version that has become known through subsequent performances and release on compact disc.

At almost nineteen minutes in length, *GENDY3* is an ample work. Upon listening, it is apparent that, like the *ST* scores, clearly defined sections are integral to the algorithm. The form is built from a succession of eleven short sections, each lasting from one to two minutes (see table 14). In the latter half of the work, sections 7a and 7b are closely

related, as are 9a and 9b. The second section of each pair continues many of the same “voices,” but the overall sound is more processed or modulated.

The eleven sections are distinguished by registral placement and scope, and by degrees of instability in either frequency or timbre. Each sound is relatively consistent in its settings throughout a section, though there are always mixtures of types, and each layer is intercut with a fair degree of silence to avoid oversaturation.

What is surprising about *GENDY3* is the degree of consonance present throughout much of the piece. Every section contains some number of sustained voices, cutting in and out in stochastic fashion, and there appears to be a predilection for consonant relationships between the sustained frequencies. In some of the sections there are also less stable voices, either in terms of frequency (creating glissandi) or timbre, resulting in noisy or rapidly fluctuating sonorities. Decidedly though, there is an emphasis upon exploring the possibilities of steady sounds.

Table 14. Formal Outline of *GENDY3. I:29*.

2:13
1:16
1:31
1:56
2:10—section 7a—1:31
section 7b—1:45 (section 7–3:16)
section 8—1:59
section 9a—1:16
section 9b—1:39 (section 9–2:55)

There are some surprisingly lifelike timbres at certain points—voicelike, or brassy (more like organ stops than real brass instruments). There is actually a great deal of organlike tone to the held sonorities. The unstable sonorities, because of their novelty, do tend to stand out most in the sections where they occur.

S.709, on the other hand, Xenakis’s second product of the digital stochastic algorithm dating from 1994, focuses more on unstable, dynamic sonorities. These are produced by allowing the vertical and horizontal points of the waveform segments to vary more widely and rapidly. At seven minutes in duration, this piece is much shorter than *GENDY3*, but the degree of sonic activity justifies the truncated architecture. There are no clear larger-scale sections; instead, the music is highly fragmented. The harmonic, sustained tones of the earlier work are entirely absent. Instead, each of the no more than three or four voices are in constant fluctuation, either in terms of pitch or timbre, or both. Amplitudes, too, are highly modulated. While there are some consistencies, certain characteristic sonorities that the voices return to, each undergoes considerable transformation, both gradually and in sudden shifts. The density of sonic information within each voice surely dictated the reduction in number of layers. In fact, for much of the time there is only one entity sounding.

S.709, which premiered at a concert at La Maison de Radio-France in December 1994, complements the more “traditional” conception of *GENDY3*. Together these pieces indicate the wide range of possibilities inherent in the dynamic stochastic synthesis algorithm, and in the stochastic algorithmic approach to composition.

Xenakis returned to the studio one more time, in 1997, to create a work on the latest personal computer-based version of the UPIC. *Erod*, a short piece of five minutes, was commissioned by the Bath Festival in England, where it premiered in May 1997 with Xenakis as featured guest. As it turned out, ill health prevented him from completing it, and Brigitte Robindoré, head of musical production at Les Ateliers UPIC, produced much of the music for him (in tribute, the title is derived from her surname). The music is evidently based, at least to some extent, upon sounds extracted from recordings of earlier scores, samples being treated within the UPIC system to simulate the sounds Xenakis had generated with his stochastic synthesis algorithm. After the premiere, it was decided that *Erod* should be withdrawn from Xenakis’s catalog, given the substantial contribution by Robindoré, herself a composer.⁸

Xenakis’s contributions to electroacoustic and computer music have been considerable both in terms of artistic production and technological or conceptual innovation. The early works, created under the auspices of Pierre Schaeffer at the Groupe de Recherches de Musique Concrète, remain important contributions to the *musique concrète* repertoire. At the same time, Xenakis was part of the vanguard in the domain of computer-aided composition. He developed a theory of granular synthesis as early as 1958, and put it into rudimentary practice with his *Analogique A+B*. This work paved the way for later practitioners such as Curtis Roads and Barry Truax to develop what has become an important and widely used alternative to Fourier-based forms of sound synthesis (see Roads 2001). The stochastic synthesis program, too, represents a novel approach to creating and organizing sounds that does not refer to traditional models.

In the domain of multimedia art, Xenakis extended the technology for coordinating the various elements by digital means, and his tape works produced for these events—for example *Persepolis* (1971) and *La Légende d’Eer* (1977)—are significant masterworks of the electroacoustic medium. Finally, his vision of a graphics-based digital music system led to a new approach to computer music, powerful but extremely user-friendly. The UPIC has been hailed as an original tool both for musical creation and for pedagogy, particularly with children. Similar paradigms have since been adopted for a number of music software applications.

Krinoïdi

Returning to 1991 and the instrumental domain, Xenakis completed two more orchestral scores that year. The first, *Krinoïdi*, for slightly reduced forces (triple winds rather than quadruple, and no tuba, percussion, or piano), was written for the Orchestra Sinfonica Dell’Emilia-Romagna “Arturo Toscanini” of Parma, Italy, where it premiered in May 1992. The title derives from a nineteenth-century book of natural history in which a rather poetic definition is given of “crinoids,” “the class of echinoderms, or sea animals, that are radially symmetrical, “in the form of a lily” (in Greek, *krinon* is the word for “lily”). These would include starfish, of course, and sea urchins, among other creatures. Much of the score is slow and contrapuntally complex, perhaps inspired by the ponderous

movements of the starfish as it maneuvers its numerous limbs in fluid, often complicated fashion in order to get from one place to another.

The symmetrical radial form of the crinoids seems to have been less of an inspiration for Xenakis, though he does set up a clear duality between the strings and the winds. In addition to the textural structure in which the two groups are set against one another in various ways, he also associates a different pitch sieve with each, a technique he had not made use of for some time. Lines are harmonized either in terms of clusters derived from one of the sieves, or chromatically. The melodic motion usually follows the intervallic structure of the relevant sieve. At the same time, there are certain interpenetrations, by which the strings switch to the winds' sieve, or vice versa. Thus, a number of organizational factors concerning pitch radiate outward from the central contrapuntal design.

Krinoïdi divides quite clearly into seven sections, whose (rounded-off) durations form a simple set of proportions (equivalent to minutes of the overall duration): 2–4–2–0.5–2–2–1. Note that the odd-numbered sections are similar in duration (a form of formal symmetry), with the exception of the final one, reversed with the section just prior. The duration yielded by the score—something under fourteen minutes—is different than the “official” duration of approximately fifteen minutes.

The opening is scored entirely for winds, beginning with a clustered woodwind chorale. Gradually, different instrumental groups split off, tracing independent, or layered, rhythmic structures. At m. 6, the trumpets and horns make a brief appearance, the horns joining the flutes and oboes and the trumpets joining the clarinets and bassoons. This two-part structure, each filled out with clusters, quickly breaks off, leaving the flutes and clarinets to continue the counterpoint. At that point (m. 7), the wind sieve is introduced, and the three-note clusters of each instrumental family fan out from chromatic intervals to changing structures derived from the sieve. The two-part contrapuntal structure continues, with the full family of winds joining in at m. 10. This is followed by a short passage in which the clarinets are set first against a flute-trumpet pairing and then an oboe-trombone combination. As the full ensemble joins in again, this time in rhythmic synchronization, the section closes on a sustained chord which carries through the introduction of the strings at the start of the second section.

This, the longest section (by a factor of two) and the most continuous, sets in motion a seven-part counterpoint in the strings, with each line harmonized as a three-note tightly voiced chord. These slow, rhythmically independent lines continue without respite, varied only by the radically fluctuating dynamics that the composer adds. Set against them are a succession of counterlines by each wind group in turn: bassoons—flutes—oboes—horns—clarinets—trumpets—trombones. Each line is fashioned from the wind sieve in contrast to the string sieve, and each is thickened by means of tight, quasi-parallel, three-part voicings.

The opening of the third section is probably the score's most dramatic moment, with its brief, but pointed, rhythmic interjection. After this brief exchange between winds and strings, the strings begin anew a contrapuntal, sustained passage, but this time the rhythms all fit into an ongoing sixteenth-note pulse. It is significant that here, from mm. 38 to 42, the strings adopt the wind sieve, presumably blending more strongly with the wind's chorale at mm. 40–41. The second part of the section switches the spotlight to the winds in a faster-moving chordal passage. At m. 44, this gives way to a two-part texture

pitting tutti winds against tutti strings in plodding, rhythmically independent chorales, the strings having reverted to their own sieve to heighten the counterpoint. The passage ends as the winds break off, leaving the strings to carry on a more active line, recalling the wind material that launched the section.

The fourth part begins with a loud chordal statement from the full orchestra. The strings revert to the by-now-familiar wide cluster and carry it on to the end. The monolithic treatment of the strings from this point forward effectively serves to divide the first three sections from the later four, creating a large-scale bipartite form, relatively balanced in terms of duration (4:3).

After the tutti chords, the orchestra splits into two, the strings and brass carrying on in a similar fashion, the woodwinds interjecting faster passages of harmonized material. At m. 55, the beginning of the fifth section, the music becomes more fragmented, a clear contrast to the immense sonorities of the previous passage. The strings continue the clusters, but in sporadic phrases separated by rests. The winds, too, continue their chordal material (woodwinds only, with horns), the passages again being separated by lengthy rests. Set against these are other phrases of reduced instrumentation. The first is taken by muted trumpets in combination with the violas, followed by a brief segment of counterpoint between trumpets and trombones. The third such passage adds bassoons, followed by a final passage of weighty wind chords.

With the string clusters carrying on into the sixth section, the winds, in another dramatic gesture, burst into a fast passage of descending chromatic scales. These lead directly into an elaborate contrapuntal passage for the seven layers of winds, balancing the strings of the second section. A final, sustained cluster chord breaks into a slightly more transparent music of five-part, sieve-based, harmonized counterpoint involving oboes, clarinets, bassoons, horns, and trumpets. As with the strings in section three, the rhythms all fit into a sixteenth-note pulse, though each layer moves at a slow pace. The strings, still carrying on their massive clusters, finish out the piece, as they did in *Troorkh* and *Dox-Orkh*.

In addition to its structural proportions, then, *Krinoïdi* exhibits other traces of symmetry, particularly in the relation of the string material in the second and third sections to the winds in the sixth and seventh sections. The binary elements such as the division of the orchestra into two competing groups, each with its own sieve, and the dual harmonizations (either clusters or sieve chords), contribute to the score's balanced character. Given its strongly contrapuntal nature, one might again cite the "currents" of *Kyania*. *Krinoïdi*, though, is much simpler in overall conception. Increasingly drawn to images of the sea, Xenakis would return to the flow of tides and currents in his next score.

Roái

In the ancient Dorian dialect, from which Xenakis has drawn a number of titles, *roái* means "flux." This title can be taken as indicative of many things—flow, current, transfer, fusion—but all of them point to a state of dynamism and interaction. *Roái* (1992) is a work of great sonic intensity, above all. The form is more mosaic-like than *Krinoïdi*, with textural changes occurring much more often. It is also a more rigorously conceived score, with intricate mechanisms underlying various passages. In addition,

while counterpoint is again a major compositional element, the sonic result is often more timbral than linear. One of the reasons for this is the static nature of some of these passages, with the polyphonic strands moving between a limited number of fixed chords or clusters. The opening is a case in point.

The first three measures plunge the strings into a complex exposition of the sieve that underlies much of the score's noncluster string material. With each of the five layers attacking and sustaining a closely voiced four-note chord, the ten possible adjacent sieve chords are cycled through in irregular fashion, following a cumulative rhythmic pattern (see fig. 32). Set against this, four of the wind groups (clarinets, bassoons, horns, trombones) play apparently similar material, the chord set not as limited, thus gaining a slightly more dynamic linear character. In addition, the winds introduce their own sieve, a transposition of the familiar *Jonchaies* (1977) scale with its cyclical intervallic pattern and pelog flavor, in contrast to the more chromatic material of the strings.

By m. 4 the music shifts, as the winds drop out and the strings join together for a chorale-like phrase harmonized with thick twenty-note chords. The next measure, though, the strings drop out in favor of the winds, who return with similar material to the opening, ending the passage on a held twenty-note chord derived from the *Jonchaies* sieve. The first six measures, then—the opening minute—already give shape to an elaborate formal structure. And so it goes. The opening string material returns in m. 7, while the tuba joins in with a series of rather virtuosic phrases, fleshed out with punctuating chords in the piano. The emphasis on the low register is filled out by closely voiced, layered phrases in the bassoons and trombones. At the same time, the strings rein in to a single rhythmic structure, switching to full clusters by m. 12. After a break at m. 13, for strings alone, the low instruments enter again, playing clustered rising scales in succession: bassoons, horns, trombones, tuba/piano. The winds overlap with the entry of the strings as they return to the opening material. This recall is brief, though, as the winds take over with harmonized, wavelike contours, each of the eight layers (the eighth being the tuba in consort with the piano) following independent trajectories. At m. 19, the strings play slow-moving massed clusters, continuing, with occasional breaks of the phrase, to the end of the passage at m. 25. Like *Kyania*, the music to this point ebbs and flows, building up some momentum for the more extended passage lasting from mm. 19–25 (a duration of well over a minute).

At this point, about one quarter of the way through, a strange rhythmic passage makes its appearance. This material is noticeably similar to the dancelike interlude in *Dox-Orkh*, but the cluster attacks that are traded off from one instrumental group to another are diffused by the addition of thirty-second-note subdivisions and a quiet, sustained “resonance” in the violins. The sense of meter that makes the passage in the earlier piece dancelike is missing here; the patterns shift too much (the double bass rhythm is 2–3–3–2–2–1–3–4–2–2–2–2–3–2–1). The patterns then spin off into a thick seven-part counterpoint of rhythmically layered clusters for the full orchestra.

At m. 29 the strings carry on alone, returning to the opening material (four-note sieve chords rather than clusters), here more active in each of the five layers. Quickly, the strings shift gears, slowing back down to the more sustained sound of earlier passages. This, too, is a short-lived gesture, turning to more harmonically static,

The image displays a musical score for the opening of the piece 'Roái'. It features a staff with a treble clef and a key signature of one flat (B-flat). The score is divided into two systems. The first system shows a melodic line with various ornaments and a series of four-note chords. Below the staff, there are five rows of chord diagrams, each labeled with a string instrument: VI (Violin I), VII (Violin II), Va (Viola), Vc (Violoncello), and Kb (Kontrabaß). Each diagram shows the fingerings for the four notes of the chord. The second system shows a bass line with a similar melodic and chordal structure.

Figure 32. *Roái*: Structure of opening string material, showing distribution of ordered four-note chords.

rhythmically articulated material at m. 34 as the winds join in. A staccato outburst by the full orchestra on a sustained cluster at m. 37 leads to a long descending glissando in the violins. It eventually settles on a sustained cluster that, after a brief flurry of activity, leads to an interlocking, contrapuntal passage of narrow clusters involving the brass, with occasional expansion into the strings. This recalls the opening measures, of course, but the single-line phrases of the tuba stand out, with their resemblance to a traditional bass line.

At m. 45 the strings enter again with a slow-moving melody filled out by a giant cluster. While the rhythmic density fluctuates, the strings continue in this fashion through the next section, the phrases being intercut with lengthy rests. Along with the strings, the brass enter at m. 49, continuing, with breaks, through to m. 69, with the woodwinds joining in by m. 59. This is an interesting passage, as the brass chords are accented by piano doublings, and Xenakis explores a sort of *Klangfarbenmelodie* by switching instrumentation with each chord, continuity being provided by the presence of the piano throughout. The piano drops out by m. 62, though, leaving the narrow-ranged chorale (not derived from the *Jonchaies* sieve) to be carried along by the kaleidoscopic succession of winds. Soon thereafter, at m. 67, the chorale begins to branch off into different layers, filling out to huge tutti chords by the end of m. 69. From that point, the winds and strings are matched, and the passage which follows builds upon the interaction between the two, finally linking them for a descending passage of clusters. The cadential nature of this gesture is heightened by a long decrescendo through the falling off of the phrase.

The following section returns to the narrow brass harmonies of the previous section, the colors changing through overlapping attacks of the otherwise highly sustained sound. Gradually, the horns and trumpets begin to interject fast little runs within the same middle register, as do the strings, who play a counterline to the evolving brass sonority. This passage represents the clearest linear statement by the strings, moving in parallel as a five-note chordal entity derived from a different sieve than previously. By m. 81, as the fast runs begin to saturate the music, the strings shift back to large clusters. An upward

glissando in the violins signals a new section of activity, with the strings playing a counterpoint of three layers of rapid cluster figurations. Set against this, the winds sustain interlocking chromatic chords. A final rising string glissando closes this section, triggering an unusual tutti passage in the winds. This material looks back to the cellular automata of *Horos* (1986) and *Ata* (1987), conceived in a slightly more linear fashion. The winds play a stretch of eight-note chords, but, unusually, not in parallel. Every chord is rescored so that the mix of instruments and registers changes with each. The overall contour is shaped not only by register, but also by timbre. This novel form of orchestration also serves as a variation of the earlier *Klangfarben* section, the melodic sense of the music here being more explicit.

At m. 91, the linear flow of the music is passed to the strings, carrying on in huge parallel clusters. The winds revert to the mixed chordal texture of the previous section. After that, the string clusters and wind chords lock up against one another in two statements of an enormous repeated chord following the iambic long-short pattern familiar from any number of earlier scores. Finally, at m. 100, the two groups go their separate ways, the strings continuing with the cluster contours broken up at mm. 103–5 by a pyramid of entries, sculpting a descending-ascending pattern out of the ongoing sonority. The winds return to their interlocking chords, implemented here in a systematic fashion. Xenakis creates four instrumental combinations—oboes/trumpets/piano (bass register), bassoons/tuba/piano (chord, midregister), clarinets/trombones, and flutes/horns—by which he unfurls varying harmonic sonorities following a cumulative rhythm comparable to the opening string passage. Here, the chords are not drawn from a closed set. Each is strongly attacked then quietly sustained, creating a pointillistic accent-effect amid an intensely thick texture. At m. 109, the tempo slows, and, with another clear bass line intoned in octaves by the low strings, the music comes to a close, another sustained string cluster fading out over the concluding notes of the bass.

Roái is closest in conception to *Kyania*, if somewhat more modest in scope. The two share a similar concern with musical flow, on the level of formal construction, with materials being stated, giving way to something else, then returning in varied form later on. The playing off of the strings against the winds, and the overlapping of sonic entities, widens the music's scope, allowing for counterpoint both within textures as well as between them. The concern for pitch organization is less focused than it is in *Krinoidi*, though the modal elements are there along with the dialectic of sieve-based versus chromatic harmonies. Both of these scores, even more so than in *Kyania*, are almost unrelentingly thick, perhaps as a consequence, after two concertos, of not needing to worry about balancing a soloist. The rapid rate of sonic shifts, though, provides the music with formal articulation or perceptual signposts.

