

## THE VOICE OF THE UPIC: TECHNOLOGY AND VIRTUAL AGENCY

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**SUMMARY.** I have previously situated the UPIC of Iannis Xenakis, a computer music instrument of legendary intransigence, as set apart from the mainstream of electroacoustic technologies, developing its own “voice” as the utterance of “prophetic” traces: ancient, not modern. Here, I will approach the sound of the UPIC from the perspective of Robert Hatten’s recent theory of “virtual agency.” The sounds of the UPIC confound traditional notions of meaning in music as expressive – in a human sense and reconfigure what Brian Kane calls the “audile techniques” of a “community of listeners.” Yet the works made with this technology remain engaging and meaningful to us as music. In this paper, I will explore the idea of ‘virtual agency’ as extended to non-human agents, as figured by the events and appearances of the natural world, and consider the ways in which Xenakis allows us, as listeners, to engage with these “virtual agents” through their traces, evident in the graphism of the UPIC’s interface.

**Keywords:** UPIC, Xenakis, virtual agency, Hatten, vitality, energy.

### Introduction

I want to consider, here, the UPIC computer system, developed by Iannis Xenakis and a team of collaborators through the 1970s and ‘80s. There are a few reasons for my continuing fascination with this device: first, there is my own encounter with the UPIC, which took place while I was an associate of the organisation, les Ateliers UPIC between the presentation of the system at the Huddersfield Festival of Contemporary Music in 1987, and its presence at the Radio France concert celebrating Xenakis’s 70th birthday in 1992. This encounter produced the strong feeling of attachment that I have

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to the *sound* of the UPIC: it's almost vocal quality, the "grain" of its sound, which gives an expressive charge that is unlike any other sonic material and sets the UPIC apart from other developments in computer generated and electroacoustic musics. Second, there is my feeling that the UPIC project encapsulates some of the key elements of Xenakis's art: its multi-facetedness and radical openness; its corporeal and situated, as well as its intellectual and spiritual determinants. Third, the work that Xenakis made with the UPIC, particularly the first work, the interludes for the Mycenae polytope, collected together as the piece Mycenae Alpha, has for me a haunted quality that provokes questions about the ways in which music comes to have meaning for us. This is sound made through a combination of graphic instincts as old as humanity, and the most contemporary of digital technologies, and this combination seems to me to reveal the place and purpose of technology itself in the animation of what I will call virtual agency.

### Virtual Agency

I am taking the notion of virtual agency from the recent work of the musicologist and semiotician, Robert Hatten, whose central concern has been to find a detailed explanation of how music has meaning.<sup>2</sup> My own recent concerns have been around notions of attachment in art; the ways in which we attach ourselves to works we love, and those works in turn create in us a sense of attachment outwards from them, particularly the sense of attachment that creates practices of care for other selves and for the environment we all inhabit.<sup>3</sup> Hatten's theory of virtual agency proposes a strong role for music in the creation of attachments, and it seems to me that the work of Xenakis has the power to attach us into networks of care that matter for our current and future political and ecological challenges. In this sense, music does not simply have meaning, it *does work*, and the creative insights of Xenakis allow his music to do specific work in specific ways. Since this discussion concerns a unique technology, the UPIC, which may be unfamiliar, I will begin by examining some of its main functions and motivations. Then I will consider more fully the notion of virtual agency and try to develop some of the potentials of that theory for the understanding of an aesthetics of attachment. Finally, I will try to consider what it is about Xenakis's works for the UPIC that gives them their particular, haunting allure.

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<sup>2</sup> Hatten, Robert S. "A theory of virtual agency for Western art music." In *Musical meaning and interpretation*. Indiana University Press, Office of Scholarly Publishing, Bloomington, 2018.

