# Meta-Xenakis

## New Perspectives on Iannis Xenakis's Life, Work, and Legacies

Edited by Sharon Kanach and Peter Nelson
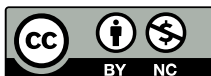
Cover image: Iannis Xenakis at the C.R. MacIntosh Museum, Glasgow, Scotland, 1987. Photo by Henning Lohner, courtesy of CIX Archives, Lohner collection.

Cover design: Jeevanjot Kaur Nagpal

# 41. The Xenakis Networked Performance Marathon 2022 (Sustainable Resources)

*Iannis Zannos, Martin Carlé, Vasilis Agiomyrgianakis,*
*Takumi Ikeda, and Hanako Atake*

This chapter functions as an appendix to Chapter 40.

## Press Release of the XNPM22 Concert[1]

The year 2022 marks the one hundredth anniversary of the birth of the Greek-born pioneer composer and thinker Iannis Xenakis, and is accompanied worldwide by events dedicated to his memory and work. To honor this Greek-born musician, a marathon concert will take place at Athens Conservatoire, on Saturday, 17 December 2022, presenting works inspired by his musical work and his reflections on science and technology, and the role of music in society and the arts. This event, will take place at the Athens Conservatoire from 7:00 PM until 3:30 AM the following day, featuring musicians and artists from ten different countries (Greece, Italy, Germany, Turkey, Japan, Mexico, England, Ireland, Germany, Turkey, United States). The artists will perform the works remotely from their countries with simultaneous participation of other artists on site and elsewhere, connected via internet. This concert is a tribute to the visionary research of Iannis Xenakis and his efforts to push the boundaries of technology and artistic creation. It highlights the potential of technology to support international collaboration in artistic creation, to create works that are performed live in multiple venues simultaneously regardless of distance, using new experimental media that allow for direct communication and exchange of musical data. In addition, with some of the central works presented, the concert is a tribute to Xenakis's vision of international collaboration among young people to overcome the "biological struggle between generations unfurling all over the planet," as he wrote about his monumental composition *Kraanerg* (1968–9), choreographed by Roland Petit (1924–2011).[2]

---

1    The following text was the official public announcement of the marathon.
2    Xenakis quoted in Harley, 2008.

# Piece Descriptions

The following paragraphs are the descriptions of the pieces performed at the marathon, as submitted by the artists.

## *FeedbackLoopExpansion* (20′)

For Pure Data (Pd), synthesizer with feedback and Open Sound Countrol (OSC).

Concept and implementation: Stelios Giannoulakis, Jiannis Papadakis.

"XNPM22 part 01 Stelios Giannoulakis and Jiannis Papadakis Greece FeedbackLoopExpansion 20′ HD 720p" (29 Mar 2023), *YouTube*, https://www.youtube.com/watch?v=blTKAdcGrts&list= PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=2

The project as an experiment is part of research into a generalized feedback-based model for structuring variably stable soundscapes and pieces of performative sonic art. The Synthi100 in the studio of the Contemporary Music Research Center (CMRC; ΚΣΥΜΕ) at the Athens Conservatoire will be patched for a generative behavior, the network including a microphone feeding back with the studio speakers. A Pd patch in the studio will manage the synth output and generate real-time analysis data. In the performance space, there will be a laptop with a local feedback network made in Pd, incorporating analysis of the sound of the speakers over a microphone. Audio and data will be transmitted over the internet between the two stations, using OSC and maybe Sonobus or some other audio peer-to-peer solution. The whole feedback system will be tuned to respond to microphone input. This will consider the microphone's position in space, both in physical areas and as part of a performative action: settling down with no input, then getting denser and more complex as it is being exited. The idea is to create, between the studio, the Synthi100, and the performance venue, an intuitively tunable and reactive organic soundscape piece with grains and drones, noise, and harmonic relationships, that can be played.