For a composer approaching seventy years of age and suffering from ill health, the achievement of these five substantial orchestral scores within the space of one year is indeed impressive. They would go on to be the highlights of various festivities surrounding Xenakis's anniversary year, celebrations that stretched from the 1991/92 concert season right through the next. This would prove to be the composer's last great burst of compositional activity.

La Déesse Athéna, The Bacchae

Over the next few years Xenakis turned his attention back to the stage and to the ancient Greek masters he had so long revered. A new production of *Oresteïa* was planned for the spring of 1992 in Athens. For this auspicious occasion, Greek Radio commissioned a new composition to extend his existing suite. The 1987 addition of *Kassandra*, for solo voice and percussion, considerably altered the tone of the music, originally extracted from the choruses of the 1966 incidental score. The more “objective” tone of the chorus texts had seemed to match best the intention of producing a concert work. When the idea of staging the suite developed, it made good dramatic sense to insert the voice of a character into the proceedings. For this new presentation, Xenakis chose to balance the disturbing premonitions of Cassandra in the first part of the trilogy with the more magisterial pronouncements of the goddess Athena. In the selected passage, she establishes the first human tribunal, or council of judges, for the citizens of Athens to deal with injustices in a better way than the bloody and agonizing path of the drama to that point.

La Déesse Athéna is meant to be inserted in the middle of the third movement of the original set, *Les Euménides* (it can also be performed as an independent piece), formally balancing the insertion of *Kassandra* in the middle of the first movement, *Agamemnon* (see table 15).

The extended baritone voice and obbligato percussion (here limited to a set of seven drums) are featured again, this time joined by the instrumental ensemble of *Oresteïa* (minus the three ensemble percussionists).

The music, shorn of the shouting of the chorus and the massed percussion effects of the surrounding music of *Les Euménides*, is highly concentrated, but no less dramatic for that. The baritone, shifting between high falsetto and low register with characteristic unconcern for the extreme difficulties of such a feat, is meant to evoke the female and male natures of Athena (unlike *Kassandra*, where the separation of register portrays the dialogue between Cassandra and the chorus). The percussion offers commentary with its intermittent flurries of patterns and polyrhythms. The ensemble, oriented toward registral extremes, takes a vertical sonority from *Les Euménides* as its point of departure, sounding a variety of blocklike sonorities, but returning often to the opening chord.

There are a couple of noteworthy moments in *La Déesse*. At m. 19, as Athena states, “here from the heights, terror and reverence, my people’s kindred powers,” the ensemble shifts away from the dissonant, Varèsian sonorities to a richly harmonious major third, widely spaced with the low *B* doubled in octaves. Soon, the sustained upper note shimmers with trills that spread out to form a high band of sound. The intensity of clustered high and low sounds soon returns, but this moment of light is striking, whether intended programmatically or not. At m. 39, with the phrase “The stronger your fear, your reverence for the just, the stronger your country’s wall and city’s safety,” Xenakis switches to a diatonic mode, creating a high, rhythmicized melody from interlocking notes and short phrases. Texturally, this passage is not so different from other episodes, but the “archaic” modal sonority definitely stands out. Within the context of the whole of *Oresteïa*, with its strange

Table 15. Definitive Organization of *Oresteia*
(timings taken from existing recordings).

<i>Agamemnon I</i> (1966/69)—9'44"—male chorus, ensemble
<i>Kassandra</i> (1987)—13'47"—baritone with psaltery, percussion
<i>Agamemnon II</i> (1966/69)—4'45"—male chorus, ensemble
<i>Les Choéphores</i> (1966/69)—11'44"—mixed chorus, ensemble
<i>Les Euménides I</i> (1966/69)—3'48"—mixed chorus, ensemble
<i>La DéesseAthéna</i> (1992)—7'55"—baritone, percussion, ensemble
<i>Les Euménides II</i> (1966/69)—4'34"—mixed chorus, children's chorus, ensemble

mixture of elements, these passages are less unusual and more integrated into the scope of the music overall.

The final ensemble passage is the most dynamic, with all of the instruments tracing a slow wavelike undulation, the high instruments rising, descending, then rising again, while the low instruments do the opposite. This prepares the concluding statement of Athena: "These words I have unreeled are for my citizens, to rouse you to your future." In spite of this exhortation, Xenakis sets this phrase with steely pizzicato glissandi in the cello, a reference from the past, his music for Seneca's *Medea* (1967).

Xenakis's *Oresteia* has proven popular, considering the forces required to mount it. In that season of seventieth-birthday celebrations, it was presented there in Athens, and by different companies/ensembles in Brussels, Paris (and on tour to other French cities), London, and Amsterdam. Parts of it were also included in a hybrid music-theater presentation of various Xenakis compositions titled *Histoire d'un Faust*, produced by Roland Auzet, a spectacle that toured throughout France and beyond. The 1995 production at the ancient amphitheater in Epidaurus would no doubt have been one of the most satisfying for the composer, as this was the scene of his first incidental music, for Aeschylus's *The Suppliants*, back in 1964.

By 1993, though, Xenakis was turning his attention to Euripides and another of the venerable Greek classics. David Freeman of London's Opera Factory invited the composer to provide the music for a production of *The Bacchae*, a drama is about the Bacchic worship that Dionysus incited of women.

When the king of Thebes, Pentheus, tries to infiltrate the ritual, he is torn apart by the cult, led by his mother, who only discovers his identity afterward. It is a brutal, wrenching story, but one that is difficult to stage because so much of the action is actually reported rather than shown. With Freeman planning to stage all of the action instead, Xenakis was free to set the five extensive choruses in Greek, creating a more abstract musical interpretation in parallel to the presentation on stage.

The choruses are relatively simple, though the women's voices are intensified a great deal by the addition of a small wind ensemble, most often sustaining dissonant sonorities in the high and low range as in *Oresteia*. In addition, there are many short percussion outbursts during the choruses as well as at other moments, adding a vivid, ritual sonic element to the drama. Dionysus sings too, at times, conveying an element of androgeny

through the splitting of the voice into high and low registers, as with Athena. Altogether, the music carries through close to half of the drama, though it is always incidental rather than the primary focus (unlike *Oresteia*).

Reviews of *The Bacchae* were mixed, some liking the music but not the explicitness of the drama, some liking the staging but not the abstractness of the music.⁹ The composer sees strong affinities between Greek drama and Japanese Noh theater, itself a genre that is far from universally accessible. Still, James Wood and his New London Chamber Choir presented a concert version of the choruses in 1996 at the Evreux Festival, so, like his earlier music for the stage, Xenakis's score to this great Euripides drama is finding an audience beyond the original production.

It is remarkable that for a composer with a reputation for fierce, uncompromising music rooted in the most advanced, abstract thought processes and creative discipline, Xenakis wrote such a quantity of incidental music. All of it, of course, is tied to the ancient tragedies (he never did set a comedy) he had steeped himself in from the days of his youth. It is quite clear, too, that such influences have strongly affected his music as a whole. François-Bernard Mâche puts it well when he states, "Xenakis has remained faithful to that inner Greece which, it seems to me, he has chosen to recreate.... These groups of myths form a network of meanings clearly connected to the personal history of the composer...but, and this is their real significance, they are also connected to the universal passing of this fascination.... Greece invented Reason only because she knew herself basically to be wild and mad.... The composer has, more than once, recognized that Reason never has the last word" (1993, 210).

Paille in the Wind

Prior to setting to work on *The Bacchae*, Xenakis completed two relatively modest pieces for performance late in 1992. The first, completed in April and written for long-time collaborator Roger Woodward and cellist Jacopo Scalfi, is a short (not sweet) duo for cello and piano. *Paille in the Wind* (*paille* means "straw"), its title recalling *Jonchaies*, is like none of his earlier works, and certainly not at all like *Charisma* (1971), the other short duo involving cello. While that score is extremely dramatic and wide ranging in its sonorities, the newer one, under four minutes in length, is much more concentrated in design.

The piece opens with a lengthy piano solo in which each hand plays five-note cluster chords derived from a single sieve. The music expands outward from the opening until the full scope of the keyboard has been set into resonance (the pedal is held down for long stretches). While sonically restricted, this material is nonetheless shaped in a highly expressive way. The rhythms, notated as straight eighths or quarter notes (there is an inexplicable switch in the middle of the passage from quarter note=40 MM to eighth note=40 MM), are made rubato through the liberal use of fermatas. The dynamics, too, are shaped with care; after the opening *ff* barrage, the dynamic level drops to *p* (one of very few moments), crescendos to a maximum—*fff*—then drops back to *mp* for the entrance of the cello.

With the piano resonating its final chord (the highest and lowest chords of the sieve), the cello enters softly, intoning a slow, low-register phrase that leads to a double stop, at which point it begins a huge crescendo to reach *fff* in four beats. After the opening phrase,

the cello no longer follows the piano's pitch sieve, but instead builds upon double stops and a melodic arch centered around the open strings. No doubt Xenakis was interested in drawing upon the added resonance and power of the open sonorities, colored by dissonant neighboring intervals (rendered all the more intensely by the lack of vibrato throughout).

After a lengthy solo, the piano joins the cello at m. 16, offering two intermittent chordal punctuations of the ongoing line. As the cello winds back down to the low register at mm. 22–23, the piano contributes a more extended commentary, built from the five-note cluster chords of the opening section. Ending with a final chord resonating as before, the cello enters again, this time on a high note (*G*₅), going on to etch a large undulation down, back up, then down finally to the low open *C* string, intensified by the addition of a major seventh above. The piano contributes just two more chords in this closing passage, both in the upper register, balancing the low rich tone of the cello.

Paille in the Wind, considering its status as a miniature, is in reality an intensely focused work. The cello part demands enormous strength and control in order to project the successions of double stops at maximum volume. The harmonic color of the sieve, set into resonance by the piano, creates a soundscape, or atmosphere, from which the powerful cello line is wrought. There is no doubt the cello remained one of Xenakis's favored instruments. He would return to it again in the years to come.

Pu Wijnuet We Fyp

The other project of 1992 was a work for children's choir. Xenakis had made use of children's voices twice before: in *Polla ta dhina* (1962), and in the final movement of *Oresteia*. The choir part, though, consists of very simple monodic chanting in both. *Pu Wijnuet We Fyp*, by contrast, is a fully conceived, challenging work, perhaps inspired by the addition of grandchildren to his own life. The title, and the text, derive from an anagrammatic reconfiguration of a poem by Arthur Rimbaud. Characteristically, Xenakis invites the children to solve the code and discover the original text that inspired the piece.¹⁰

As well, this score does not fit into a repertoire or tradition of choral music for children, apart from being written in the treble range. Its difficulties are such that few choirs would be capable of taking it on. The voices are subdivided into as many as twenty-one parts, though much of the music is scored for two or three, each harmonized by parallel clusters. The textural shifts are numerous, the most striking being the rapid alternations between full choir and two soloists. The pure timbre of the children's voices, in these passages singing a counterpoint of predominantly open or dissonant intervals reminiscent of *À Hélène*, is quite beautiful.

In terms of overall structure, *Pu Wijnuet We Fyp* is organized around a tripartite form, each highlighting a different contrapuntal conception. The first, after an opening eight-voice passage of overlapping chords, divides the voices mainly into two, most often alternating between clustered voicings of up to seven parts and solo passages for two individual voices. The second large-scale section begins at m. 18 with a solo passage that gradually opens out to a harmonic texture of eleven parts. At m. 22, the choir is divided into three groups, exchanging unison lines and vertical sonorities of up to seven-part clusters. At m. 31, the choir returns to distributed chords, like the opening, this time in thirteen parts. From there Xenakis pits fourteen-voice cluster glissandi against a solo line,

followed by a lengthy passage for the two solo voices (at last). The final chordal section, divided into two, is lengthier than any previous segment. The first part unites the choir into a single rhythmic layer, the melodic organization fluctuating between two and seven parts. The closing phrase is again harmonic and sustained, the notes being distributed across six layers.

Xenakis makes use of sieves, but none are used so consistently as to be easily recognizable. The melodies are built from a mixture of intervals, but the almost ubiquitous thickening of the lines with chromatic clusters tends to obscure the timbral-harmonic character of the music, a hitherto important element of his sieve-based music. In fact, *Pu Wijnuej We Fyp* heralds a new phase in Xenakis's music (even if already present in varying degrees). In this, the linear structure (melodic intervals) becomes separated from the harmonic structure. The clusters are used to intensify the sonority, to increase the sonic density rather than to convey a sense of harmonic color (as in *Paille in the Wind*, for example). The melodies, too, are conceived in a more dynamic way. The constant use of pitches derived from a sieve lends a distinctive character to the music, but it also guarantees a certain degree of stasis. This intervallic anchoring is an important component of much modal music throughout the world (such as the gamelan music that obviously inspired Xenakis). But in some of these later scores, Xenakis turned his attention to evolving linear structures with a great deal more intervallic variation and development. This approach, also incorporating melodic shaping and contour variation, relates to his algorithmic generation and variation of waveforms in his dynamic stochastic synthesis computer program.

Mosaïques

With *The Bacchae* set to be premiered in September, much of 1993 was spent on that project. Along the way, though, Xenakis responded to a request by Michel Tabachnik, one of the major proponents of his music (having already conducted a dozen or so premieres). As director of the Orchestre des Jeunes de la Méditerranée, Tabachnik, who had performed other Xenakis works with the youth orchestra over the years, was persistent in his requests for a new piece. Finally, the idea of creating a "mosaic" of quotations from existing orchestral works came up, and the composer agreed to the idea. In the foreword to the score, Tabachnik equates its seventeen sequences with the seventeen Mediterranean countries represented in the orchestra. Xenakis's scores have often been inspired in some way by the sea, so that already created an affinity with this geographical conception.

Xenakis chose to extract short segments from five recent works: 1987's *Ata*, 1991's *Kyania*, 1991's *Troorkh* and *Krinoïdi*, and 1992's *Roái* (see table 16). The order of presentation of the seventeen excerpts is left to the conductor, making it a mobile form. Though each one concludes with a fermata, the intent is that the segments should follow one another without break.

A wide range of materials are represented, including clusters, rhythmic passages, interlocking melodic patterns, sieve-derived lines and harmonies, different combinations of instruments, and so on. But, as Tabachnik tries to emphasize, the elements of this mosaic are "of the same essence" because they are all by Xenakis, and from within a relatively short time span, five years (Tabachnik 1993).

Table 16. Extracts used in *Mosaïques*.

Extract (in <i>Mosaïques</i>):	Score (taken from):	Measure(s) (of original score):
A	<i>Ata</i>	40–44
B	<i>Kyania</i>	121–25
C	<i>Troorkh</i>	1–3
D	<i>Kyania</i>	67–69
E	<i>Ata/Kyania</i>	126/48
F	<i>Roài</i>	64–70
G	<i>Ata</i>	73–75
H	<i>Kyania</i>	40–42
I	<i>Roài</i>	51
J	<i>Troorkh</i>	37–39
K	<i>Roài</i>	25–29
L	<i>Ata</i>	52–55
M	<i>Kyania</i>	55–59
N	<i>Roài</i>	47–49
O	<i>Roài</i>	34–36
P	<i>Kyania</i>	11–14
Q	<i>Krinoïdi</i>	73–76

That Xenakis would undertake such a “postmodern” project may seem disconcerting; but considering how often he included brief references to existing fragments in his scores, the self-quotational mosaic is less far removed from his ordinary compositional practice than might be apparent at first. In this respect, Excerpt E is the most telling, given that it is a brief segment common to both *Ata* and to *Kyania*. In fact, this measure goes back to *Horos*, taken from the implementation of cellular automata in that score in 1986.¹¹

Plektó

After the protracted effort of completing the music for *The Bacchae*, Xenakis mustered his powers to create an entirely new chamber work in response to a commission for the Köln Ensemble to be premiered at the Wittener Tage für New Kammermusik in April 1994. At fourteen minutes in duration, *Plektó* turned out to be one of his most substantial chamber works in some time. The instrumentation is a “Pierrot” ensemble (flute, clarinet, violin, cello, piano) minus the voice and with the addition of percussion (using a restricted palette of five woodblocks and seven drums). For this, perhaps the most influential chamber instrumentation of the twentieth century, Xenakis composed a lean,

contrapuntal score, mitigated on occasion by weighty chordal passages in the piano and short flurries in the percussion.

The title means “braids,” and this image is made manifest in a number of ways. There is, first of all, the intertwining of the wind and string lines, as in the beginning (mm. 1–21). Rhythms and notes are woven together, each instrument drawing upon a limited number of pitches, each set being partially shared by one or more of the other instruments. It is worth noting the variational nature of the phrases, even though the thematic connections are tenuous at times. There is also a dialogue woven among the group of four sustaining instruments and the more percussive piano, and eventually the percussion itself. During the opening section, the piano’s chordal statements are at first set in opposition to the phrases of the other instruments, but by m. 13 the two strands of music are brought into juxtaposition.

This formal culmination prepares the entrance of the percussion, at m. 16, which proceeds for three measures on its own, with three minor interjections by the piano or flute-clarinet pair. At m. 19, the situation is reversed as the rest of the ensemble enters for a final burst of the opening material, the percussion being relegated to just one brief outburst. This brief gesture in the percussion, though, is reflected by similar gestures in the flute and cello (m. 21), which transgress the boundaries of the ongoing material of each instrument’s part. In summary, then, the opening section introduces three strands of music: the linear, contrapuntal music of the winds and strings; the chordal music of the piano; and the rhythmic patterns of the percussion. The fluctuating manner in which each is deployed constitutes another element of the musical weave.

The next brief passage integrates the piano into a melodic texture involving the clarinet and cello (mm. 22–27). The clarinet and right hand of the piano spin out a narrow, modal melody that is set off by a quasi-tonal bass line in the cello, doubled an octave lower by the piano’s left hand. This music is reminiscent of the violin/horn passage of *Dox-Orkh*, with a similar “tonal” opposition between upper and lower parts. After a brief interlude of percussive chords on the piano, a similar passage returns (mm. 29–34). This time, the flute sings a lyrical, narrow-spanned melody over a resonated three-note modal sonority in the clarinet, violin, and cello. The piano chords return at the end of m. 34, this time in the company of woodblocks. At m. 40, the clarinet’s material from m. 22 returns in the violin. Here, the music is molded to fit the opening material, with the other melodic instruments creating counterlines in close registral proximity to the violin (the clarinet being paired rhythmically with the violin, the flute with the cello). As before, each instrument draws upon its own set of partially overlapping pitches, the modal nature of the main melody being obliterated by the other parts. The woodblocks continue their dry interjections throughout.