<sup>3</sup> Nelson, Peter. "What's the Use of Music?" In *Proceedings of the Xenakis 22: Centenary International Symposium*, Athens & Nafplio, Greece), 24-29 May 2022, pp. 33-42. <https://xenakis2022.uoa.gr/proceedings/> [accessed 22-09-2023]

## UPIC and the Sonic Imaginary

The history of the UPIC, as related in an article by three of the collaborators in its building, Gérard Marino, Marie-Hélène Serra, and Jean-Michel Raczinski, reveals some elements of the basic conception of the device.<sup>4</sup> Marino and Serra are programmers and software designers, Raczinski is an electrical engineer. Their account thus focuses on the practicalities of the UPIC's design, development, and operation, but they begin their article with an account of what they take to be the UPIC's key attributes and originary insight. They start with an anecdotal account of the conception of the UPIC in relation to the materials for Xenakis's early orchestral work *Metastasis*, and, in particular, in relation to a key conceptual element of Xenakis's invention, the glissando. They write:

graphic representation has the advantage of giving a simple description of complex phenomena like glissandi or arbitrary curves. Furthermore, it frees the composer from traditional notation that is not general enough for representing a great variety of sound phenomena.<sup>5</sup>

This statement gives the graphic image, and the process of drawing as a sort of direct access to the imagination, the status of an initial insight, and it asserts a fundamental link between graphic image and sound phenomena. This link between the visual and the audible is registered in terms of speed:

If the system is fast enough, the composer gets the result of his work directly, so that the exchange between thought and ear is made very easy and immediate.<sup>6</sup>

This proposes the system as a sort of rapid prototyping environment for the process of composition, where the access granted to the imagination by drawing is put into a feedback loop with the aural imagination. However, this process of composition is freed not just from traditional notation, but in fact from all previous compositional strategies. They write:

the system should not impose predefined sounds, predefined compositional process, predefined structures, and so on. It is essential for the creative mind that ideas do not go through theories or limitations that might not suit the composer.<sup>7</sup>

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<sup>4</sup> Marino, Gérard, Marie-Hélène Serra, and Jean Michel Raczinski. "The UPIC System: Origins and Innovations." In *Perspectives of New Music*, 31, 1, Winter, 1993, pp. 258-269.

<sup>5</sup> Marino, Gérard, Marie-Hélène Serra, and Jean Michel Raczinski. "The UPIC System: Origins and Innovations." In *Perspectives of New Music*, 31, 1, Winter, 1993, pp. 258-269.

<sup>6</sup> Ibid.

<sup>7</sup> Ibid.

This presents the UPIC as a sort of *tabula rasa*, and echoes Xenakis's own view, when he writes,

In musical composition, construction must stem from originality which can be defined in extreme (perhaps inhuman) cases as the creation of new rules or laws, as far as that is possible; as far as possible meaning original, not yet known or even foreseeable.<sup>8</sup>

This presents a moment of what James Mooney and Trevor Pinch call the "sonic imaginary".<sup>9</sup> "In a sonic imaginary," they write,

sound itself has a sociomaterial agency and makes a crucial difference in how worlds are enacted. ... we treat the imaginary as an emergent phenomenon from the material world.<sup>10</sup>

The "material world" here includes not just the technical device of something like the UPIC but also the conceptual, social, and actively embodied practices that make up the apparatus of music. In categorizing sound as "an emergent phenomenon", Mooney and Pinch are also suggesting that it is the product of more mysterious, originary forces, and that it may not "come first" as we shall see in a moment.

## Polyagogy

The heterogeneity of the list of features above, that evoke the sonic imaginary of the UPIC, in fact prompts the system's name: the first two letters U and P stand for *Unité Polyagogique*. Xenakis explains this name in one of his published interviews with Bálint András Varga:

"Polyagogique" is my coinage: "agogie" means training or introduction into a field; "poly" means many. When designing we are working in space with our hands (geometry); in constructing rhythmic models we have to compute distances (geometry and arithmetic); also, general forms. And finally, there's the sound. All those things together ... make "polyagogique".<sup>11</sup>

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<sup>8</sup> Xenakis, Iannis. *Formalized music: thought and mathematics in composition*. Revised ed., additional material compiled and edited by Sharon Kanach. Pendragon Press, Hillsdale, NY, 1992, p. 258.

<sup>9</sup> Mooney, James, Trevor Pinch. "Sonic Imaginaries: How Hugh Davies and David Van Koevring performed electronic music's future." In ed. Antoine Hennion, Christophe Leveau, *Rethinking Music Through Science and Technology Studies*, Routledge, London, 2021, pp. 113-149.

<sup>10</sup> Ibid. p. X

<sup>11</sup> Varga, Bálint András, and Iannis Xenakis. *Conversations with Iannis Xenakis*. Faber and Faber, London, 1996, p. 121.