## *Kraanerg Variations 1: Polymorphic Universes* (15′)

Dance with sensor-controlled sound

Mariannina Simatou

Dance: senior students and members of Corporis Miracula Ensemble: Athina Kolovou, Andrea Michailidi, Vilelmini Kalambratsidou, Giannis Varsos, Dimitra Filippaki, Evgenia Oikonomou, Elektra Smyri, Ioanna Ragia, Katerina Gerali

Choreography: Marianinna Simatou (Athens Conservatoire Professional Dance School Alumna, member of Corporis Miracula Ensemble)

Sound design: Vasilis Agiomyrgianakis

Sensor design and development: Martin Carlé

'XNPM22 Part 02 Mariannina Simatou Greece Kraanerg Variations 1 Polymorphic Universes 1 HD 720p' (29 Mar 2023), *YouTube*, https://www.youtube.com/watch?v=Wzalo_zHhhA&list= PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=3

The music of the sound masses by Iannis Xenakis is embodied in three dimensions, with the movement of the bodies of the universe, the galaxies. Universes are malleable and distinguished by simple, sonic, and architectural structures and patterns, which are approached, intertwined, coexisting, and juxtaposed, creating intense contrasts and dynamic spaces. They compose a visual universe that brings Wassily Kandinsky's (1866–1944) seemingly still and silent work to life and alters spatial sense through alternations of basic colors and shapes and through the sound sculptures born from the bodies, the moving masses. They pass through different atmospheres, sometimes thinner and sometimes denser, affecting the frequency of movement and sounds and creating a surge in the changing patterns, a chaotic delay in the reaction of the points of mass.

## *Gendy Cloud* (8′)

Csound controlled over the web via OSC

Concept and implementation: Serkan Sevilgen

'XNPM22 Part 03 Serkan Sevilgen Turkey HD 720p' (29 Mar 2023), *YouTube*, https://www.youtube.com/watch?v=9etZeH5JHAQ&list= PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=4

This work is heavily inspired by an event that occurred during the Xenakis Centenary Symposium. In front of the building where Xenakis was wounded, participants played a stream of sounds generated by GENDYN with their phones.[3] The idea is to generate a cloud of GENDYN sounds around the audience with multi-spatial setup. I use Csound's "gendy" opcode to build eight instruments whose parameters are determined randomly at different intervals. The performers are assigned for each instrument, and they control the duration of the state with a very simple web-based user interface. If they choose 5 seconds for instrument 1, then the parameters of the "gendy" opcode in instrument 1 will be recalculated every 5 seconds. The durations can be changed freely between 1 and 100 seconds during the performance. The performers can be anywhere, thanks to the web interface. The communication between the web interface

---

3    @serkansevilgen (24 May 2022), *InstaGram*, https://www.instagram.com/p/Cd9M4beoade/

and Csound will be handled via Remote OSC (a Node.js library written by Serkan Sevilgen to enable hassle-free data and code sharing between computer musicians).

### *Kraanerg Variations II: Route through Time* (30′)

Dance with sensor-controlled sound

Choreography: Marianinna Simatou (Athens Conservatoire Professional Dance School Alumna, member of Corporis Miracula Ensemble)

Sound design: Vasilis Agiomyrgianakis

Sensor design and development: Martin Carlé

Dance: senior students and members of Corporis Miracula: Artemis Strongylaki, Vasia Koutsilianou, Garyfalia Kontrafouri, Irini Dimojianni, Katerina Psaroudaki, Konstantina Kondyli, Maria Bosda, Nefeli Anthidi.

"XNPM22 Part 04 Mariannina Simatou Greece Kraanerg Variations II Route through Time HD 720p" (29 Mar 2023), *YouTube*, https://www.youtube.com/watch?v=KnGXvx3bRTs&list= PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=5

A creature exists in time to serve a specific purpose, to regulate the flow of time, in a laboratory beneath the Earth. It is a moving sound mass that produces sounds, originating from the environment, which it feeds on and absorbs. These sounds are then emitted from the body through the voice and through special extensions—members of its limbs. It moves perpetually in a plane of parabolic hyperbolicity, where each step forward is a subsequent moment in time, during which the frequency of movement and sounds changes. Each stop on the line of time freezes the linear continuity of it and brings to life memories of the molecules that make up the sound creature, in the dilated time of the stop.