At m. 43, the music shifts to a series of short statements by different individuals or pairs of instruments. At first overlapping, these are eventually fractured by abrupt shifts from one to another. To begin with, the winds and strings are treated in pairs, but thereafter they act as a single unit, in opposition to the piano and percussion (which for this section shifts back to drums). After the initial few bars, the primary character of these blocks is rhythmic, with the piano playing chordal polyrhythms in opposition to the regular pulsations of both the drums and the winds/strings. At the end of this section (mm. 55–57), a more complex statement by the percussion leads to a final outburst by the rest of the ensemble, cut off to make way for the fourth section.

In a remarkable passage that looks back to 1975's *Phlegra* (although much slower in tempo), the six instruments launch into layered pulsations on fixed pitches (forming a cluster, overall), each player essentially following an independent tempo. The drums begin with more elaborate patterns, but by the time the piano enters at m. 62, these patterns subside to a steady pulse. At the same time, the melodic instruments begin to break away to undulating melodic contours, the piano paralleling this movement with two streams of chords. At m. 64, most of the instruments drop out, leaving the flute and cello to continue their lines, along with two brief piano interjections. The final section begins at m. 67, the contours continuing at a faster pace, turning into glissandi for the strings at m. 68 and the winds at m. 70. The piano shifts to a fixed-interval chord at m. 70—two series of three perfect fourths a half step away from each other—and the percussion contributes intermittently on the drums.

The overall progression of *Plektó* is toward increasing continuity, both in terms of melodic construction (becoming more scalar, evolving finally into glissandi) and formal structure. The final two sections are conceived as sustained gestures rather than successions of smaller units. On the level of pitch organization, the overlapping sieves used for much of the piece become subsumed by the oscillations of the glissandi. The piano, though, continues holding to its chordal structures right up to the final few measures, when it shifts to the superimposed fourths. In fact, the piano part is highly organized in combinatorial fashion. Xenakis created a set of chords, each built from a close voicing, not derived from a single sieve (but neither are they chromatic clusters). In the first section, there are eleven chords, ranging across a span of over four octaves. The succession of chords is unpredictable, but the set is fixed. In the second section, Xenakis expands the set to twelve, but locks the two hands together, essentially creating six large chords, three having been held over from the previous set and three being new. A similar process governs the chordal passages of the remaining sections, with a few sonorities being added and a few dropped.

Plektó is an elaborate chamber work, even if relatively transparent in comparison to the recent orchestral and ensemble works. There are a number of strands and layers to the music, as the title indicates (and as relates to the interacting “currents” of *Roïi*). The treatment of the heterogeneous nature of the ensemble makes this piece something of an anomaly in Xenakis's later output. The chamber works to follow, such as *Ergma*, for string quartet, are much more vertical and organlike in conception. Could this be his tribute to Arnold Schoenberg? If so (and any such homage is far from explicit), then the next score might well be seen as a tribute to Richard Wagner.

Dämmerchein

Xenakis enjoyed quite an extraordinary degree of support over the years from two organizations: the Gulbenkian Foundation in Lisbon, through the efforts of Lui Pereira Leal, and Westdeutscher Rundfunk (WDR—West German Radio) in Cologne, through Wolfgang Becker (see table 17). It is unusual for composers of other nationalities to be commissioned more than once or twice by any patron based in a particular country. That Xenakis would have received a whole series of grants from these institutions speaks both to his reputation as an original creative force and to his ability to attract funding.

These two organizations came together for a major orchestral commission, to be premiered in Lisbon by the Westdeutscher Rundfunk Orchestra conducted by Zoltán Peskó at the Gulbenkian Festival in June 1994.

Dämmerschein (“light of dusk,” “rays of twilight”), while not Xenakis’s last orchestral score, is his most substantial work of the years following 1990–91. The orchestral pieces that follow become progressively shorter and, while certainly not inconsequential, are less fully conceived as large-scale forms. At fourteen minutes, *Dämmerschein* is by no means Wagnerian, but Xenakis does indeed treat the orchestra as a gigantic, richly colored instrument, as did Wagner. One of the most striking features of the score is the spatial element. This is expressed in two main ways. First, as evidenced right at the opening, short cluster attacks are tossed around the various orchestral groups, creating a disjunct *Klangfarben* contour that is also structured in space. Similar material was introduced in *Dox-Orkh*, but here it is much more developed. Second, there are many passages in which sustained-note or cluster entrances are staggered across the orchestra (or subdivisions of winds or strings). These sculpted sonorities sweep up or down the registers (and across the disposition of the musicians onstage), often in a layered fashion to create even more complex trajectories.

The rhythmicized entity dominates first. The opening passage, going into m. 3, is actually lifted directly from *Rodāi* (mm. 25–27). The violins carry on a sustained

Table 17. Commissions from the Gulbenkian Foundation and Westdeutscher Rundfunk.

Gulbenkian Foundation	Westdeutscher Rundfunk
<i>Nuits</i> (1968)	<i>Khoāi</i> (1976)
CEMAMu—digital equipment (c. 1971)	<i>La Légende d’Eer</i> (1977)
<i>Cendrées</i> (1974)	<i>Nekuia</i> (1981)
<i>Psapha</i> (1975)	<i>Alax</i> (1985)
<i>À Colone</i> (1977)	<i>Tetora</i> (1990)
<i>Tetras</i> (1983)	<i>Dämmerschein</i> (1994)
<i>Ata</i> (1987) [with Sudwestfunk Baden-Baden]	[with the Gulbenkian Foundation]
<i>Dox-Orkh</i> (1991) [with Musica—Strasbourg]	<i>Roscobeck</i> (1996)

line of clusters, changing pitch level with each attack to produce a dynamic element amid the mostly static clusters of the rest of the orchestra. Similar material continues right up to m. 15, though there is one brief interlude for solo string quartet. This unusual passage shifts the focus from the orchestral mass to a chamber setting of four melodic lines, set pitches being interspersed with narrow glissandi. That a similar passage never reoccurs renders it all the more distinctive in terms of formal placement (neither is it taken up in the string quartet Xenakis would complete later that year). After this interlude, the orchestra continues as before, with the sustained sound expanding to include the violas and cellos. (That the quartet gesture is placed between two passages featuring the sustained strings may offer one explanation for its inclusion: that is, to offer a different

perspective on the linearity of the strings in an otherwise highly vertical, rhythmical texture.) At m. 6, the strings drop out and the sustained sonorities shift to the high woodwinds and then, when the strings join back in, to the horns. At the same time, each layer becomes less static, creating a sort of granulated counterpoint highlighted in the passage from m. 10 on, when the sustained element drops out completely.

There is a sudden shift in sonority (and spatial coherence) at m. 16 as the winds drop out to leave the strings playing an active passage of parallel clusters. This is followed by an explicitly spatial gesture that serves to introduce the sculptural effects that dominate much of the rest of the piece. A fixed cluster is passed off from one wind family to another, in score order (e.g., flutes, oboes, clarinets, etc.) and then back again to the top, each attack resonated by one of the five layers of strings, briefly sustaining a cluster that expands outward by step with each entrance and then contracts again. This rather subtle choreographic moment is followed by a rhythmically regular succession of short, cluster-thickened motives passed off from one group to another, each sustaining its final sonority until the full orchestra has joined in. At m. 21, these motives expand into longer contours, superimposed rather than ordered. The transition to a more sustained, melodic sound leads directly to layered material in subgroups of the orchestra, each following its own tempo (subdivision of the beat). The flutes and oboes carry on from the previous passage, succeeded by the brass with bassoons, and finally the strings in clusters, tracing a melodic contour by means of parallel glissandi. This layered melodic material continues at m. 43, but there is another sculptural episode in between.

At m. 29, as the strings finish the glissando phrase, each instrument jumps to a central *E4*, following score order, from the highest and lowest inward. Once every instrument has landed on the unison, a cluster begins to expand from the center outward. When it is filled out completely, the strings shift to a soft dynamic level, sustaining their sonority as the winds create their own spatialized flux. The high woodwinds and bassoons/brass are treated separately, the upper group beginning to fill out its cluster below a high *G6*, adding the notes one at a time, with the lower group starting on a low *D3* and expanding upward. The rates of succession are not the same, so, over the course of the nine measures of this gesture, the bassoons/brass fill out their cluster up to *D#5*, descend again to *F3*, then climb back up to *D5*, finishing on *Bb4*. The woodwinds drop from *G6* to *B3*, climb to *F6*, then finish on *Ab5*. The almost imperceptible evolution of the clusters make for a beguiling perceptual experience, with the added weight of a counter sonority in the strings—parallel clusters shaping a slow-moving line.

The layered melodic material returns at m. 43 and the pace drops dramatically (to sixteenth note=42 MM). The twelve melodic strata (harmonized in clusters) follow their own rhythmic subdivision, creating an extremely concentrated polyphonic texture. The music breaks free of this morass at m. 49 with a bipartite spatial music for winds and strings. The strings slowly sweep through the registers with clusters that are sustained through the succeeding entrance, moving down and up through the five groups of strings. The winds, too, move through ordered successions of clusters, but their progression is more complex, the orders of entrances not being consistent and the degree of sustain also fluctuating widely. The density and mixed succession of the wind material becomes such that the music starts to resemble the granulated texture of the opening. The chaotic nature of this passage is quickly reined in, followed by ordered “pyramids” interspersed with elephantine trills for the full orchestra.

The next passage is quite extraordinary. It consists of layered polyrhythms involving seventeen layers of strings and each individual wind instrument (for a total of twenty-nine). The tempo drops (to sixteenth note=40 MM), and the strings play staccato articulations of twenty-one fixed pitches spread across their full range, each layer pulsating at a different rate. Then, the instruments drop out one layer at a time, from the bottom up, creating a slow ascent in the cumulative sonority. At the same time, the winds, starting with the low brass, launch into melodic sequences, each following a regular rhythmic pulsation that traces a unique trajectory of polyrhythms (e.g., tuba: 7:8–5:6–4:5–4:5–5:7–5:8–5:9–5:8). The entrances follow score order from the bottom up, filling out the sound in an ascending fashion, in imitation of the strings. At the end of m. 64, all the winds sustain the final note of their phrase, creating a large, widespread sonority gradually filtered out from the bottom to the top.

An extended section of sculpted sonorities follows, carrying on to the end. The strings enter again at m. 66, filling out a large cluster from the top down, followed by the winds in similar fashion. At m. 69, Xenakis launches a series of rising gestures, the overlapping sustained clusters of the strings succeeded by punctuated attacks in the winds. These shapes begin to overlap, creating a complex texture in which the ordered progression of different layers becomes extremely difficult to discern. The closing gesture sets an oscillating pattern of two clusters in the strings against a final sustained sonority in the winds, filling out from bottom to top then shifting to flutter tongue. A final accented cluster in the winds fades out together with the sustained string cluster.

There is little recognizable reference to pitch sieves in *Dämmerschein*. Some of the melodic material is quite restricted, even modal, but when it is paralleled by other members of the same instrument family a sequence of half steps lower, filling out the almost ubiquitous clusters, the character of the intervallic structure is weakened. The music is concerned with mass and with intersecting and layered trajectories, both of sonority and of rhythm. The density of the music is often of an incredibly high order, creating a sonic intensity that is palpable, especially in the concert hall. Xenakis shaped the sounds with great care, and was obviously concerned with integrating the various types of materials (perhaps with the exception of the passage for string quartet) in order to create an organic form. The rhythmic atomization of the orchestra heard at the beginning gives way to more sustained, sculpted sonorities, but these two elements relate later, in passages where they are superimposed.

The difficulties facing the orchestra are formidable, as much as in any of his earlier scores. Still, the sense of mastery over the medium and the confidence by which this composer, having already penned dozens of symphonic scores, is able to express himself via the orchestra, come through strongly on every page. Although very different in style, *Dämmerschein*'s bold exploration of the spatial, massed properties of the orchestra bring to mind *Terretektorh* (1966), and even *Pithoprakta* (1956). This, though, was not to be Xenakis's *Parsifal*, a final crowning achievement. He had more music to write, and, like Giuseppe Verdi late in life, his thoughts would turn to William Shakespeare.

Sea Nymphs

Full fathom five thy father lies,
 Of his bones are coral made:
 Those are pearls that were his eyes.
 Nothing of him that doth fade,
 But doth suffer a sea-change
 Into something rich and strange...
 Sea-nymphs hourly ring his knell.
 Ding-dong.
 Hark! now I hear them—
 Ding-dong bell.

—William Shakespeare, *The Tempest*

It may have been the return to Spetse for the filming of Marc Kidel's BBC documentary on Xenakis, *Something Rich and Strange* (1991), that brought back the memories of reciting Shakespeare as a schoolboy. The aging composer, in any case, turned to *The Tempest* when asked to contribute music for the seventieth anniversary of the BBC Singers. With a strong interest in the sea (and a fascination with death), it was perhaps inevitable that Xenakis would select Ariel's song of the deeps to use as his source. To say that it serves as his text would be to put the case too strongly, though. Instead, syllables from *The Tempest* are randomly distributed throughout the score (perhaps even attached to the music after it was written). The semantic content of the words is obliterated, though the fact that the phonemes derive from an English text certainly implies that some syllables and words will be recognizable, unlike texts derived from ancient Greek. There is, however, little or no word-setting, in the programmatic sense, to be found in *Sea Nymphs* (1994).

The music is scored for twenty-four mixed voices, and uses multiples of six-note chromatic clusters exclusively, with the exception of brief solo passages scattered about. The formal shape of the score is built up in mosaic style; there are no obviously discernible large-scale sections. There is a fair degree of textural variation, nonetheless, not only in the contrasts between solo voices and the clustered choir, but also in the rhythmic density, degree of intervallic conjunction, and so forth. Even in the first few bars, the music shifts from a narrow, smooth opening for women's voices to a more elaborate interlocking treatment of the full choir, with wider intervallic jumps and brief interjections of a high solo voice, joined by another at m. 6 (the solo notes themselves form a smooth stepwise line). Faster, repetitive motives are introduced at the end of m. 6, and these form a structural strand that recurs at various points.

The solo passages become more prominent as the music progresses, expanding to incorporate a number of voices in brief contrapuntal phrases free from the thickening agent of clusters. They are often skillfully woven into the ongoing choral textures, at times creating resonances as clusters are cut off (mm. 19–21) or traditional harmonies

where a number of soloists hold their pitches (mm. 40–44). In terms of formal organization, while the piece is not conceived as a sequence of contrasting sections, there is, nonetheless, a passage toward the end that clearly reduces the harmonic and rhythmic density for several measures (mm. 34–44). After that, the full choir is brought in again for a final burst of maximal intensity before ending quietly with two female “nymphs” sustaining a high minor third and a final low cluster punctuation in the men’s voices.

Sea Nymphs proved to be Xenakis’s final vocal work. It is puzzling that his late choral style would adopt the chromatic cluster so readily as a means of intensifying the sonority. It is obviously extremely difficult for singers to hold their pitch in the midst of a cluster that often follows a disjunct intervallic succession. The BBC Singers, of course, as a professional choir specializing to a great extent in new music, are quite capable of singing what the composer has written. When the clusters are sung out with full intensity, the dense, vibrating sonority is rich (yes, and strange!). The contrast with the pure voices of the solo passages (1990s *Knephas* and 1992’s *Pu Wijnuet We Fyp* contain similar textural oppositions), also to be sung with no vibrato, is striking, and sets off the beauty of the individual voices (and isolated intervals or harmonies) remarkably well. Xenakis would return to *The Tempest* in 1997 for the title to his final orchestral work, also commissioned by the BBC. In the meantime, though, he was drawn to a different sort of purity and beauty, that of the Dutch painter, Piet Mondrian.

Ergma

As much as *Tetora* contrasts with *Tetras*, *Ergma* (1994) is different from *Tetora*, even though only four years separate them. The title, in deference to the austere art of Mondrian, means, simply, “finished work” (there is an etymological relation, via *erg*, to *Waarg*).¹² The word *minimalist* carries too many connotations to be used as reference, but highly concentrated this music decidedly is. The strings play double stops almost exclusively, and the intervals are almost exclusively major sevenths or minor ninths (though minor sevenths are also quite common). In addition, for much of the piece, the four instruments play together, often synchronized in their rhythms. The tempo, as with all of his later works, is very slow, and does not change. The abiding sonority is unrelentingly harsh and grating, as the dissonant intervals and strong dynamic markings engender such a tone. Within these constraints, severe as they are, there is a great deal of variation in the music, introduced incrementally.

In contrast to the parallel clusters of many of his works for larger forces, there is relatively little strictly parallel writing for the quartet as a whole. As a result, while dissonant intervals predominate, the specific content of vertical conglomerations changes from one chord to the next. The opening is a case in point. It makes for an interesting comparison to examine the closing passage for its intervallic structure as well. At m. 50, the four instruments do indeed shift to a mostly parallel motion, each playing successions of minor sevenths. The resulting chords are primarily symmetrical, featuring the tritone prominently at the top and bottom. The final chord is perceptibly more consonant, perhaps for cadential reasons; the upper notes sound a diminished seventh chord, and each instrument sustains a minor or major sixth.

Other textural elements are varied independently within the strict confines of the overall austere character. There are, for example, two passages where the instruments

break away from playing double stops. The first occurs in the midst of a passage otherwise notable for the liberal use of fermatas to emphasize a series of high tessitura chords (mm. 19–22). Beginning in the second beat of m. 20, the intervening material uses single-stop attacks to fracture an eight-note sonority by means of overlapping melodic diads in each instrument. By m. 21, this material is expanded to include a contrapuntal passage, eight notes in length, of just four voices. The music fills right out again, though, at m. 22, with a series of sustained, full-voiced chords. The other passage of single-stop writing comes at mm. 43–50, just before the closing section of parallel chords. This passage is definitely more lyrical, scored as four-voice counterpoint proceeding for the most part in rhythmic synchronization. The vertical structures are mostly dissonant, but they are intervallically mixed, and the first violin part in particular is smoothly melodic (even if the lack of vibrato constrains any traditional sense of lyrical expression).

Given that the strings perform primarily at a dynamic marking of *ff*, the character of the musical gestures is drastically affected. It is all the more striking then, when the dynamic markings change. The first shifts, jumping up to *fff* between mm. 6 and 16, are implemented in order to accent brief faster-paced gestures that begin to infiltrate at m. 4. Apart from these fragments, the rhythmic succession of the music proceeds rather uniformly in multiples of the sixteenth-note pulse in the range of 1–4. At m. 19, with the onset of the fermata chords, the ongoing dynamic level is again bumped up to *fff*, continuing on to the major textural change at m. 25. At that point, the other three instruments drop to what by that point would seem a whispery *p*, while the viola carries on a succession of *ff* double stops. This lengthy soloistic passage is followed by an exchange between *fff* outbursts from the full quartet, playing primarily thirty-second notes, and a duo of *mf* double-stop lines in the first violin and cello. By m. 43, the full ensemble wins out, pushing on to the end with a marking of *fff*. It is notable that the major formal contrasts, the viola solo and the violin-cello duo, are framed by radical shifts in the dynamic markings.