This account of the UPIC's core conception brings together notions of sound, space, and number in a way that seems to me to propose *music* - let's call it that - as a sort of "challenging object".<sup>12</sup> This term, introduced by Matteo Valleriani in his discussion of Galileo, applies as follows: we know what music is in general, but there is no "canonical explanation" for it. Indeed, Xenakis seems to explode this object, "music" into multiple "fields": space, rhythm, sound, each with its own sort of epistemology - geometry, arithmetic etc. - that the UPIC seeks to combine into a unity. How do these foundational, conceptual elements help us to listen to the sound of the UPIC?

My experience, presenting the UPIC in public demonstrations, assisting composers to use it for making their own works, and composing with it myself, only confirmed the legendary intransigence of the device. As Dimitris Kamarotos remarks:

One of the reasons why many surprising difficulties for the users remained after their first contact with the system was due to the influence of how the system was promoted: as an intuitive, non-technically inclined system encouraging creativity. People were promised they would be able to make music, or at least complex, interesting sound structures without any knowledge of computers, or even music.<sup>13</sup> (255)

When Xenakis speaks of *agogie* as "training or introduction" I think he is not really describing the UPIC as a tool for education and learning in the obvious sense. Learning to use the UPIC is an education in itself; a means of exploration of the "challenging object" that is music. The extreme openness of the technical apparatus of the UPIC makes it a fertile space for puzzlement as well as for creative play. It seems to me emblematic of the conception of the UPIC that sound comes at the end: as Xenakis says, "And finally there's sound," marking the distinction Xenakis makes between *in-time* and *outside-time* structures. When the composer, and my colleague at Les Ateliers UPIC, Brigitte Robindoré refers to the perception of the UPIC's sound as being "somewhat harsh," she is registering the frequent sense of disappointment of people using the device for the first time, and even Xenakis himself seemed not always to be convinced.<sup>14</sup> There is a moment, in an interview given at the

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<sup>12</sup> Valleriani, Matteo. *Galileo Engineer*. Boston studies in the philosophy of science. Springer, Dordrecht [Netherlands] London New York, 2010.

<sup>13</sup> Kamarotos, Dimitris. "The UPIC in Greece: ten years of living and creating with the UPIC at KSYME." In ed. Peter Weibel, Ludger Brümmer, Sharon Kanach, *From Xenakis's UPIC to Graphic Notation Today*, Hatje Cantz, Berlin, 2020, p. 255.

<sup>14</sup> Condorcet (Robindoré), Brigitte. "Beyond the Continuum: the undiscovered terrains of the UPIC." In ed. Peter Weibel, Ludger Brümmer, Sharon Kanach, *From Xenakis's UPIC to Graphic Notation Today*, Hatje Cantz, Berlin, 2020, p. 403.

Huddersfield Festival in 1987 where the UPIC was showcased, when Xenakis seems to express some regret about its functioning. In answer to a question about the quality of computer-generated sound, he said the following:

The natural sounds, yes, they are, indeed they are richer. Of course, the instruments for instance have still a very fine sound which can be very complex, provided that you write in such a way that this can be shown, and the computer is still poor in that domain. I think it's not a matter already of the technology, but also of thinking and theories.<sup>15</sup>

Here is a moment when we understand that, for Xenakis, technology is not at all the labor-saving automaton of the Modern era, but fundamentally a matter of “thinking and theories,” in which the non-modern aspects of his own thought come to the fore. How then, given these testimonies to disappointment, can we gain a more positive encounter with the sound of the UPIC?

In a recent paper entitled “The Voice of the UPIC: Technology as Utterance,” I situated the UPIC as set apart from the mainstream of electroacoustic technologies, developing its own “voice” as the utterance of what I identified as “prophetic” traces: ancient, not modern in intent.<sup>16</sup> This argument arose out of an attempt to allow the UPIC to be heard, not as a poor version of something it is not - a machine for the synthesis of hyper-real, digital instrumental sound, like the outputs of computer synthesis languages such as SuperCollider, or commercial keyboard samplers and synths - but rather as its own voice. In that earlier paper, I tried to characterize the voice of the UPIC as a voice of enunciation, rather than replication, and I tied the notion of enunciation to an oracular moment. However, enunciation is in any case a sign of agency, and I now want to consider the notion of the virtual agency that seems to me to lie behind the sound of the UPIC.

## Energy

In his book on Xenakis, Makis Solomos identifies *energy* and *abstraction* as two of the key determining factors of Xenakis's art.<sup>17</sup> The energy, in the first place, is the energy of the event, and the key events in this case are historical events: the street demonstrations and actions of resistance in which Xenakis participated as a young man. The abstraction is

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<sup>15</sup> Xenakis, Iannis. Public interview with Richard Steinitz at the Huddersfield Festival of Contemporary Music, 1987. Transcribed by the author.

<sup>16</sup> Nelson, P. “The Voice of the UPIC: technology as utterance.” In ed. Reinhold Friedl, Thomas Grill, Nikolaus Urbanek, Michelle Ziegler, *Xenakis2022: Back to the Roots*. mdw press, Wien/Bielefeld, 2024.

<sup>17</sup> Solomos, Makis. *Iannis Xenakis*. PO Editions, Mercues, 1996.

the identification of invariant properties that characterize those events. Thus, Solomos writes:

To naturalise the street demonstrations in question means to break the concentration on their surface phenomena in order to get at their material elements: their richness, their warmth, their interior energies.<sup>18</sup>

At the same time, Solomos identifies two aspects of energy that motivate events: an energy of the event itself, and a creative energy that inhabits the imagination before and after the event. He writes:

Energy which channels tension without eliminating it, as the desire to create something *ex nihilo*, and the universalism that comes from a powerful imagination ... these are inextricably linked ...<sup>19</sup>

The thing about energy is that it always appears as a dynamic form; a form producing time by means of invariant properties inherent to it, properties that provide not only the keys to abstraction but also moments of recognition that can identify the energetic form as emanating from another *self*. As Daniel Stern notes: "Our minds tend to see vitality forms whether they come from nature, self, or other humans."<sup>20</sup> This tendency is a signifying tendency; a predisposition to understand energy as motivated, and to draw from that recognition of motivation a sense of another self to which we are drawn: as kindred, in enmity, in awe, or perhaps in abstract fascination. It is this tendency that Robert Hatten puts to use in trying to identify the ways in which music is meaningful to us, as he traces the types, trajectories, and interactions of energetic forms within the surface manifestations of musical sound. Hatten uses the term *virtual agency* to account for the motivations that we interpret as we sense the forms of vitality in music as signs of another self: a virtual self, in Hatten's terms. For Hatten, these other, virtual selves with their rhetorical elaborations of identifiable topics are always human in character, but I think that we can, as Stern suggests, identify and feel drawn to a variety of energetic characters that may include, but are not restricted to the human. It is indeed the generation of the presence of specifically non-human energies that are none the less sympathetic - in the sense that they draw us to them - that seems to me to characterize a key aspect of Xenakis's creative power. One further consequence of this focus on the trajectories of

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<sup>18</sup> *Naturaliser les manifestations en question signifie briser les fixations de surface pour restituer pleinement leur côté concret : leur richesse, leur chaleur, leur énergie intérieurs.* Ibid. p. 111.

<sup>19</sup> *Énergie qui canalise la tension sans l'éliminer, souci de création ex nihilo et universalisme qui tient d'un imaginaire puissant ... sont inextricablement liées ...* Ibid. p. 109.

<sup>20</sup> Stern, Daniel. *Forms of Vitality*. Oxford University Press, Oxford, 2010, p.30.

forms of vitality is that it moves the discussion around the challenging object of music away from ideas of expression and emotion, topic and rhetoric, towards a consideration of sympathy and attachment, and of the ways in which the *virtual* in music draws us to the forces that surround us. It is in his exploration of these forces that Xenakis makes his most significant artistic contributions.

One of the key features of Robert Hatten's work is the detail with which he seeks to encounter the virtual agencies of music. His analyses take account of the particulars of specific human cultures and focus on the possibilities for identifying the *topics of discourse* and the *semiotic strategies* within those cultural specifics. I do not doubt the usefulness of this line of thinking, but it seems to me that music has a wider set of dynamic and agential possibilities than those set out by Hatten, and it is these I want to touch on now, briefly, in order to get a better sense of what it is that I find so touching about the sound of the UPIC.