The other major parametrical element deployed in *Ergma* is the treatment of density. While homophonic, double stops are predominant, there is a great deal of filtering, where an instrument drops out for one attack by the other instruments, to join in the next, or where one or more instruments sustain a double stop while other instruments move to a new harmony. Fluctuation of density within otherwise unified textures occurs mainly in the first part, between mm. 1–9 and mm. 14–21. The other element concerning density derives from the ordered entrances of the instruments, each sustaining its double stop as the harmony gradually fills out (between mm. 7–9 and mm. 19–21).

Under a magnifying glass, then, *Ergma* is a richly detailed work. Its impact on the listener, though, is more along the monolithic lines, at least at first. The thick, jarring tones of the vibratoless, full-out ensemble, sounding thick, primarily dissonant harmonies, heighten this effect. It is said that the geometric designs of Mondrian—black lines on white with occasional lines or blocks of primary colors—create patterns of vibrations that carry the work beyond austerity of design to perceptual vividness. The same could be said of this late piece (among many others) by Xenakis. This quartet is, in any case, an interesting tribute to one modernist master by another.

Mnamas Xapin Witoldowi Lutoslawskiemu

Xenakis's next score, too, is highly concentrated and austere, while at the same time serving as a powerful evocation of a ritual for the dead. In this case, the music was written to commemorate the passing of Witold Lutoslawski. Xenakis, long a favored guest of the Warsaw Autumn Festival,¹³ was acquainted with the venerable Polish composer through Lutoslawski's involvement with the program committee of the festival. When asked to contribute to a tribute concert at the 1994 festival, Xenakis felt compelled to oblige.

Mnamas Xapin Witoldowi Lutoslawskiemu ("in memoriam Witold Lutoslawski"; a mixture of Greek and Polish) is a short piece for two trumpets and two horns. Rhythmically, one trumpet-horn pair is pitted against the other, but the timbral separation of the two instrument types produces a kind of double counterpoint of upper and lower voices. The dominant vertical sonorities are built from perfect intervals and neighboring dissonances, though this aspect of the music is not strictly controlled. The rhythmic flow is fairly uniform throughout, being multiples of the sixteenth-note unit with no cumulative duration (where all four players sustain their notes together) lasting longer than one beat (until the final chord). The texture is delineated in two main ways: through repetitions of a single pitch in one instrument or by sustained notes in one pair or the other, and through occasional unison doublings by the two trumpets or horns. These moments provide signposts in the ongoing flow, as do the high points of the melodic contours. Each line covers a range of little more than an octave, but the slight changes in registral emphasis—the trumpets climb to *A*5 at mm. 17–18, back down a little, then reach back up to *A*♭5 to end—serve as articulation points in a musical flow which otherwise has no breaks or rests.

Xenakis would return to similar two-part contrapuntal textures in 1996, with a pair of duos for string instruments. First, he turned his energies to a series of orchestral and ensemble works that would take him the better part of two years.

Koïranoï

Koïranoï ("leader," from Homer) is another of the many German commissions accorded Xenakis in the 1990s. This one was composed in celebration of the fiftieth anniversary of the Nord Deutscher Rundfunk Symphony Orchestra in 1995, though it was not actually premiered until March 1996. Unusually, the tempo marking is not given. Instead, the indication "langsam" is used. With a duration of about twelve minutes, the tempo would have to be eighth note=c. 25 MM, an incredibly slow pace. For the premiere, the conductor (Zoltán Peskó, who had also premiered *Dämmerschein*) adopted a tempo just about twice as fast, compressing the music into six minutes instead.¹⁴

Regardless of the pace, the music of *Koïranoï* is quite different from *Dämmerschein*. Perhaps most notable is the absence of clusters in the winds (the strings do carry on with full clusters, though there are few such passages of any great length). The four instruments of each of the seven wind families are synchronized rhythmically, with no staggered entrances as found in the earlier piece, but they are harmonized using varying chordal configurations (or scored, rarely, in unison). Such complex counterpoint

constitutes the primary wind texture, with the strings most often contributing short, active phrases of parallel clusters, either as a whole or in subgroups.

A contrasting element is introduced at m. 4, with staccato repeated chords being passed off from one instrumental group to another, down and back up through score order. While the staccato repeated material returns several times, the quasi-spatial distribution of this particular passage does not. It could be a brief nod to *Dämmerstein*. The third sonic entity of *Koïranoï* is the glissando, introduced in m. 7 with a series of short exclamatory gestures in the strings, sliding up from each instrument's lowest note into a full cluster. In m. 8, the high winds also unravel from their chordal material into a brief polyphony of glissandi. This is the only appearance of sliding tones in the winds, but more would be made of them in Xenakis's subsequent orchestral score, *Ioolkos*.

Much of the rest of the piece is fashioned from the chordal counterpoint in the winds, the faster staccato material, and the cluster interjections in the strings. The repeated figures break out into more dynamic figures, too, such as scales or oscillating patterns, or combinations of both (e.g., mm. 13–14). There is one odd passage for the strings in which a modal melody is presented in a harmonization derived from the spacing between the low open strings of each instrument. There is another anomalous segment, at m. 23, which seems to be an inexact quotation from the rhythmicized clusters passed around the orchestra at the beginning of *Dämmerstein*. The layering of this material with ongoing string clusters disguises its identity and diffuses the atomizing spatio-rhythmic effect. At m. 29, the strings finally join the winds in a culminating section of closely voiced counterpoint, the five layers of strings also carrying on four-part harmonies. At m. 34, the strings break away to a series of glissandi, sliding upward to large clusters and then back again to common anchor-notes. As the winds drop out, the music ends on this low five-note chord in the strings. The harmonically resonant character of this sonority carries on for several seconds, sustained at full volume rather than fading away as many of the earlier scores had done. Clearly, Xenakis had nothing here to fear from harmonious sounds!

Voile

In his next work, scored for twenty string instruments, Xenakis returned more explicitly to the sculptural concerns of *Dämmerstein*. Here, though, the massive cluster is replaced (for the most part) by sieve structures with each instrument treated as soloist. *Voile* (1995) is, of course, a strongly impressionistic title. The composer notes that both meanings are important: the “sail” that he uses on his kayak, and the “veil” that can keep secret what may be behind it. The music is far from being reminiscent of Claude Debussy, though. The vertical and diagonal sonorities are more geometric than evocative of a breezy day.

The forty-note sieve heard at the beginning returns as a touchstone for the brief excursions to other formations (including the occasional chromatic cluster). The music unfolds as a sequence of short segments of varying material. At 5–1/2 minutes, this commission for the Münchener Kammerorchester is hardly a major work, but still, a wide range of expression is compressed into its brief duration. After the geometric opening section, there is a brief passage of short glissandi passed along from one to another of the eleven violins. The spatialized distribution of this material is closed off with a tutti

glissando at m. 10, followed by a chordal passage, still just for violins, of three vertical sonorities of contrasting intervallic structure and span. At m. 13, the opening sieve returns, spreading down from the top to the bottom, bringing in the rest of the string ensemble. Another chordal progression leads to a contrapuntal passage in which the five string groups pursue independent contours. Each layer stays within its own register and draws upon a different interval for its double stops (Vln I—m2, Vln II—m7, Vla—TT, Vc—P4, Cb—P4).

The passage at mm. 19–21 is fascinating for what is exposed once the veil is blown aside. A descending succession of notes from a secondary sieve gives way to an evocative melodic fragment. It is harmonized in double stops of varying intervals, beginning and ending with the archaic sound of open fifths. This tantalizing glimpse of a completely different kind of music is then swept away as the sieve fills back in again. Succeeding this passage is a brief spotlight on the violas, heard in a closely voiced counterpoint. This leads, at m. 23, to a more widespread section of polyphony that shifts from the violas to the violins, back to the violas, and then to the cellos and basses. The final section is more rhythmic, with the music filling out from the middle, each instrument pulsating its double stop until the full ensemble has entered. The piece ends with a brief, rocking oscillation between two full-voiced sieve chords.

Voile is a concentrated work of primarily thick, textural material, with passages of counterpoint and melody as well. Xenakis's next two scores, for smaller ensembles, would shift the focus more to linear and rhythmic concerns, though the cluster would reappear as timbral coloration.

Kai, Kuilenn

Kai (“and”; 1995) was written for the Oh Ton Ensemble of Oldenburg, Germany, and is scored for a mixed ensemble of five winds and four strings. *Kuilenn* (Gaelic for “small brush of leaves and thorns”; 1995) is also scored for nine instruments, in this case an expanded woodwind quintet (one flute, two oboes, two clarinets, two bassoons, and two horns). After *Anemoessa* (1979), this piece was Xenakis's second Holland Festival commission, written for the Nederlands Blazers Ensemble. Both are thickly scored, though the smaller forces preclude any sense of “orchestral” sonority such as can be found in *Waarg*, for thirteen instruments. While clusters are present in both, there is a great deal of structured harmonic writing, and block passages of dense linear counterpoint. Aside from the instrumentation, the main distinguishing feature between the two is that the textures of *Kuilenn* give rise to more clearly melodic passages for a single instrument or combinations of two or three. In addition, while *Kai* contains a number of passages of layered polyrhythms, it is *Kuilenn* that seems more fluid rhythmically, with several changes of tempo underscored by shifts of dynamics and articulation.

Kai was completed first, and, at forty-five measures in length and eight minutes in duration, is the more substantial of the two. (*Kuilenn*, slower in tempo, lasts seven-and-a-half minutes, and is thirty-three measures in length.¹⁵) The formal trajectory is fairly clear. A declamatory opening of thick, held chords in the strings and woodwinds leads into a contrapuntal section in which the strings are generally pitted against the winds, the linear motion passing back and forth from one to the other. The overall rhythmic flow

settles onto a sixteenth-note pulse, breaking up by m. 10 into a more stochastic distribution of thirty-second notes. Staggered double-stop entrances in the strings lead to another tutti declamation at m. 13, moving to a more rhythmically active section the following measure. This passage, which proceeds through m. 18, is organized in an intricate fashion. Each of the wind instruments plays a set-derived melody built from six pitches, each set overlapping the others in terms of register and sharing at least one note. The ordering of the notes is different for each instrument, but the succession of each is linked to the others. The trombone, which uses seven notes instead of six, follows the same pattern, substituting a second pitch occasionally for one of its series. The strings, treated rhythmically as an opposing block, follow the same principle, each instrument cycling through varying sequences of five double stops. While the overall harmonic progression is static, the interior mechanism of each block is complex, contributing, together with the opposing rhythms, to a polyphonic structure of great force.

There is a central episode in which harmonies built from the full ensemble sweep through the instruments in an overlapped, spatial fashion. By m. 22 the strings begin to lock into rhythmic synchronization, building to short-long repeated chords in the winds, a signature gesture. The following section is again contrapuntal, but the sixteenth-note pulsation of the earlier section is here doubled, and the strings are generally treated as an opposing block to various melodic fragments in the winds. By m. 34 the winds lock in, too, trading places with the strings, who, from mm. 37–40, proceed in solo fashion. The texture becomes increasingly fractured, with various instruments pursuing individual phrases, along with occasional polyrhythms. The winds combine for a final recall of the set-derived faster material from before, the music breaking off without a sense of cadential arrival apart from a dramatic *rallentando*.

A continuation from *Kai* may be discerned at the beginning of *Kuilenn*, with the ensemble split into two units, contrapuntally opposed. This division, though, does not continue beyond the first four measures. The tone of the music, too, is quite different, setting out with the vibrating intensity of chromatic clusters, a relatively rare phenomenon in *Kai*. Still, careful listening will reveal that the vertical formations vary a great deal, even within tightly voiced configurations. The cluster is not treated solely as a coloration device but as part of a harmonic sound world that is shaded with considerable finesse.

The music basically proceeds as an alternation between faster, melodically active passages and slower, more homophonic ones (sometimes varied by staggering the entrances). At m. 5, the two-part block writing of the opening gives way to a melodic fragment featuring the two oboes. The linear writing is based on modal segments, though these tend to change quite rapidly, avoiding tonal identity. The flute takes over, carrying on into the chordal section that follows at m. 8. As noted already, the range of intervallic variation in the vertical structures is wide and constantly in flux. The passage at mm. 8–9, for example, features thirds-based sonorities alternating with other, usually more dissonant, intervals. The use of octave doublings adds to the harmonious quality of the sound as well. Note that at the end of the passage, the upper and lower voices are doubled for the voice-leading motion: $E-F-E/E-D$. This would traditionally be considered bad counterpoint, but in this case, given the density of voices and pitch classes, such doublings help to articulate the progression rather than hinder it.

After another melodic passage in which brief fragments are passed off from one instrument to another, the music arrives at the first major structural shift. On the last beat of m. 11, the tempo drops, the dynamics change from *fff* to *p*, and the articulation marking is given as *legato*. In this passage and the several that succeed it, each instrument follows its own melodic trajectory (with occasional doublings). The texture, built predominantly from thirty-second notes, is much more rhythmically active than the slower-moving chordal sections. The score, however, is inconsistent in not including the dynamic and articulation markings in the subsequent sections. This was perhaps an oversight, but may also indicate that such a strong formal articulation, reinforced by the alignment of the different parameters, was not intended each time the material returns.

In any case, the music proceeds in mosaic-like fashion, moving between those thick blocks of counterpoint, sparser passages of melodic fragments, and the chordal sections. At mm. 19–20, there is a quasi-stochastic moment of sustained material in which the rhythms are disbursed among triplet subdivisions. An emphatic tutti chordal attack at m. 21, where an unusual, dramatic, decrescendocrescendo leads to a brief recall of the pelog melodic turn (*B4–C5–B4–G4*) so characteristic of Xenakis's music from the time of *Jonchaies*. It is blurred through staggered doublings, however, as if to veil the reference (this blurring/resonance, however, was also quite characteristic of his music in that period). After a few more episodes, the full ensemble is brought together for a final section of synchronized melodic contours, colored this time primarily by chromatic clusters, recalling the tone of the opening. A widely spaced chord keeps bursting out, though, and it is this relatively harmonious sonority (including an open-spaced minor triad in the bottom voices), that ends the piece.

Itidra

Kuilenn was completed in June 1995. Xenakis would not finish his next score until April 1996, and there is no doubt he was finding it difficult to compose. The different ailments from which he had been suffering seemed to have acted one against the other to aggravate his medical situation. Whereas earlier in his life he may have been happy to be able to forget the past, to put things aside in order to focus on his present creative preoccupations, he was now finding it taxing to remember, to concentrate. This would explain the dwindling lengths of the works he undertook. Nonetheless, 1996 was quite productive considering the strain he must have been working under. Four scores were completed in relatively short order, including one for orchestra.

The first to reach the publisher was a piece for Xenakis's longtime colleagues, the Arditti String Quartet. This time, the forces of the group were expanded to a sextet with the addition of an extra viola and cello. *Itidra* ("Arditti," backward) is quite unlike *Ergma*, the extra instruments creating the possibility for thicker, "orchestral" sonorities. In fact, the six players act in consort throughout almost the entire piece, usually playing double stops. The sonority is organlike, with its vertical mixtures of pure, vibratoless tones. There are no soloistic passages beyond isolated notes, and these fleeting moments of one or two instruments alone occur no more than five times over the course of the 8–1/2-minute duration. The effect of these is striking, though, rather like the sudden shafts of solo voices in the late choral creations such as *Sea Nymphs*. While most of the piece is

chordal, there is a fair degree of textural variation, primarily in terms of rhythmic density, register, and degree of intervallic conjunction.

The opening passage is a fascinating application of the technique of set rotation used previously in *Horos* or *Tetora*. A progression of eight chords is introduced, each with its own structure and ambitus, ranging from a twelve-note chromatic cluster (used twice, the second time transposed) to aggregates spanning well over four octaves. The succession of these sonorities is accordionlike; as the range contracts and expands the tonal character changes due to intervallic reconfiguration. Xenakis divides the section into formal units (although there are no breaks in the ongoing flow), each, after the initial introduction of the material, drawing upon a subset of the chords. (Note: chords B and C are not used again, though C, the cluster, reappears numerous times later in different transpositions.) The duration of each chord changes, ranging between two and thirteen sixteenth notes. Many of these aggregates are heard again, interspersed with more linearly conceived music.

The melodic passages, usually quite brief, are very directional and geometric. The lines ascend or descend directly, usually harmonized in clusters. Occasionally, the upper and lower instruments will diverge or converge, as in mm. 25–26, or m. 29. Other chordal passages contain oscillations between two sonorities (m. 16, m. 21) or repeated articulations of one chord (mm. 37–38). The closing passage presents similar material to the opening (chords A, C, D, and H are included), with six new chords, more closely voiced, rotating in like fashion. The final gesture is a slow, ascending chromatic line in the upper violin harmonized with these same chords. Both *Kai* and *Kuilenn* also contain prominent chromatic lines, descending rather than rising. The balance in *Ittidra* between hieratic material and directional lines or sonorities is what carries the formal weight. The dynamics are singular, being *sempre fff*, and this sonic, performative intensity certainly adds to the impact of the music.

Iolkos

In October 1996, Xenakis returned to Donaueschingen for the premiere of his latest orchestral work by the Südwestfunk Symphony Orchestra. Forty-one years earlier, that same orchestra had premiered *Metastaseis* at that same festival, launching his career. *Iolkos* (“homeland of Jason, leader of the Argonauts”), about the same length as *Ittidra*, is conceived as a single, long-breathed gesture, a journey. The pace—as one would by this point expect—is slow, but the scope is impressive. Gone are any of the spatial effects of *Dämmerchein*. Instead, the music is entirely contrapuntal, for most of the piece dividing the orchestra into five huge “voices,” each thickened by means of parallel chromatic clusters: high woodwinds, bassoons/tuba, brass, and two groups of strings. The strings proceed more or less independently of the winds, playing almost continuously, via one group or the other. There is some use of glissandi, and the winds, too, are called upon to bend their pitches along sliding contours, particularly in the first part.

As in *Ittidra*, there are no dynamic indications beyond the *sempre fff* marking at the beginning. The composer seeks maximal intensity for the massed sonorities he has scored. Along with the strings, playing a two-part counterpoint of wide clusters, blending glissandi with pitched contours, the high woodwinds set off from the beginning with a very slow melody scored as a twelve-note cluster. The contour begins to slide from one

note to the next at the end of m. 3, a characteristic mirrored in the brass at their entrance the following measure. The two groups are distinguished by register as well as timbre and rhythmic structure. At m. 7, as the brass shift to more active melodic material, the bassoons and tuba enter with a third line of low, growling counterpoint. The strings, of course, are also present, treated as a separate sonic entity (although one cannot avoid hearing these layers, at least partially, as components of the ongoing polyphony).

By m. 12 all three layers of winds shift to faster, more disjunct material. The strings, by contrast, lapse into long-held trills at mm. 13–15, returning to this distinctive sonority at mm. 18–20 and mm. 22–24. The rhythmic density of the wind material intensifies up to m. 21, the halfway point, after which it eases back, long glissandi being heard again in the high woodwinds between mm. 22 and 24. By m. 25 the other two layers drop out, and the musical momentum shifts from a polyphonic structure to a monophonic one (along with the strings, ever carrying on), the lines being passed from one group to another. Individual instrumental families begin to emerge from the large wind groups, contributing more distinctive timbral tones to the ongoing linear material.

At m. 30, close to three-quarters of the way through *Ioolkos*, there is a significant articulation point. The strings are silenced, for the first time in a significant way, and the melodic contours of the winds are wound down. The high woodwinds enter with a tutti cluster attack, followed on the next beat by the brass and half of the strings. This chordal accent signals the transition to the concluding section in which similar cluster accents (sustained, to be sure) are interspersed with short melodic phrases. In contrast to the first long section, the lines are not harmonized with clusters, and each instrumental layer is treated independently. Thus, while the sonority is more transparent, it is also more contrapuntally elaborate (it should be noted, though, that the strings continue with their clusters, at times in opposition to the winds, at times intersecting the tutti attacks). A final, widespread cluster across the full orchestra closes the work.

At its premiere in Donaueschingen, *Ioolkos* was naturally compared to *Metastaseis* (see Löscher 2000, 5). They are both, in fact, approximately the same duration. The earlier score is, of course, remarkably original, an almost naive gesture by a young, ambitious personality with an urgent need to give expression to the creative forces erupting within himself. The later piece is also an expression of a powerful inner force, but this time shaped by years of experience with the orchestral medium and also by decades of exploring the inner workings of complex sonorities and compositional processes. The slower pace and stark textures point to the composer's interest in the rich phenomena of instrumental sound, and the contrapuntal structure points to his ability to carry on multiple streams of musical activity simultaneously. The music is shorn of any extraneous details, effects, or sonorities in order to focus purely on density, intensity, and sustained linear contours. While *Ioolkos* may not be quite the radical statement that *Metastaseis* was, it is certainly not mellow or conciliatory. With all his remaining strength, Xenakis was continuing to escape destruction, to live his life to the fullest through uncompromising creative action.

Roscobeck, Hunem-Iduhey

In 1951, the fledgling composer had completed a short duet for violin and cello that was evidently performed and broadcast.¹⁶ Xenakis returned to the string duet form again in

1996, some forty-five years later, producing two in short order. *Roscobeck*, the more substantial, was written for the cello/bass duo of Rohan de Saram (of the Arditti Quartet) and Stefano Scodanibbio, who were touring together at the time. The title is a conflagration of their names, along with Wolfgang Becker of WDR in Cologne, the host of the premiere. *Hunem-Iduhey*, for violin and cello, much shorter at just three minutes, was written for Sir Yehudi Menuhin (the title is a reverse-name tribute), and was premiered at the Lincoln Center in New York by Edna Mitchell (violin) and Ole Akahoshi (cello). Both pieces are marked *ff* throughout, both require each performer to play continuously, and both mix small-interval double stops with single-stop lines. In addition, the two works are built from textures that shift between conjunct and disjunct intervallic motion, and between active and sustained rhythmic gestures.

Where the two can be distinguished (aside from instrumentation) is in the independence of the two interlocking contours of each duo. *Roscobeck* makes use of a fair degree of parallel, or quasi-parallel, motion (see fig. 33a), while *Hunem-Iduhey* treats the two instruments in more contrary-motion fashion (see fig. 33b). Perhaps because of its brevity, the latter score shifts much more rapidly between single notes and double stops, often inserting an isolated harmonic interval into a single-note passage. This piece also takes the cello above the violin at times, mixing the sonorities more than in *Roscobeck*, where the two instruments are for the most part registrally distinct. In both scores there are remarkable moments of stark transparency where isolated intervals are exposed for sizeable moments. In m. 4 of *Hunem-Iduhey*, for example, the long sustained $B\flat_2$ in the cello supports the violin as it outlines the other notes of a dominant-seventh chord. There are no obvious tonal consequences to this gesture, but it stands out as a sonic icon, as does the sustained semitone cluster in mm. 4–5 of *Roscobeck*.

The tone of the two pieces is otherwise completely different. The cello-bass duo is much rougher and sonoric, by virtue of the perceptual limits on hearing narrow intervals in the low register. The agility of the violin and cello is manifested in the greater concentration of wide, disjunct intervals in that duo, even if the cello is similarly treated in some sections of *Roscobeck*. While both are harsh and austere, the intimacy of the duet genre underscores the composer's fondness for strings in chamber settings. His legacy in this instrumental domain is a major one, with solos for every instrument of the string family along with numerous other works, most notably the four string quartets. The cello pieces, in particular, have become integral elements of the contemporary repertoire, with *Kottos* a particular favorite among a number of performers.

Zythos

By coincidence, the final works of Xenakis, completed under duress in 1997 due to the composer's failing health, were all premiered in England. The first, *Zythos* ("fermented drink"), was actually a Swedish commission, but the first performance took place in Birmingham that April. Scored for the unusual combination of trombone and six marimbas, this piece unites Christian Lindberg (for whom

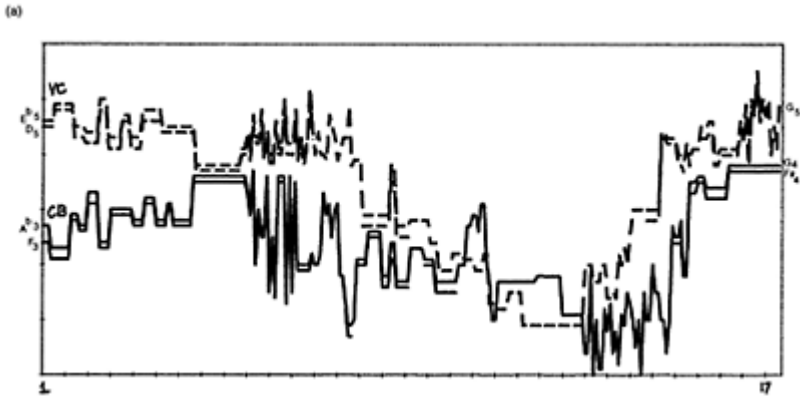


Figure 33a. *Roscobeck*: Graphic transcription of opening, mm. 1–17.

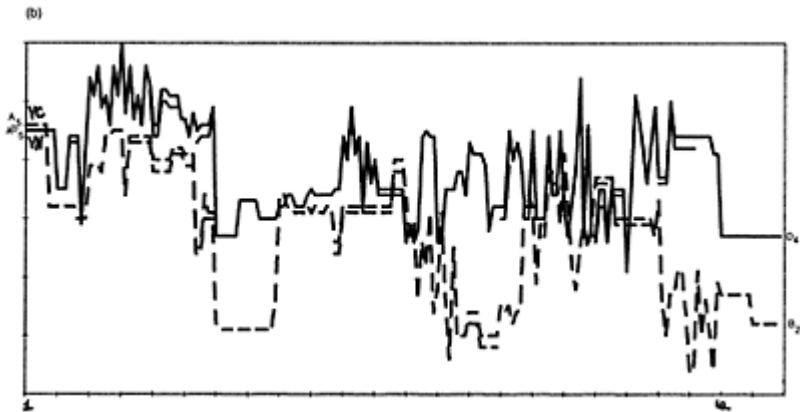


Figure 33b. *Hunem-Iduhey*. Graphic transcription of opening, mm. 1–12.

Xenakis had written *Troorkh* in 1991) and the Swedish percussion ensemble Kroumata. This group, who initiated the commission, had performed his earlier percussion ensemble scores and were looking for a piece of their own from Xenakis.

By any account, *Zyθος* is an odd piece. The tempo is extremely slow (eighth note=c. 25 MM) and the texture is often sparse. The trombone part, notated across two staves, is built primarily from erratic, widely disjunct melodic phrases (there are no glissandi or additional effects), with leaps of up to three octaves and beyond. One might be tempted to compare the part to the extended baritone of *La Déesse Athéna*, but in fact the contours range right across the full register of the instrument, making no systematic distinction between high and low as the vocal writing does. Rather, the double staff is a notational convenience, making the intervals easier to read on the page. The marimba parts are often

treated spatially, passing off phrases from one instrument to the next. The marimba material ranges from disjunct lines, acting as countermelodies to the trombone, to scalar passages. Strikingly, the marimbas come together at several points on a single pitch or chord, repeating the notes as a form of cadential punctuation. The trombone does not ever join in on these gestures, but they often serve to touch off a new phrase in the solo part.

The pitch organization does not convey any particular intervallic or modal consistency, apart from a striking emphasis on the pitch class *F*. Without wanting to read too much tonal significance into this fact, the repeated-note gestures of the marimbas feature this pitch at mm. 7–8 (the trombone finishing out its phrase at the same time on *A4*), m. 19, and mm. 20–21. *F* is also associated with *D* at mm. 13–14, and the trombone emphasizes it as well with long sustained high notes (*F5* is the highest pitch the instrument reaches). There are other pitches that are emphasized, however, such as *C* at m. 3, *B* at m. 16, and *C#* at the final cadence at the end of m. 25, this in conjunction with a long sustained *A3* in the trombone, providing a link by thirds to the tonal center of *F*. There are interesting moments of voice leading that also lend a strongly tonal character to the music at particular moments. One comes at m. 8, as mentioned, where the marimbas conclude the trombone's phrase with repeated *F*s while the trombone sustains an *A*. The major-chord implication is immediately shifted to minor as the trombone begins the next phrase with an *A♭4*. Similarly, at the end, below the sustained *A3* of the trombone, the marimbas shift from a repeated *C3* to *C#3*. These tonal inflections certainly add highlights to the music, but the treatment of these gestures is iconic rather than relational. They constitute one more element that helps to articulate the form, along with the interplay between the trombone and the marimbas, and the disjunct, conjunct/scalar, and sustained/repeated notes that comprise the basic building blocks.

Ultimately, *Zythos* succeeds on the basis of its timbral richness and the complementarity of the brass trombone and the wooden marimbas. Xenakis, who again indicates *ff* as the overall dynamic level, is sensitive to the combination, insisting that the resonant marimbas balance the trombone with sounds that are clear but soft (a pointer to mallet choice rather than dynamic level). The size of these large keyboards ensures that the six players will be spread well across the stage. The effect of trading off phrases from one performer to the next creates a mobile ballet of sound as a backdrop for the more forthright character of the trombone.

Sea-Change

As noted before, Xenakis was back in England in May 1997, a featured guest of the Bath Festival. The tape piece *Erod* was premiered, and a number of other works were performed. In July, a new orchestral commission was unveiled in London at a BBC Promenade Concert at Albert Hall. *Sea-Change* takes its title from Shakespeare, as did *Sea Nymphs*. The score comes with the nostalgic inscription, "To the memory of a child who played a Shakespearian role in *The Tempest*" (Xenakis 1997). This, his final orchestral score, is quite unlike the ones just preceding, the composer unwilling, right to the end, to settle for earlier achievements. "Composing is a battle... It's a struggle to produce something interesting... You must nevertheless go on working" (Varga 1996, 204, 213).

In *Sea-Change*, the instruments of the orchestra are not subdivided at all, with the occasional exception of the strings. The score, then, resembles more an ensemble work than an orchestral one in terms of vertical density. The sonority, though—with each line played fortissimo by a number of instruments (quadruple winds and the usual large complement of strings)—projects an intensity that is uniquely symphonic. What is especially interesting is that Xenakis creates, for the first time in a long time, passages of intricate glissandi. Of recent scores, this material is most reminiscent of the brief passage for a solo string quartet in *Dämmerchein*. Here, right from the opening passage, the lines unfurl one after another. Framing this linear material is a sustained sonority—high strings on *D7* and low brass on *B \flat 1*, occasionally thickened with a neighbor tone—continuing, with breaks, through almost half of the piece. The glissando line is passed from the cellos (split into two strands) to the double basses, and then to the oboes, each separated by a break. The oboe leads into a contrapuntal passage for woodwinds beginning at m. 7, the glissando being left behind in favor of articulated pitches after one last sliding tone in the flutes. The contour of these lines is much more conjunct than in *Zythos*, though in this case there is no sense of modal or intervallic identity within the material. A slow countermelody is heralded by the trumpets just prior to the entrance of the oboes, gradually becoming more active and eventually joining the contrapuntal tissue of the woodwinds by m. 10.

The music shifts suddenly at m. 13. With the high strings continuing, by now a three-note cluster rather than a unison, the full complement of winds join together for a chordal statement comprising ten chords, each of differing spans and intervallic structure, varying in duration. As a gesture of harmonic coherence, two subsets of these chords reappear later in a second chordal passage that begins at m. 25. In between (mm. 17–23), the winds present a second, more extended, passage of intricate polyphony, built from relatively conjunct lines in the middle register. A slow, stately phrase cuts through, this time with the horns doubling the trumpets, then diverging into two strands submerged within the ongoing counterpoint. Meanwhile, the strings sail along a slowly undulating glissando, the instruments diverging into as many as ten layers. As the winds come to rest on a long-sustained cluster, the strings, having split into high and low strands, break off suddenly. As the winds drop out, though, the string glissandi start up again, carrying on, with one further break, right until the end. After the second chordal passage in the winds, the woodwinds contribute one further contrapuntal passage before giving way to the arrival of the strings on a unison *E4*, doubled by the brass for added cadential impact.

The long slow glissando gesture, finally converging to a unison, certainly brings to mind *Metastaseis*, linking this final orchestral effort with the composer's first. The evocation of the rolling swells of the sea can also be sensed, particularly in light of the title and the numerous earlier scores owing some sort of inspiration to the Mediterranean. Fittingly, *Sea-Change* is dedicated to Xenakis's wife of over forty years, Françoise, his long-suffering companion for their annual kayaking adventures.

O-Mega

Evelyn Glennie, at a relatively young age, has become one of the best-known percussionists in the world. Her repertoire has tended toward the popular and accessible, but by 1997 she had been pursuing a commission from Xenakis for some time. With the

composer set to be a featured attraction at that year's Huddersfield Festival, the idea of a concertante work featuring Glennie came about. Festival director Richard Steinitz, who had presented a great deal of Xenakis's music in previous years, turned to the London Sinfonietta, long associated with the composer through three commissioned works going back to *Phlegra* from 1975.

O-Mega, not even four minutes in duration, is probably not the creation anyone was expecting. By this point, it must have become clear that Xenakis was no longer able to sustain the effort required to compose a score of the expected (or requested) length. The title, taken from the final letter of the Greek alphabet, and often used to denote "the end," was perhaps intended to be a message from the composer that he was resigning his calling. While *Sea-Change* was listed as being ten minutes in length (with no metronome marking given), the extreme slow pace required to achieve this span of time comes close to freezing the music to a standstill. The BBC Symphony Orchestra, under its conductor Andrew Davis, performed it in something like half the time indicated. While the proportions are Webernesque, the material is decidedly not.

In the new percussion piece, the tempo is more realistic (eighth note=60 MM), though the duration is not actually given in the foreword to the score. The music, while brief, is nonetheless dramatic. For the first time in several scores, Xenakis includes dynamic markings, notating crescendos and decrescendos, and marked contrasts from *fff* to *p* with little in between. The opening and closing passages are reserved for the soloist alone. The beginning makes striking use of lengthy silences to allow the forceful gestures of the percussionist to resonate throughout the performance space. The soloist plays on just eight drums, and the first passage is scored for a single bongo. The ensemble, when it enters, is treated primarily as a harmonic entity. The blocks of sound are shaped with a great deal of finesse by means of layered entrances and timbral successions. The soloist, after a break at mm. 5–7 to allow the ensemble to enter, is heard almost without break thereafter. The closing gesture, after the ensemble drops out again, is a continuation of the ongoing rhythmic material. There are few technical challenges for the soloist, aside from considerations of physical force. Instead, the music is hieratic, evoking ritual more than showy virtuosity.

The two layers, solo percussion and ensemble, proceed in parallel fashion, their contrasting characters creating a sonic counterpoint. The chordal material passes from one instrumental group (woodwinds, brass, strings) to another, either as phrases, sometimes overlapping, or as isolated punctuations. The harmonic structure of these chords varies a great deal, from dissonances to quasi-triadic configurations voiced in wide spans or grouped close together. At one point, at mm. 18–21, the woodwinds actually settle onto one high-pitched chord, repeating and sustaining it as the strings carry on melodically active material (all five strings move as a block, though not in strict parallel motion). The brass take over at m. 21 with a chorale-like passage leading to a final block phrase for the full ensemble before fading out as the soloist plays through to the end on her own.

The bulk of the soloist's material alternates between sustained rolls and short rhythmic phrases. Once the ensemble enters, there are no real resting points nor clear shifts in rhythmic character. It is notable that there are no clear repetitions of percussion patterns, and this certainly heightens the informational density of the music.

As the final effort of one of the major composers of the second half of the twentieth century, *O-Mega* may garner more attention than it would otherwise deserve. Nonetheless, the music is a dramatic statement in the concerto genre for percussion, a sonority Xenakis clearly felt a strong attachment to over his long career.

Epilogue

While the tempos had become slower and slower, the number of measures dwindling to a relative handful, Xenakis continued to compose with full integrity, right until the end. By then—1997—it was clear that the effort was too great for such a frail disposition. The title of his last work signals the end of a most remarkable outpouring of musical creativity lasting close to fifty years and spanning some 150 works. It is always uncomfortable seeing great artists give up their activity because of illness or old age; and few are at ease with such a situation. While he continued to be feted around the world (with the Kyoto Prize in Japan, the Polar Prize in Sweden, etc.), Xenakis had to give up his musical explorations of a new world, one of his own making.

In a 1997 interview, when asked to describe his state of mind, Xenakis replied, with poignant directness: “A desert... An endless desert...where nothing can grow any longer... A desert with a powerful but unbearable past” (Lalas 1998, 43). One can only imagine what it must feel like to be unable to continue the creative activity that had been all-consuming for so many years. This quest had, to some extent, grown out of an urgent need to give expression to the intense, horrific experiences he had lived through as a young man, barely escaping from all that violence and upheaval with his life. As he confesses in another interview, music was connected with life in a fundamental way: “For years I was tormented by guilt at having left the country for which I’d fought. I left my friends—some were in prison, others were dead, some had managed to escape. I felt I was in debt to them and that I had to repay that debt. And I felt I had a mission. I had to do something important to regain the right to live. It wasn’t just a question of music—it was something much more significant” (Varga 1996, 47).

Xenakis certainly achieved “something important.” Simply put, he altered the course of music. His compositions are among the most original and forceful ever composed. The rigor of his theoretical thought has challenged assumptions and trends, most notorious being his demonstration that serialism and tonal music can be understood as subclasses of a more general approach to the organization of pitch and other parameters. He, more than virtually anyone else, pointed the way to new ways of understanding music and of organizing it. In addition, his activities have ranged much wider than most composers, touching on writing, mathematics, engineering, architecture, multimedia design, and computer programming.

Ultimately, though, what remains primarily is the music. Powerful scores that challenge, provoke, thrill. Xenakis’s music is best heard live—for the complex spatial distributions, the pounding, often layered, rhythms, and the massive, intense sonorities.