For Hatten, the implied agents in music are necessarily human agents, but I do not consider humans to be the only possible agents. Indeed, where Hatten locates his agencies within a highly circumscribed view of a shared culture, I want to suggest that culture, as Hatten describes it, is not required for the recognition and companionship of other selves. Indeed, Hatten's entirely understandable, yet notably Eurocentric view of culture depends on Enlightenment values that do not, in my understanding, accord with Xenakis's entirely pre-modern stance. Xenakis himself was quite explicit about his orientation. In an interview given at the Huddersfield Festival in 1987, he states quite clearly: "I brought myself up into the ancient Greek tradition, that's for sure,"<sup>21</sup> and in a published interview with Bálint András Varga: "I felt I was born too late - I had missed two millennia."<sup>22</sup>

### **Ancient Energies**

To get a sense of the implications of that stance, and to substantiate my claim that we respond to more than the human, I want to consider very briefly a few moments from anthropological literature. First, I turn to the account of culture presented by Eduardo Viveiros de Castro, for whom culture is all-encompassing rather than particularizing. As he tells it:

For Amazonian peoples, the original common condition of both humans and animals is not animality but, rather, humanity. Animals are ex-humans (rather than humans, ex-animals). ... To say, then, that animals and spirits are people,

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<sup>21</sup> Xenakis, Iannis. Public interview with Richard Steinitz at the Huddersfield Festival of Contemporary Music, 1987. Transcribed by the author.

<sup>22</sup> Varga, Bálint András, and Iannis Xenakis. *Conversations with Iannis Xenakis*. Faber and Faber, London, 1996, p. 15.



is to say that they are persons; and to personify them is to attribute to non-humans the capacities of conscious intentionality and social agency that define the position of the subject.<sup>23</sup>

This is to reposition the concepts of nature and culture, proposing that there is one culture, inhabited by many natures, a repositioning that suddenly makes possible the mutual recognition and relation of selves of many sorts, including the meteorological, the spiritual, and even the supernatural.

One of the consequences of thinking about human experience in terms of signs, which is what Hatten's notion of virtual agency proposes, is the opening up of a discourse that is not so much about "meaning" or emotion as it is about community. Signs make connections, of different types and availabilities, and while meanings may be open to interpretation, it is the connection itself that is undeniable. Here is an example of the interpretative possibilities of a sign, related by the anthropologist Eduardo Kohn. He is recounting a difficult journey into the heartlands of the Amazon basin, delayed by bad roads and landslides:

... after a fitful night, I was still out of sorts. I couldn't stop imagining different dangerous scenarios, and I still felt cut off from my body and from those around me. ... Trying at least to act normal, and in the process compounding my private anxiety by failing to give it a social existence, I took my cousin for a short walk along the banks of the Misahuallí river ... Within a few minutes I spotted a tanager [a type of bird] feeding in the scrubs at the scruffy edges of the town ... I rolled the focus knob [of my binoculars] and the moment that the bird's thick black beak became sharp I experienced a sudden shift. My sense of separation simply dissolved. And, like the tanager coming into focus, I snapped back into life.<sup>24</sup>

There are several observations to make about this passage. First, the bird appears as a sign of a "self". It is a self that is not human, but one which locates the human within a grounded context. The ground appears because the sign is - to use the terminology of Charles Sanders Peirce - indexical: it points to something. The panic that Kohn felt at the start of the passage is attributable to signs that are symbolic, that is whose arbitrary meanings can - and do - "run wild". The indexical nature of the sign that is the bird connects Kohn in a sympathetic, directed way that creates a grounded sense of community. The "self" that appears with the bird also allows the definition of an "I"; a "myself". As Kant proposed, in his late lectures on anthropology, the source of our sense of world begins with the face-to-face encounter,

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<sup>23</sup> De Castro, Eduardo Viveiros. "Exchanging perspectives: the transformation of objects into subjects in Amerindian ontologies." In *Common Knowledge*, 25, 1-3, 2019, pp. 22-23.

<sup>24</sup> Kohn, Eduardo. *How forests think: toward an anthropology beyond the human*, University of California Press, Berkeley, CA, 2013, p. 47f.

characterized by sympathy: the presence of an “I” in the company of a “you”.<sup>25</sup> From this initial encounter comes the sense of *company* where, as expressed by Joao Pina-Cabral, “more than two persons interact with a shared set of worldly affordances.”<sup>26</sup> In Kohn’s account we understand that the “selves” required for these processes of subject formation are not required to be human: only other subjects. The sight of the bird is the sign of a subject.

It seems to me that this story is related to the notion of “interior energy” described by Solomos. The abstractions that Xenakis was able to make from his encounters, both physical and mathematical, with the events of the world allowed him to perceive virtual agencies of immense power, channelling energies of elemental form and allowing us, as listeners, a situated sense of sympathetic connection with a set of “selves” we had not otherwise encountered in the art of our day: selves that are sometimes awe-inspiring or terrifying, overwhelming or confronting, but which, none the less, through their dynamic forms, manifest as sympathetic figures that allow us to attach to the energies of the universe not as abstract, sublime moments of separation, but as committed moments of community. This, for me at least, is what makes the music of Xenakis so exhilarating: the virtual agencies at play are not acculturated, in the Enlightenment sense, or even recognizable, in the sense of representing forces we already know. They come from a beyond, that the particular insights of Xenakis allowed him to explore, and which, despite their strangeness, are nevertheless clearly *real*.<sup>27</sup> On the *tabula rasa* of the UPIC, these agencies appear in graphic form, like cave drawings, whose sonic energy emerges as a moment of utterance. Perhaps this is what Xenakis means when he says:

Composing is a battle. It should be an unconscious battle ... It’s a struggle to produce something interesting. Of course I can’t define what I mean by that. From my point of view it can’t be defined.<sup>28</sup>

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<sup>25</sup> Kant, Immanuel. “Lectures on Anthropology.” In ed. R. Louden & A. Wood, trans. R. Clewis & G. Munzel, *The Cambridge Edition of the Works of Immanuel Kant*, Cambridge University Press, Cambridge, 2012 [1798].

doi:10.1017/CBO9781139028639

<sup>26</sup> Pina-Cabral, Joao. “Company and the mysteries of a dugout canoe.” In *Journal of the Royal Anthropological Institute*, 2022, 10.1111/1467-9655.13814, p. 2.

[https://www.researchgate.net/publication/362770271\\_Company\\_and\\_the\\_mysteries\\_of\\_a\\_dugout\\_canoe](https://www.researchgate.net/publication/362770271_Company_and_the_mysteries_of_a_dugout_canoe) [accessed 22-09-2023]

<sup>27</sup> For a discussion of energy in Xenakis’s instrumental works, see García De La Torre, Mauricio. “El fenómeno de la activación sonora en la obra de Iannis Xenakis.” In *Pilacremus, Centenario Xenakis 1922-2022*, Seminario Universitario de Investigación en Creación Artística, SUICREA, UNAM, CDMX, México, December 2022, pp. 71-98.

<sup>28</sup> Varga, Bálint András, and Iannis Xenakis. *Conversations with Iannis Xenakis*. Faber and Faber, London, 1996, p.204.

Except, of course, that we know it when we hear it, because the virtual agencies at play buzz with life.

## Conclusion

What I have tried to do here is to think about the UPIC, and the works that Xenakis made with the system, in terms of production and enunciation, rather than as composition with sound synthesis: as the consequences of a process of sonic revelation similar to those achieved by Xenakis through his use of mathematics and logic. The graphical interface of the UPIC is, in one sense, another moment of abstraction, taking the physical, embodied experience of the hand and the eye encoded as they are with millennia of image-making, and providing a blank space for the exploration of the ways in which images spring from and outline their own virtual agencies. These double traces, of visual line and sonic energy, mark the *polyagogic* aspect of the UPIC, opening up an area of exploration where virtual agencies are registered as shifting shapes: as Xenakis says, in an interview with Bálint András Varga:

I believe that what is lacking today: a theory about shapes. Perhaps in twenty, thirty, forty years' time, fundamental shapes will be classified along with their applications and expressions in different fields of observation and production. ... And what's the meaning of a line? How does it come about? It's as if a point gave birth to a next point and so on until you get a line.<sup>29</sup>

This is the sense of an energy created, as Xenakis says in *Towards a Philosophy of Music*, "*ex nihilo*", but also the sense of mystery that is invoked by those virtual agencies, forces, and energies from deep in the cosmos, whose traces we register, and whose company we seek.<sup>30</sup>

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<sup>29</sup> Ibid. p. 207.

<sup>30</sup> Xenakis, Iannis. "Towards a Philosophy of Music." In *Formalized music: thought and mathematics in composition*. Revised ed., additional material compiled and edited by Sharon Kanach. Pendragon Press, Hillsdale, NY, 1992, pp. 201-241.

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