And yes, even the modal melodies, the delicate moments, the starkly beautiful colors and textures.

Anyone who has glimpsed the wild landscapes of Greece knows something about where this music comes from. Ancient Delphi, for example, is set in the mountains, with sheer rock cliffs falling off into olive groves that spill down the valley to the salty, blood-warm waters of the Gulf of Corinth. In summertime, the heat is intense, the cicadas shrill, the shooting stars bright. As well, anyone who has put themselves out into the sea in a small boat or kayak knows of the dangers that hide beneath the sparkling blue waters: the currents that can pull you out or drive you onto the rocks, the swells, the sudden shifts of wind and weather, the sting of the salt and sand. Nature can be pastoral, as so many artists have evoked. But it can also be brutal and overpowering, savage and unforgiving.

The music of Xenakis evokes something of the violence of humanity as well as the striving of our creative impulses to understand and express the thoughts and impulses that swirl about our rational and unconscious selves. But equally, his music echoes the primal forces of nature, the wonders of the cosmos.

Of course, such an artist is doomed to fail. Fail, that is, to give adequate expression to the complexities and awe-inspiring power of the human spirit and the natural world. The composer is always doubtful, always questioning: "Everything changes. How, then, can we know something about anything?" (Varga 1996, 133). But Iannis Xenakis has indeed succeeded in creating sparks, in illuminating the universe in a unique way which is surely of some significance, now, and undoubtedly for some time to come.

Notes

Chapter 1. The Outsider

1. Newspaper reports of the revelations that came to light during the opening of inactive accounts in various Swiss banks from the period of the Nazi regime in Germany and World War II turned up the name of Xenakis's uncle.
2. Makis Solomos offers a succinct outline of the chronology of events in Greece during this period (1996, 38–39).
3. Xenakis had not readily discussed this intense, and ultimately painful, episode of his life until much later (see Fleuret 1981, 64–68; Matossian 1986, 18–27; Varga 1996, 14–19).

Chapter 2. From the Personal to the Individual

1. Jean Boivin (1995) has made a detailed study of Messiaen's pedagogical activities. Much of Messiaen's analytical materials have been published posthumously in seven volumes by Éditions LeDuc (see Messiaen 1994–).
2. The title *Chronochromie*, derived from two Greek works, “chronos” and “chroma,” is remarkably similar to such bipartite titles as *Metastaseis* or *Pithoprakta*.
3. Boivin reports that Xenakis recalls meeting Stockhausen in Messiaen's class just once (1995, 112).
4. Mâche refers to the major collection published by Samuel Baud-Bovy: *Chansons populaires greques du Dodecanese* (Mâche 1993, 200; see also Varga 1996, 26).
5. Solomos posits that Xenakis could have written this article, one of the few primary documents shedding light on the composer's concerns during this nascent period of his musical development, as early as 1952 (Solomos 2001, 3).
6. Mâche gives the unconfirmed broadcast date as 16 April 1953 (Mâche 1993, 198).
7. According to Radu Stan, of Éditions Salabert, *Zyia* also exists in a version adding a tenor chorus to the trio, and another adding horn and percussion. The score, with trio and chorus, was published for the much belated 1994 premiere at Evreux, France.
8. Xenakis also completed a couple of short vocal works during that time, including a choral work, *La colombe de la paix*, awarded a prize at the socialist World Student and Youth Festival in Bucharest (1953). As Mâche puts it, this piece “marked a return to that simplicity praised by the Prague Manifesto” (1993, 201). Xenakis made no attempt to have it published, an indication of his rapidly evolving aesthetic orientation.
9. Xenakis would return to Dionysian themes in later works: live bulls (*Taurhiphanie*, 1987), and staged sacrifice (*The Bacchae*, 1993).

Chapter 3. From Architecture to Algorithm

1. The use of the Fibonacci series has already been noted in *Zyia* and *Le Sacrifice*.
2. Xenakis also worked on the Unité d'habitation at Marseilles (1947–52), The Palace of Assembly at Chandigarh, India (1953–60), and the Unité d'habitation at Nantes-Rezé (1951–57). His architectural involvement in these projects was relatively minor, although the hyperbolic shell of the palace roof in Chandigarh is undoubtedly a product of his design, an innovative conception realized more fully in the Philips Pavilion and the abandoned project for the Stadium at Baghdad (see Xenakis 1976a).
3. It should be taken as a sign of the great respect Le Corbusier held for his young protégé that Xenakis was given space in *Modulor 2* to discuss his approach to the composition of *Metastaseis* (Le Corbusier 1980, 326–30).
4. Matossian perceptively notes that Messiaen, the other major influence on Xenakis at that time, pieced many of his works together in collage fashion, an approach derived in part from the work of Igor Stravinsky and Claude Debussy (Matossian 1986, 64).
5. The word *metastaseis* is to be understood as being in the plural form, and is in fact often misspelled through overlooking this fact. The *B* (beta) affixed to the title in the score refers to the revisions carried out on the advice of Hermann Scherchen (reducing the strings from the impractical 12–12–12–12–4 to a more manageable 12–12–8–8–6).
6. The woodblock does enter, once the glissandi start, beating out an irregular pattern derived from the Fibonacci series. The effect, and sonority, is remarkably similar to the sharp articulations of the high “ko tsuzumi” drum in Japanese Noh theater performances.
7. The first quote comes from Heinrich Strobel, director of the Donaueschingen Festival, and the second is from Wolfgang Steinecke’s report for *Melos*. It is interesting to note that Boulez’s *Le marteau sans maître* was also presented at the festival, another major work that opened the serialist dogma to other influences and possibilities.
8. John Cage introduced glissandi into his music in *Imaginary Landscape No. 1* (1939), which uses testtones on variable-speed turntables to achieve the effect. It is unlikely that Xenakis would have known about this piece, although Cage did spend several months in Paris in 1949. There are striking parallels between the aesthetics and compositional development of Cage and Xenakis, deserving of more detailed study.
9. André Baltensperger (1996) has studied the structure of *Metastaseis* in great deal, analyzing the music from various perspectives and tracing the serial elements.
10. The nomenclature for the indication of pitches in the text follows one of the common standards. “A4” refers to the *A* above middle C (*C4*). *G3* is in the octave below middle C, *C5* an octave higher than middle C, etc.
11. See Meyer-Eppler 1958 and 1959; Moles 1958; Meyer 1956.
12. Although pitch is not specified for this knocking sonority, the different sized instruments produce sounds of varying register and power. These parameters thus contribute to the texture as well.
13. Matossian gives this number as fourteen (1986, 99, 102). The discrepancy can be accounted for by the addition of “combination” sonorities from the basic ones listed in her discussion.
14. Matossian (1986), after presenting an impressionistic commentary on the piece (98–99), analyses it as “being roughly divided into four parts,” without offering precise locations for her divisions (105–6).
15. Henryk Górecki’s *Scontri* (1960) caused a sensation at the Warsaw Autumn Festival in 1960; Krzysztof Penderecki’s *Threnody to the Victims of Hiroshima* (1961) followed suit the next year, along with Witold Lutoslawski’s *Jeux vénitiens* (1961). The “sonoristic” style prevalent in Poland throughout the 1960s owes much to the sonorities of Xenakis’s scores though little to the theoretical basis of his music (see Rappoport 1983).

16. Philips had originally proposed Benjamin Britten for the music, an indication of the difficulties Varèse faced in gaining the confidence of the commissioner. Xenakis himself wrote to Philips on more than one occasion to reassure them of the elder composer's abilities and significance (as did Le Corbusier, who made his own participation contingent upon the inclusion of the composer). Louis Kalff, general art director at Philips, kept a record of all correspondence for the project. This valuable archive is now in the possession of the Getty Research Institute in Los Angeles and makes for fascinating study. Marc Treib (1996) has published an account of the genesis of the Philips Pavilion and *Le Poème électronique* that details the architectural, engineering, and artistic/multimedia elements with painstaking care.
17. Matossian, in her discussion of the Philips Pavilion (1986, 109–20), details the conflict that eventually arose between Xenakis and Le Corbusier over authorship of the work. While it is clear that Xenakis carried out much of the work, it is evident from the archives that Le Corbusier had a great deal of input. And, once the (quite unprecedented) demand for credit was put forward by the junior architect, it took Le Corbusier less than two weeks to acquiesce and place Xenakis's name beside his own as collaborator. Surely not the actions of a tyrant! (My conclusions are drawn from an examination of the correspondence among the parties involved: Xenakis, Philips, and Le Corbusier.)
18. Xenakis to Louis Kalff, 17 December 1957; my translation.
19. In fact, it is not even listed in some studies of the architect (see Pawley and Futagawa 1970).
20. The studio was renamed in 1958 as Groupe de Recherches Musicales (GRM), by which it is known today. This newer acronym title is sometimes used in the present volume when referring to works completed there prior to that date.
21. There are conflicting dates given for this piece. Matossian cites Xenakis's own records as showing he began work on *Diamorphoses* in January 1957, completing it six months later (1986, 125). It is also claimed that the work was begun in 1956 (Brody 1970). François Delalande, who has written the most detailed account of Xenakis's association with GRM, lists the completion date as 1958 (1997, 36, 154–55). The consensus from most sources, however, seems to be that it was produced in 1957. Brody notes that a new version (perhaps four tracks instead of the original two, along with *Orient-Occident* and *Concret-PH*) was produced in 1968 (Delalande gives 1969 as the date for new mixes of the latter two, without mentioning *Diamorphoses*).
22. Brody states that a revised version was carried out in 1968 in which the original, longer, ending was restored. Delalande notes that a four-track version was produced in 1969. The CD release of *Orient-Occident* is sixteen seconds shorter than the version found on the Nonesuch LP, and does not include the final segment of the earlier release.
23. Solomos has made a graphic transcription of *Orient-Occident*, providing a useful orientation for analysis (1993, 269).
24. Another contributing episode involved a “collective concert” in which nine composers—Claude Ballif, François Bayle, Edgardo Canton, Luc Ferrari, François-Bernard Mâche, Ivo Malec, Bernard Parmegiani, Michel Philippot, and Xenakis—were to contribute fragments to a large-scale electroacoustic work. Xenakis, who took charge of organizing this event, suggested that the succession of fragments be determined according to a probability matrix. His proposal was rejected by the others, and he withdrew from the project (Delalande 1997, 36; Schaeffer 1981, 86–87). This anecdote signals the strength of Xenakis's convictions.
25. Surprisingly, the digital release of *Bohor* is cut off twenty seconds too soon (from previous recordings). This last segment consists of a greatly heightened culmination of the crescendo of dynamics and density, the “piercing angle” Xenakis mentions. No explanation is given, but it certainly represents a distortion of the compositional intent.
26. This interpretation of the possible meaning of the title *Achorripsis* owes much to composer Brian Ferneyhough's imagery evoked in discussion of his own creative processes (c.f., Ferneyhough and Boros 1990, 20–21).

27. It is significant that John Cage was also pursuing a similar question through his application of chance operations to the construction of musical forms, carried out primarily in the period from 1951 to 1956 (see Cage 1961; Pritchett 1993). Ultimately, it was Cage's approach that proved more influential to the new music world at large, although Xenakis's work has been of defining importance for the field of computer music.
28. This recording, together with *Eonta* (performed by Constantin Simonovitch and the Ensemble Instrumental de Musique Contemporaine), was released in 1965. It was subsequently awarded the Grand Prix du Disque later that year.
29. *Syrmos*, originally published by Boosey and Hawkes, was later transferred to Salabert (along with *Duel* and *Hiketides*). While a vinyl recording has been available, the piece has not yet been released on compact disc.
30. Hungarian mathematician László Méré (1998) has recently argued the psychological and ethical implications and applications of game theory, an extension of the aesthetic considerations explored by Xenakis.
31. *Linaia-Agon* has been studied in detail by Thomas DeLio, whose doctoral dissertation is summarized in an article published in *Interface* (1985, 143–64).
32. *Herma* has been studied by several scholars over the years; see Montague 1995; Sevrette 1973; Squibbs 1996; Sward 1981; Uno 1994.
33. In addition, discrepancies between the composer's discussion of the piece and the score itself has given rise to debate. In her dissertation, Sward (1981) proposes a set of "corrections," a solution strongly contested by Montague.
34. In the early list of works appended to the 1963 publication of *Musiques formelles* in *La revue musicale*, the quartet is titled *ST/4-2*. This would imply that the transcription was made after *Morsima-Amorsima*, although the subsequent precision likely refers to the fact that the piece was generated at the same time as *ST/10-1*. Strangely, the subtitle of the other quartet, *Morsima-Amorsima (ST/4-1,030762)*, was not changed to reflect the adjustment.
35. The *ST/4* transcription is discussed by this author elsewhere in more detail (see J. Harley 1998).

Chapter 4.

The Voice, the Stage, and a New Conception of Time

1. Antigone, the main character of this, the third work of the Oedipus cycle, is a woman. In this ode the chorus is, to some extent, referring to her as well as to humanity in general. Joan O'Brien discusses the "androgynous" character of the text in the introduction to her translation from the Greek (1977, xxii–xxvii).
2. The notable exceptions are Makis Solomos, in his dissertation (1993, 260–263), and Hans Zeller, who refers to the celebrated German translation by Friedrich Hölderlin (Zeller 1987, 6–9). Xenakis was aware of the influence on German culture of the Greek classics, a factor in his selection of the text (Matossian 1986, 198). He may even have been aware of the importance of *Antigone* in particular, and the ongoing critical evaluations of Hölderlin's "subjective" rendering of the text, from the scorn heaped on it by Johann Wolfgang von Goethe and Friedrich Schiller to the importance accorded it by Walter Benjamin and Martin Heidegger (see Steiner 1984, 66–103).
3. Solomos rightly notes the quasi-spectral structure of this chord, being built primarily on the overtones of C, particularly in the lower strings (Solomos 1993, 170).
4. The pedaling indications are highly detailed, for both the damper and soft pedals. Matossian mistakes the notation of a partial depression of the damper pedal for an indication of quarter tones (Matossian 1986, 179).

5. The original score, for choir and instruments, intended as incidental music for the staging of *Hiketides*, is unpublished and little known. The music is available as an instrumental suite, with cellos and trumpets taking the part of the chorus in the chantlike passage at the end.
6. The major difference between outside-time and temporal structures is that the former are commutative (*a* before *b* is the same as *b* before *a*), whereas the latter are not. While this may seem obvious, Messiaen and the serial composers held that temporal structures could be perceived in retrograde. The fallacy of this proposition has been argued not only by Xenakis but also by French “spectral” composer Gérard Grisey (1987, 242–43).
7. This example forms the basis for the outside-time structure of *Nomos alpha* (Xenakis 1992, 215–36). Xenakis draws on the same example in a more general discussion of the theory of groups (Varga 1996, 87–88). While the geometrical figures are intended to serve an abstract compositional purpose, Xenakis would, for his seminar at the Université de Paris, bring in a three-dimensional model to demonstrate the symmetrical rotations.
8. Each event in this section is separated by a clear break, with the exception of two where the events overlap slightly. One could consider these as compound events, hence their labeling on the chart.
9. Xenakis outlined his sieve theory in the 1971 edition of *Formalized Music*, then added an additional explication, first published in *Perspectives of New Music* in 1990 to the book’s 1992 revised edition, along with a computer implementation (Xenakis 1992, 194–200, 268–88).
10. See DeLio 1980; Naud 1975; Vandenbogaerde 1968; Vriend 1981.
11. The original publishers’ catalogs give the duration of *Nomos alpha* as seventeen minutes, in spite of the score stating a length of fifteen minutes. The updated brochure published by Boosey and Hawkes in 1977 gives a duration of ten minutes (possibly a printing error).
12. De Saram’s insights were shared in masterclasses held at the 1985 Centre Acanthes summer course, devoted that year to Xenakis.
13. This annotated copy of the English version of *Oresteïa* comes from Xenakis’s personal archives.
14. The *Oresteïa* suite was given its concert premiere in Paris in December 1967. It has since been produced in various forms, including a dance version by Don Asker of the Human Veins Dance Theatre in Canberra, Australia (June 1982). *Kassandra* was added for an outdoor production by Yannis Kokkos at Gibellina, Sicily, in August 1987. *La Déesse Athéna* was composed in 1992 for a production in Athens in May of that year. A film of the Gibellina staging was produced by Hugo Santiago for *La Sept* in France (see Santiago 1987).
15. In some venues (GRM, in Paris and Bourges; BEAST, in Birmingham; Concordia, in Montreal), electroacoustic music is now presented with diffusion systems involving numerous loudspeakers, often of differing size and character, distributed in three dimensions around the concert space. There is still an “ideal” listening location, usually right where the mixing console is located.
16. Maria Anna Harley has analyzed the spatial motion in *Terretektorh* in detail, following indications given in the composer’s sketches (see M.A. Harley 1994a).
17. Faugeron’s pavilion is one of the few still standing on the former EXPO 67 site. Presently, it houses the Casino de Montréal. Xenakis’s installation of cables and lights remained in place until the remodeling in 1993.
18. The term *polytope* does not originate from Xenakis, but from advanced mathematics (see M.A. Harley 1998, ff. 4). Xenakis’s polytope creations are presented most impressively in Olivier Revault d’Allonnes’s (1975) study, which includes numerous photographs and sketch reproductions.
19. That the commission money for *Nuits* came from the Gulbenkian Foundation of Lisbon did not prevent Xenakis from naming a Portuguese prisoner in the foreword to the score. He was soon thereafter to accept a series of commissions from the shah and empress of Iran, a situation that evidently did not suggest political implications, at least to the composer. One

- wonders whether the designation of the phonemes as being derived from Persian and Sumerian—the music is abstract enough that there is no semantic necessity to the chosen phonemes—came about from contact with the Iranian entourage, whose connection to cultural life in Paris was strong.
20. Xenakis gives a brief explanation of the compositional procedures employed for *Nomos gamma* (Xenakis 1992, 236–41). Much is left unstated, however, which makes analysis on that basis extremely difficult. No mention is made of what became of *Nomos beta*, which should have come before “gamma” (sketch materials do exist, however).
 21. The quarter tone is here treated as the basic intervallic unit, as in many of Xenakis’s scores from *Eonta* onward. It is thus treated as a normal element of music, rather than anything unusual. The resulting sonority, however, is far removed from the mainstay of European classical, or even contemporary, music.
 22. The chart showing the overall timbral divisions gives durations that add up to almost twenty-two minutes. This is far different from the fifteen-minute duration noted in the publisher’s catalog (and reproduced in most other listings). The overall duration, estimated or calculated, is not given in the score, unusually. The existing recordings (commercial and archival) are much closer to fifteen minutes than to twenty-two, so the published estimate may be based upon these established performances.
 23. Xenakis was certainly aware of the difficulties producing glissandi on woodwind and fingered brass instruments. He was attracted to the unusual timbres and “roughness” resulting from attempts to carry out this technique by the means available. Merely fingering chromatic scales to fill in the glissando contour is to misinterpret the intent, a mistake often made by resistant performers.
 24. Much of the information about the circumstances of *Kraanerg* comes from the archives of the National Ballet of Canada and the National Arts Centre in Ottawa (see M.A. Harley and J.Harley 1997, 24–31).
 25. Xenakis to Wallace Russell, administrator of the National Ballet of Canada, 6 March 1969; Archives, National Ballet of Canada.
 26. Some material is shared between the chamber orchestra performing live and the prerecorded tape. Excerpts of recordings from earlier pieces were also used in the production of the tape part, although the sound processing disguises the material much of the time.
 27. The score is notated in reference to chronological time rather than measure numbers, as coordination with the numerous tape interjections must be handled with great precision.
 28. A new choreography was more recently produced by Joachim Schlomer for the Basel Dance Theatre, in January 1999.
 29. *Persephassa* is discussed by Jean Batigne (1981), leader of Les Percussions de Strasbourg, who includes an account of its challenges for the performers. His group has performed it on numerous occasions (probably hundreds), and continued a close relationship with the composer, engendering two subsequent works for percussion ensemble. The score has been studied by Solomos, who analyses portions of it in detail (Solomos 1994), and Maria Anna Harley, who discusses the spatialization element (M. A.Harley 1994a, 305–10).
 30. Solomos posits three main sections for *Persephassa*, combining what are labeled here as the second and third sections. These divisions are kept distinct here in order to give the appropriate structural emphasis to the introduction of the different timbral classes in the third section.
 31. The published score gives the duration of *Persephassa* as twenty minutes, but Jean Batigne cites its length at half an hour, which would make it one of Xenakis’s longest works. A calculation of the duration based on timings given in the score put it at something over twenty-seven minutes. Recordings range between twenty-four and thirty minutes.
 32. This project is mentioned by Hugues Gerhards in his chronology of Xenakis’s activities (1981b, 370) and by Maria Anna Harley in her discussion of the polytopes (M.A. Harley

- 1998, 58). No original music seems to have been produced for it, however, and no details have been included in any other publication.
33. The version produced for LP (released in 1972) breaks it into two parts and reduces the duration to forty-five minutes. Performances of this impressive work have been far too few.
 34. The detailed sketch giving precise timings only covers the first reel of tape, which ends at 31–1/2 minutes. The second reel should ideally come in with no break, requiring two eight-track machines.
 35. This anecdote has been oft recounted (see Revault d'Allonnes 1972, 26).
 36. Having longed for better control over the installation operations back in 1967 in Montreal, Xenakis was at last able to enlist digital technology to his aid. From his early days in the studios of GRM, he had foreseen the utility of computers in the production of sound. Having carried out his experiments in algorithmic composition in 1962 (his *ST* program), he wanted to pursue computer-generated synthesis of sounds as well. To that end, he established an organization in 1966, EMAMu (l'Équipe de Mathématique et Automatique Musicales), which in 1972 became CEMAMu (Centre d'Études de Mathématique et Automatique Musicales), associated with the Université de Paris and housed at the Centre National d'Études des Télécommunications, where it remains to this day. The digital control signals for the *Polytope de Cluny* were developed with the engineers at CEMAMu.

Chapter 5.

Arborescences, Random Walks, and Cosmic Conceptions

1. Tabachnik became one of Xenakis's foremost interpreters, premiering no fewer than twelve of his works, primarily through the 1970s, but continuing into the 1990s.
2. *Synaphai*, like the earlier pieces, requires a spatial distribution of the orchestra, though simpler. The four divisions of instruments (placed side by side, with groupings of strings in front, followed by woodwinds, brass, and then percussion) are meant to be seated on a normal stage, with the piano solo in front.
3. Xenakis does not explain his intent in the score. If the glissando notation, a connecting line drawn between two note heads, indicates that the in-between notes are to be filled in, why would he use it between neighboring notes? On the other hand, there are times when such a notation is not used, even though the context is otherwise identical. Such paradoxes, of which there are many in Xenakis's scores, force the performer to confront the music in new ways. The composer leaves the decision open, as if to pose a challenge (see Couroux 1994).
4. The ballet was originally intended to feature Suzanne Farrell, a favored member of Balanchine's company. When she abruptly left the New York City Ballet in 1971, the project was canceled, and the aging choreographer was unable to mount it at a later time, even after Farrell rejoined the troupe. The duration is listed as twenty-three minutes, but the score itself yields a length of just over twenty minutes.
5. The "mixed" element is made up of a dense complex of various entities, and is related to similar textures in *Nomos gamma* and *Kraanerg*.
6. Ronald Squibbs has studied *Mikka* (and *Mikka "S"*), and argues that the proportioning of the distinctive elements of the music (relatively smooth contours versus jagged ones, dynamic shifts, ponticello, tremolo) indicates that the random-walk process would not have been continuous from beginning to end, but compiled according to a formal design (1996, 230–42). It is possible, though, to obtain such a design through dynamic control of the parameters of the generative mathematical function.
7. British pianist Peter Hill provoked a debate with his discussion of the compromises he found necessary to adopt in performing *Evryali* (Hill 1975 and 1976), with indignant responses

- coming from Xenakis devotee, Yuji Takahashi (1975), and another British pianist, Stephen Pruslin (1975).
8. There is also a fermata at the end of the opening passage, but as it leads directly into the more amorphous “cloud” texture, its impact as a distinctly perceived element is minimized. Squibbs, in his analysis of *Evrlyali*, labels the passage beginning at m. 136 as the second of three stochastic passages, whereas I have called it a “wave entity.” It can be heard as a combination of the two, really, as the boundaries of the texture form waves, but the contours are filled in such that it also resembles a “cloud.” The rhythmic propulsion of this passage is what distinguishes it from the other stochastic sections, including the one immediately after, which is of a much lower rhythmic density (see Squibbs 1996, 146–80).
 9. One could assume this to be a misprint, but, given the other utopian passages in the piece, this is not a decision that can be taken unreservedly.
 10. One exception is found in the relationship between the entity at m. 95 and the succeeding one at m. 100, which contains the same intervallic structure as the first, transposed up a minor third.
 11. The duration is listed as approximately twenty-five minutes, but the score yields the shorter duration (when calculated at the tempo minimums; Xenakis also indicates that the tempos could be faster).
 12. The novel timbral quality of the countertenor, here torn from any association with early music beyond the sound of the voice itself, would return in several works. Beginning with *Aīs*, Xenakis would write a number of pieces for Greek baritone Spyros Sakkas, whose falsetto range greatly attracted the composer.
 13. One of these layers is strongly reminiscent of the accelerando-decelerando rhythmic figure of *Synaphai*, which had also been used in parts of *Persephassa*.
 14. Swedish composer Bengt Hambraeus, himself an organist, has pointed out the connections between the structure of the organ, with its additive timbres, and elements of orchestration. Especially noteworthy in this regard is the treatise on orchestration by Charles-Marie Widor (a celebrated organist in Paris in the early part of the century). He exerted a great deal of influence on Messiaen, and it is certainly possible that Xenakis would have known of his work (see Hambraeus 1981).
 15. Again, the score errs in giving an overall duration. The tempo markings result in a duration of 12–3/4 minutes, while the stated length is 16 minutes. The available recordings fall somewhere in between.
 16. It is interesting to note, however, the care with which the composer worked with Sylvio Gualda, the percussionist who premiered *Psappha*, to find acceptable sonorities (particularly the metallic ones), to solve the problems of mallet choices, and so on. The aim was to reconcile the ideal, the abstract rhythmic structures, with the real or practical. Even as there is much leeway given the performer as to choice of instruments, Xenakis still needed to know that a good, convincing performance was possible (see Gualda 1981, 243–51).
 17. Ellen Rennie Flint (1989 and 1993) has done groundbreaking analytical work on *Psappha* (1975), to which I owe a great deal in my discussion.
 18. The quintuplet does not have the effect of shortening the cycle, as Flint postulates, though its singular inclusion in the music is certainly enigmatic.
 19. Swedish percussionist Johan Söderberg has recounted to the author that his performances of *Psappha* at dance clubs were always well received. In addition, at an orchestral performance in Pittsburgh in 1996, an audacious young fan came up to Xenakis to ask him to autograph a bootleg vinyl single of the piece.
 20. Squibbs has studied *Theraps* in detail, and discusses it in his dissertation (1996, 252–66).
 21. The Javanese gamelan in fact makes use of two tunings: the *pelog*, a seven-note scale, and the *slendro*, a five-note scale. The exact pitches vary, to some extent, from one set of instruments to another.

22. One commentator, though, does assign tonal centers in his analysis of the music (Halbeich 1988, 227–28). There is nothing in the treatment of the material to support this assumption, apart from the occurrence of certain pitch classes in several octaves (e.g., *A*, *D*, and *G*).
23. The CD (Auvidis Montaigne MO 782058, 1995) erroneously gives the premiere date as 11 February 1977, a year earlier than the actual date.
24. This statement could be taken as a veiled criticism of Stockhausen, who had a hand in the design of the German pavilion for the 1970 Osaka World Fair. Within the spherical design of the pavilion, Stockhausen installed a three-dimensional sound projection system for the performance and diffusion of his music.
25. The CD recording of *La Légende d'Eer* lasts for just under forty-five minutes. The entry is listed in the publisher's catalog as being just short of forty-six minutes. It is possible, given the length, that in transferring it from eight-track tape to digital format, a slight augmentation of tape speed could have caused temporal compression.
26. At Ateliers UPIC (recently renamed The Center for Contemporary Music "Iannis Xenakis"), the pedagogical/musical production center established independently from CEMAMu (which remains primarily a research facility), the original working score of *Mycenae alpha* is on display. This manuscript includes indications for elements not shown in the published score.

Chapter 6.

Sieves, Ensembles, and Thoughts of Death

1. There are a few rhythmic errors in the score (notated durations that don't add up), which must make performance of this passage even more treacherous than it already is.
2. There is some evidence to suggest that *Pléiades* was intended as a ballet, though it appears that this aspect of the project was abandoned.
3. The parallelism is broken in two spots by contrary motion between the upper piano line and the rest of the ensemble. The quality of this chordal block sonority changes but slightly.
4. In his discussion of *Mists*, Ronald Squibbs describes four types of material. He breaks the arborescences into two contrasting configurations (basically, scalar and "sprouting" patterns), and includes silence as the fourth entity (1996, 180–81).
5. Recall that one of the major sonic components of *La Légende d'Eer* is the rattling, ceramic sound.
6. *Cendrées*, for example, received its belated British premiere at the 1997 Huddersfield Festival. In spite of the country's choral and oratorio tradition, *Anemoessa* has never been performed in the United Kingdom, and *Nekuia* received a single performance in 1987.
7. For a more detailed analytical discussion of *Tetras*, see J. Harley 1996.

Chapter 7.

Melody, Harmonic Color, and Nonlinear Form

1. The title has a *l* appended to it, signaling an intention to compose a series of works (or at least two) under the same heading. As it turns out, there were no other *Lichens*.
2. The originality is not specific to this piece. Similar textures had appeared earlier, including in *Shaar* from the previous year.
3. Olivier Revault d'Allonnes (1986), in his discussion of *Thallein*, points out the wider implications of the title, noting that Thalie is one of the three graces in Greek mythology. In his discussion of the music, however, he attempts to read a programmatic element in it, a "burgeoning" of the rhythmic organization going from simple to complex, at the same time

according a privileged role to the percussion. The score simply does not support this assertion.

4. The score appears to call for bass drum in each of the three percussion parts while the instrumentation in the foreword to the score indicates that only Percussion 3 is assigned the bass drum. The other percussionists could easily play this passage on tom-toms or timpani, but the intention is unclear.
5. In 1987, Centre Acanthes settled at the Chartreuse in Villeneuve-les-Avignon, where it has remained, operating in conjunction with the Festival d'Avignon.
6. The piano does play in the opening passage, but it is treated as an orchestral instrument, helping to fill out the bass register.
7. I am grateful to Benoît Gibson for pointing this out to me, along with the further connection of this material to *à r*, the brief piano solo composed the following year.
8. More recently (around 1994), another ensemble was named after the composer, this time based in New York. The ST-X Ensemble Xenakis USA has given a number of concerts of Xenakis's music and has dedicated itself to recording his complete works for ensemble and chamber formations (five CDs have been released so far). There are others, such as the Psappha Ensemble in the United Kingdom. There was even an experimental rock band in Norway in the mid-1980s that went by the name Hyperbolic Paraboloid.
9. The highest *B_♭* is actually a *B*, due to the structure of the pitch sieve used, subverting the strongly tonal emphasis the octaves lend the music.
10. Xenakis would, however, write a concertante work in 1989 for bass clarinet and ensemble. *Échange* has proven to be one of his most popular ensemble works.
11. Xenakis discussed cellular automata in his aesthetic seminar at the Université de Paris in the spring of 1986. *Horos* was completed in the summer of that year, so it is possible that he was working on it concurrently with his lectures. The new technique occurs only in the first part.
12. Peter Hoffmann discusses cellular automata (and many of the other mathematical foundations of Xenakis's work) in his doctoral thesis (1994, 145–52). Stephen Wolfram (1984) is the mathematical pioneer in the exploration of this interesting modeling technique.
13. Daniel Durney gives an interesting overview of the political situation in France (with reference to contemporary music) through the period leading up to, and beyond, the creation of IRCAM and the Ensemble InterContemporain. He notes that the ensemble's funding "is more than double the total of all the subsidies allotted to the other contemporary music groups" (1993, 8).
14. A strikingly similar passage, though for strings alone, is found in the central movement of British composer Richard Barrett's orchestral work *Vanity* (1994). His admiration for the music of Xenakis is well known, but that movement, otherwise of quite a different style from Xenakis, is dedicated to Phil Lesh, bassist for the Grateful Dead, whose Rex Foundation assisted in the funding of the commission.
15. The original published score of *Ata* contains a numbering error for the measures 124 to the end. The numbering skips back to 124 when it should be 127, so that the numbering from there to the end (m. 135, which should read 138) is three measures off. Presumably, the parts and a newer engraved edition of the score would correct this problem.
16. This discussion is based on the author's eyewitness account of the event, from 13 July 1987.
17. This remarkable production in the powerful ancient setting in Sicily was filmed, as noted above (see chapter 3, note 14).
18. The score also calls for a large African "skin," heard but briefly on two occasions. Performers have been known to leave it out and play the part on the djembés.
19. The transcription of his lectures from the Polish Society for Contemporary Music Summer Course for Young Composers has been published in Polish (Xenakis 1988c). It also served as the basis for his 1996 article on determinacy and indeterminacy (Xenakis 1996).

20. The Asko recording (Attacca Babel 9054–1) of live performances of *Échange*, *Palimpsest*, *Waarg*, and *Eonta* is a remarkable document of the extraordinary energy and commitment the group brings to this music.
21. *Erod* was produced in 1997 at Les Ateliers UPIC in collaboration with Brigitte Robindoré.
22. *Kyania*, for orchestra, was probably completed before *Tetora* (both date from November 1990). It more properly belongs with the group of orchestral works that follow, though, so it is discussed in the subsequent chapter.
23. The stated duration of *Tetora* is approximately seventeen minutes. The only available recording, by the Arditti Quartet, for whom it was written, is much faster, at just under fifteen minutes.

Chapter 8. The Late Works

1. Heart troubles in the late 1980s led to a bypass operation. This relatively fragile situation was complicated by the onset of prostate cancer. Weighing in around the same time was the appearance of diabetes. This latter condition resulted in several comas, and seriously weakened Xenakis's state of well-being.
2. Françoise Xenakis has paid poetic tribute to their vacations on the water in her ironically affectionate book *Moi j'aime pas la mer* (F. Xenakis 1994).
3. This passage is identical to the measure in *Ata*, which is the exact retrograde of the measure in *Horos*.
4. One is able to discern five main sections in *Kyania*, but only with relative difficulty. The ebb and flow of the various elements on different time-scales makes a definitive formal segmentation rather pointless, apart from general orientation.
5. The foreword to the score indicates a duration of approximately twenty minutes. The score itself yields a duration of about eighteen minutes, which is in concordance with the 1996 recording by Irvine Arditti with the Moscow Philharmonic Orchestra, conducted by Jonathan Nott (BIS 772).
6. One might point out the proximity of this climactic point to the Golden Mean, but it is not close enough to have been calculated with any precision.
7. Marie-Hélène Serra (1993), a researcher then working on this project with Xenakis at CEMAMu, has written a clear, succinct description of Dynamic Stochastic Synthesis.
8. I am grateful to Brigitte Robindoré for information regarding the production of *Erod* and the reasons for its withdrawal from Xenakis's catalog.
9. There were precedents in London that made comparisons inevitable. These include Hans Werner Henze's *Bassarids*, an opera to a libretto by W.H. Auden, and John Buller's opera *BAKXAI*, presented just the previous season.
10. While (or perhaps because) Xenakis spent much of his life posing and solving all manner of puzzles and problems, from the mechanical to the aesthetic, he has had no problem relating to children. During a visit to his studio, he handed my precocious two-year-old daughter a nut and bolt to thread, a challenging but perfectly satisfying puzzle to keep her occupied for a few precious moments.
11. Benoît Gibson, in his doctoral research on Xenakis's music, has noted many more instances of shared material than I have had room to point out.
12. *Ergma* was commissioned for the Mondriaan String Quartet, based in the Netherlands. In spite of his close relationship with the Arditti String Quartet, for whom all of his chamber string music since *Tetras* had been written (with the exception of *Paille in the Wind*), Xenakis took on this project because of his affinity for the influential Dutch artist.

13. Begun in 1956, *Diamorphoses* was presented at the 1959 Warsaw Autumn Festival, followed by a highly successful performance of *Pithoprakta* in 1962. The music of Xenakis has been included almost annually since that time.
14. No doubt, there will be much debate regarding the proper approach to the very slow tempi Xenakis has preferred in his later scores. One would normally try to follow the indicated tempo, where it is specified, but there are times when this decision gives rise to serious performance difficulties. In *Koïranoï*, for example, the opening note of the trombones would last over fifteen seconds; played at the dynamic marking of *fff* this would be virtually impossible without taking a breath. On the other hand, the textural density might enable individual players to take a breath without disrupting the music.
15. Strangely, the available recording of these two pieces, by the ST-X Ensemble Xenakis USA, inverts the lengths, clocking just over six minutes for *Kaï*, and just under nine minutes for *Kuilem*. The performances by the commissioning ensembles, though not yet available on disc, are more convincing.
16. The details of any performances prior to *Metastaseis* remain extremely sketchy. Matossian reports on this particular piece, but there is no other confirmation of a public presentation of it (Matossian 1986, 51).

Bibliography

- Baltensperger, André (1996). *Iannis Xenakis und die Stochastische Musik: Komposition im Spannungsfeld von Architektur und Mathematik*. Bern: Verlag Paul Haupt.
- Barnes, Clive (1969). Ballet by Xenakis Opens Ottawa Arts Center. *New York Times*, 4 June.
- Batigne, Jean (1981). Sur *Persephassa et Pléiades*. In *Regards sur Iannis Xenakis*, edited by Hugues Gerhards, 175–83. Paris: Stock.
- Bois, Mario (1967). *Iannis Xenakis: The Man and His Music*. London: Boosey and Hawkes. First published in French in 1966.
- Boivin, Jean (1995). *La Classe de Messiaen*. Paris: Christian Bourgois.
- Brody, James Mansback (1970). Liner notes to *Iannis Xenakis Electro-acoustic Music*. Nonesuch Records H-71246.
- Bucquet, Marie-Françoise (1981). Sur *Evryali*. In *Regards sur Iannis Xenakis*, edited by Hugues Gerhards, 219–26. Paris: Stock.
- Cage, John (1961). *Silence*. Middletown, Conn.: Wesleyan University Press.
- Chojnacka, Elisabeth (1981). Sur *Khoai*. In *Regards sur Iannis Xenakis*, edited by Hugues Gerhards, 227–35. Paris: Stock.
- Couroux, Marc (1994). Dompter la mer sauvage: réflexions sur *Evryali* de Iannis Xenakis. *Circuit* 5, no. 2:55–68.
- Delalande, François (1997). *‘Il faut être constamment un immigré’: Entretiens avec Xenakis*. Paris: INA-Buchet/Chastel.
- DeLio, Thomas (1980). The Dialectics of Structure and Materials: Iannis Xenakis’ *Nomos Alpha*. *Journal of Music Theory* 24, no. 1:63–96.
- (1985). Structure and Strategy: Iannis Xenakis’ ‘Linaia-Agon’. *Interface* 16:143–64.
- Durney, Daniel (1993). The State, the Creator and the Public. *Contemporary Music Review* 8, no. 1:3–18.
- Emmerson, Simon (1976). Xenakis [interview]. *Music and Musicians* 24:24–26.
- Ferneyhough, Brian and James Boros (1990). Shattering the vessels of received wisdom. *Perspectives of New Music* 28, no. 2 (Summer 1990): 6–50. Reprinted in *Brian Ferneyhough: Collected Writings*, edited by James Boros and Richard Toop, 369–405. Amsterdam: Harwood Academic, 1995.
- Fleuret, Maurice (1972). Une musique à voir. *L’Arc* 51:32–35. First published in the Program of the Festival d’Automne, Paris, 1972.
- (1981). Xenakis avant Xenakis. In *Regards sur Iannis Xenakis*, edited by Hugues Gerhards, 55–70. Paris: Stock.
- (1988). Il teatro di Xenakis. In *Xenakis*, edited by Enzo Restagno, 159–87. Torino: Edizioni di Torino.
- Flint, Ellen Rennie (1989). An Investigation of Real Time as Evidenced by the Structural and Formal Multiplicities in Iannis Xenakis’ *Psappha*. Ph.D. diss. University of Maryland-College Park.

- (1993). *Metabolae, Arborescences and the Reconstruction of Time in Iannis Xenakis' Psappha*. *Contemporary Music Review* 7, no. 2:221–48.
- Fulchignoni, Enrico (1981). Sur *Orient-Occident*. In *Regards sur Iannis Xenakis*, edited by Hugues Gerhards, 257–63. Paris: Stock.
- Gerhards, Hugues, ed. (1981a). *Regards sur Iannis Xenakis*. Paris: Stock.
- (1981b). Biographie de Iannis Xenakis. In *Regards sur Iannis Xenakis*, edited by H. Gerhards, 365–82. Paris: Stock.
- Gibson, Benoît (1994). La théorie et l'oeuvre chez Xenakis: éléments pour une réflexion. *Circuit* 5, no. 2:41–54.
- Griffiths, Paul (1975). Xenakis: Logic and Disorder. *Musical Times* 116:329–31.
- Grisey, Gérard (1987). *Tempus ex Machina: A Composer's Reflections on Musical Time*. *Contemporary Music Review* 2, no. 1:239–75.
- Gualda, Sylvio (1981). Sur *Psappha*. In *Regards sur Iannis Xenakis*, edited by Hugues Gerhards, 243–51. Paris: Stock.
- Halbreich, Harry (1988). Da “Cendrées” a “Waarg”: quindici anni di creatività. In *Xenakis*, edited by Enzo Restagno, 211–70. Torino: Edizioni di Torino.
- (1989). Foreword to *à r. score*. Paris: Editions Salabert.
- Harley, James (1998). The String Quartets of Iannis Xenakis. *Tempo* 203:2–10.
- (1996). Sonic and Parametrical Entities in *Tetras: An Analytical Approach to the Music of Iannis Xenakis*. *Canadian University Music Review* 16, no. 2:72–99.
- Harley, Maria Anna (1994a). Spatial Sound Movement in the Instrumental Music of Iannis Xenakis. *Interface: Journal of New Music Research* 23, no. 3:291–313.
- (1994b). *Musique, espace et spatialisation*, translated by Marc Hyland. *Circuit* 5, no. 2:9–20.
- (1998). Music of Sound and Light: Xenakis's Polytopes. *Leonardo* 31, no. 1:55–65.
- Harley, Maria Anna and James Harley (1997). Triumphs of Modernity: Xenakis's *Kraanerg* at Canada's National Arts Centre. *Musicworks* 67:24–31.
- Hambraeus, Bengt (1981). Aristide Cavallé-Coll, Charles-Marie Widor: The Organ and the Orchestra. In *L'Orgue a notre époque: Papers and Proceedings of the Symposium Held at McGill University, May 26–28, 1981*, edited by Donald Mackey, 185–190. Montreal: McGill University.
- Hill, Peter (1975). Xenakis and the Performer. *Tempo* 112:17–22.
- (1976). Letter to the editor. *Tempo* 116:54–55.
- Hoffmann, Peter (1994). *Amalgam aus Kunst und Wissenschaft: Naturwissenschaftliches Denken Denken im Werk von Iannis Xenakis*. Frankfurt am Main: Peter Lang.
- Hoad, Brian (1988). Murphy's New Journey. *The Bulletin*, 22 November, 125.
- Kendergi, Maryvonne (1981). Xenakis et les Québécois. In *Regards sur Iannis Xenakis*, edited by Hugues Gerhards, 301–13. Paris: Stock.
- Lalas, Thanassis (1998). Interviews. *Array: Communications of the International Computer Music Association* 17, no. 3:34–57.
- Langlois, Frank (1996). The Flute as a Universal Instrument [liner notes]. *Cécile Daroux: Xenakis-Dusapin* Disques Salabert SCD 9603.
- Le Corbusier [Charles Edouard Jeanneret] (1980). *Modulor I and II*, translated by Peter de Francia and Anna Bostock. Cambridge, Mass.: Harvard University Press. Originally published in French as *Le Modulor* (1954), and *Modulor 2* (1958).
- Leber, Jean (1996). Liner notes, *Anaktoria*. Accord 605652. Taken from *Autour d'Anaktoria*, in *Regards sur Iannis Xenakis*, edited by Hugues Gerhards, 184–85. Paris: Stock, 1981.
- Löscher, Wolfgang (2000). Xenakis: Orchestral Works and Chamber Music [liner notes]. Col Legno WWE ICD 20504.
- Maceda, José (1981). Xenakis, l'architecture, la technique. In *Regards sur Iannis Xenakis*, edited by Hugues Gerhards, 335–39. Paris: Stock.

- Mâche, François-Bernard (1993). The Hellenism of Xenakis. *Contemporary Music Review* 8, no. 1:197–211. First published in Italian in 1988 as L'ellenismo di Xenakis in *Xenakis*, edited by Enzo Restagno, 77–92. Turin: EDT/Musica.
- Marino, Gérard, Marie-Hélène Serra, and Jean-Michel Racziński (1993). The UPIC System: Origins and Innovations. *Perspectives of New Music* 31, no. 1:258–69.
- Matossian, Nouritza (1981). L'artisan de la nature. In *Regards sur Iannis Xenakis*, edited by Hugues Gerhards, 44–51. Paris: Stock.
- (1986). *Xenakis*. London: Kahn and Averill. First published in French as *Iannis Xenakis*. Paris: Fayard/Sacem, 1981.
- (1998). *Xenakis: Choral Works* [liner notes]. Hyperion CD A66980.
- Méró, László (1998). *Moral Cakulations: Game Theory, Logic, and Human Frailty*. New York: Copernicus Books.
- Messiaen, Olivier (1994–). *Traité de rythme, de couleur, et d'ornithologie* (1949–1992), 7 vols. Paris: Alphonse Leduc.
- Metzger, Heinz-Klaus and Rainer Riehn, eds. (1987). *Xenakis. Musik-Konzepte* 54–55.
- Meyer, Leonard (1956). *Emotion and Meaning in Music*. Chicago: University of Chicago Press.
- Meyer-Eppler, Werner (1958). Statistic and Psychologic Problems of Sound. *Die Reihe* 1: 55–61. First published in German in 1955. Vienna: Universal Editions.
- (1959). *Grundlagen und Anwendungen der Informations Theorie*. Berlin: SpringerVerlag.
- Moles, Abraham A. (1958). *Théorie de l'information et perception esthétique*. Paris: Flammarion.
- Montague, Eugene (1995). The Limits of Logic: Structure and Aesthetics in Xenakis' *Herma*. M.A.thesis. Amherst: University of Massachusetts.
- Naud, Gilles (1975). Aperçus d'une analyse sémiologique de *Nomos Alpha*. *Musique en jeu* 17:63–72.
- O'Brien, Joan V. (1977). *Bilingual Selections from Sophodes' 'Antigone'*. Carbondale: Southern Illinois University Press.
- Oswalt, Philipp (1991). Polytope von Iannis Xenakis. *Arch+* 107 : 50–54.
- Pawley, Martin and Yukio Futagawa (1970). *Le Corbusier*. New York: Simon and Schuster.
- Petit, Roland (1969). *Kraanerg*: Synopsis Program, Opening Festival. Ottawa: National Arts Centre.
- Pritchett, James (1993). *The Music of John Cage*. Cambridge: Cambridge University Press.
- Pruslin, Stephen (1975). Letter to the editor. *Tempo* 115:54.
- Rappoport, Lidia (1983). Sonorism: Problems of Style and Form in Modern Polish Music, translated by Jennifer M. Goheen. *Journal of Musicological Research* 4, nos. 3–4: 399–415.
- Restagno, Enzo (1988). Un'autobiografia dell'autore raccontata da Enzo Restagno. In *Xenakis*, edited by E. Restagno, 3–70. Torino: EDT Edizioni.
- Revault d'Allonnes, Olivier (1972). Xenakis et la modernité. *L'Arc* 51:20–26.
- (1986). *Thallein* de Xenakis. In *Harmoniques* 1: 189–195.
- , ed. (1975). *Xenakis/Les Polytopes*. Paris: Balland.
- Roads, Curtis (2001). *Microsound*. Cambridge, Mass.: MIT Press.
- Santiago, Hugo (1987). *The Gibellina Chronicle*. Film. Paris: La Sept—INA—PARI—Commune de Gibellina.
- Schaeffer, Pierre (1966). *Traité des objets musicaux: essai interdisciplines*. Paris: Éditions du Seuil.
- (1981). Chroniques xénakiennes. In *Regards sur Iannis Xenakis*, edited by Hugues Gerhards, 79–88. Paris: Stock.
- Serra, Marie-Hélène (1993). Stochastic Composition and Stochastic Timbre: *GENDY3* by Iannis Xenakis. *Perspectives of New Music*, no. 1:236–57.
- Sevrette, Daniel (1973). Étude statistique sur *Herma* de Xenakis. M.A.thesis. Paris: Schola Cantorum.
- Shannon, Claude and Warren Weaver (1949). *The Mathematical Theory of Communication*. Urbana: University of Illinois Press.

- Shonu, Susumu (1987). The Role of Listening in *Gagaku*. *Contemporary Music Review* 1, no. 2:19–43.
- Solomos, Makis [Gérassimos] (1985). *Sémiologie et musiques actuelles: 'Nuits' de I. Xenakis*. Mémoire de D.E.A. Paris: Université de Paris IV.
- (1993). À propos des premières oeuvres (1953–69) de I. Xenakis: pour une approche historique de l'émergence du phénomène du son. Ph.D. diss. Paris: Université de Paris IV.
- (1994). *Persephassa: durée, geste et rythme*. *Percussions* 33:11–19.
- (1996). *Iannis Xenakis*. Mercuès: P.O.Éditions.
- (2001). Du projet Bartókien au son: l'évolution du jeune Xenakis. In *Présences de Iannis Xenakis*, edited by Makis Solomos. Paris: CDCM.
- Squibbs, Ronald (1996). *An Analytical Approach to Recent Music of Iannis Xenakis*. Ph.D. diss. New Haven: Yale University.
- Steiner, George (1984). *Antigones*. New Haven: Yale University Press.
- Sward, Rosalie la Grow (1981). *An Examination of the Mathematical Systems Used in Selected Compositions of Milton Babbitt and Iannis Xenakis*. Ph.D. diss. Evanston: Northwestern University.
- Tabachnik, Michel (1993). *Mosaïques*. Foreword to *Mosaïques* [score]. Paris: Éditions Salabert.
- Takahashi, Yuji (1975). Letter to the editor. *Tempo* 115:53–54.
- Takemitsu, Toru (1987). My Perception of Time in Traditional Japanese music. *Contemporary Music Review* no. 2, 1:9–13.
- Treib, Marc (1996). *Space Calculated in Seconds: The Philips Pavilion, Le Corbusier, Edgard Varèse*. Princeton: Princeton University Press.
- Uno, Yayoi (1994). The Roles of Compositional Aim, Syntax, and Design in the Assessment of Musical Styles: Analyses of Piano Music by Pierre Boulez, John Cage, Milton Babbitt, and Iannis Xenakis circa 1950. Ph.D. diss. Rochester, N.Y.: Eastman School of Music.
- Vandenbogaerde, Fernand (1968). Analyse de 'Nomos Alpha' de Iannis Xenakis. *Mathématiques et Sciences Humaines* 24:19–34.
- Varga, Bálint András (1996). *Conversations with Iannis Xenakis*. London: Faber and Faber. Portions of these interviews were first published in *Muzsikuszportrék*, Budapest: Zeneműkiadó, 1979. The 1980 interviews were published as *Beszélgetések Iannis Xenakisszal*. Budapest: Zeneműkiadó, 1980. The complete set of interviews was first published in German as *Gespräche mit Iannis Xenakis*, translated by Peter Hoffman. Atlantis Musikbuch, 1995.
- Vriend, Jan (1981). 'Nomos Alpha' for violoncello solo (Xenakis 1966): Analysis and comments. *Interface* 10:15–82.
- Wolfram, Stephen (1984). *Universality and Complexity in Cellular Automata*. Amsterdam: Elsevier.
- Xenakis, Françoise (1994). *J'aime pas la mer*, rev. ed. Paris: Éditions Balland. First published in 1979.
- Xenakis, Iannis (1955). Problems of Greek Music. *Art Review* 9:185–189.
- (1956). Wahrscheinlichkeitstheorie und Musik. *Gravesaner Blätter* 6:28–34. First published in French as *Théorie des probabilités et composition musicale* in *Musique formelles* (26–33), and reprinted in *Musique. Architecture* (9–15) and again in *Kéleütha* (46–53). Included in English in *Formalized Music* (12–21).
- (1958). Genèse de l'architecture du pavillon: le pavillon Philips à l'Exposition universelle de Bruxelles 1958. *Revue Technique Philips* 20, no. 1. Reprinted in *Musique. Architecture* (123–42).
- (1967). Foreword. *Metastaseis* [score]. London: Boosey and Hawkes.
- (1968). Foreword. *Atrées* [score]. Paris: Éditions Salabert.
- (1969). Foreword. *Nuits* [score]. Paris: Éditions Salabert.
- (1972). Foreword. *Duel* [score]. Paris: Éditions Salabert.
- (1974). Foreword. *Cendrées* [score]. Paris: Éditions Salabert.
- (1976a). *Musique. Architecture*, rev. ed. Paris: Casterman. First published in 1971.

- (1976b). La ville cosmique. In *Musique. Architecture*, rev. ed. Paris: Casterman: 151–160.
First published in *L'Urbanisme, Utopies et Réalités*, edited by Françoise Choay, 335–342. Paris: Éditions du Seuil, 1965.
- (1976c). Foreword. *Phlegra* [score]. Paris: Éditions Salabert.
- (1977). Foreword. *Jonchaies* [score]. Paris: Éditions Salabert.
- (1978). *Le diatope: geste de lumière et de son* [program book]. Paris: Centre Georges Pompidou.
- (1982a). Foreword. *Dikhthas* [score]. Paris: Éditions Salabert.
- (1982b). Foreword. *Komboï* [score]. Paris: Éditions Salabert.
- (1984). Foreword. *Naama* [score]. Paris: Éditions Salabert.
- (1985a). Foreword. *Synaphai* [score]. Paris: Éditions Salabert.
- (1985b). Foreword. *Idmen A* [score]. Paris: Éditions Salabert.
- (1986). Foreword. *Antikhthon* [score]. Paris: Éditions Salabert.
- (1987a). Foreword. *Pour les baleines* [score]. Paris: Éditions Salabert.
- (1987b). Foreword. *Kassandra* [score]. Paris: Éditions Salabert.
- (1988a). Foreword. *Aïs* [score]. Paris: Éditions Salabert.
- (1988b). Foreword. *À l'île de Gorée* [score]. Paris: Éditions Salabert.
- (1988c). *Determinizm—indeterminizm: Kazimierz '84*. Warsaw: Polskie Towarzystwo Muzyki Współczesnej.
- (1989). Notes on *Kraanerg* [liner notes]. *Kraanerg*. Amsterdam: Etcetera Records KTC 1075.
- (1992). *Formalized Music*, rev. ed. Stuyvesant, N.Y.: Pendragon Press. First published in English in 1971. Bloomington: Indiana University Press. First published in French as *Musique formelles* in 1963. Paris: Éditions Richard Masse. A new edition was published in 1981. Paris: Stock.
- (1993). Foreword. *Knephas* [score]. Paris: Éditions Salabert.
- (1994a). Musique et originalité. In *Kéleütha [Écrits]*, 106–11. Paris: L'Arche. First published in *Phréatique* 28 (1984):62–66.
- (1994b). La crise de la musique sérielle. In *Kéleütha [Écrits]*, 39–43. Paris: L'Arche. First published in *Gravesaner Blätter* 1 (1955):2–4.
- (1996). Determinacy and Indeterminacy. *Organised Sound* 3, no.1:143–55.
- (1997). Foreword. *Sea-Change* [score]. Paris: Éditions Salabert.
- Zeller, Hans Rudolf (1987). Xenakis und die Sprache der Vokalität. *Musik-Konzepte* 54–55: 3–27.

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