### *Study for a Cosmic City* (8′)

Pure Data (control), Max/MSP (Sound) and IanniX (Graphics)

Concept and implementation: Julian Scordato

Performers: Arazzi Laptop Ensemble: Giorgio Klauer (Conservatory of Trieste), Nicola Privato (Iceland University of the Arts, Reykjavík), Julian Scordato (Conservatory of Padova), Giovanni Sparano (Conservatory of Reggio Calabria), Paolo Zavagna (Conservatory of Venezia)

"XNPM22 Part 05 Julian Scordato Italy: Iceland Study for a Cosmic City HD 720p"
(29 Mar 2023), *YouTube*,
https://www.youtube.com/watch?v=wkV9Uv-VsVQ&list=
PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=6

*Study for a Cosmic City* is an audiovisual work inspired by a utopian urban planning
proposal exposed by Iannis Xenakis in his essay entitled "The Cosmic City" (1965).[4]
As an attempt to relate computer graphics to the formalization of sound, the structures
that characterize the utopian city are designed using superquadratic curves capable
of describing reasonable variations of sound parameters, such as amplitude and
pitch. Parameter values extracted from buildings and pathways are sent remotely to
an ensemble of electroacoustic performers via OSC messages. Performers are free to
map the score data to the variables of their favorite devices and algorithms. The aim
is to preserve an autonomous design of digital musical instruments within a common
environment based on data sharing. Performative gestures are left to the sensitivity
of each musician. In the graphic representation of the score, each building transmits
continuous messages relating to the position of a running cursor. Moreover, paths
on the ground activate messages at road intersections and define the macro-formal
articulation of the score. The graphic project and management of control parameters
have been implemented exploiting advanced features of IanniX, (a poly-temporal and
multi-formal graphic sequencer based on Xenakis's UPIC) such as recursion, cursor
acceleration patterns, and complex curves described by mathematical equations.[5]

## *Time Warp* (12′)

For dancer with wearable motion sensors

Choreography: Marianinna Simatou (Athens Conservatoire Professional Dance School
Alumna, member of Corporis Miracula Ensemble)

Sound design: Vasilis Agiomyrgianakis

Dance: Sabina Mouratidou (Athens Conservatoire Professional Dance School Alumna,
member of Corporis Miracula Ensemble)

"XNPM22 Part 06 Marianinna Simatou Greece Time Warp HD 720p" (29 Mar 2023),
*YouTube*,
https://www.youtube.com/watch?v=aKtMy_E9UZ4&list=
PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=7

A creature awakens in a temporal space where the boundaries between memories,
dreams, and experiences of the present and the past are confused, in a malleable

---

4    Xenakis, 2008, p. 136–41.
5    *Iannix*, https://www.iannix.org/en/

space where we find it difficult to perceive whether it is real or imaginary, and which generates an inner struggle. The creature moves in a musical tableau, which disturbs its balance, creating new spaces and places, sometimes immerses itself in it and sometimes seeks to converse, through its own music, with this jumble of living moments, sounds, images, sensations, and tries to bring back with all its senses the memory of experiences and sometimes wishes to share them with us.

## *Politics I* (15′)

For Python, SuperCollider, Ableton Live, Twilio CLI Interface, ngrok CLI Interface, Postgresql, Redis, Processing

Concept and implementation: Eric Lemmon

'XNPM22 Part 07 Eric Lemmon U S A Politics I HD 720p' (29 Mar 2023), *YouTube*, https://www.youtube.com/watch?v=iGrtxuyOB8A&list= PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=8

In Western concert art music, the audience's participation in the presentation of a musical work is traditionally restricted to a staid listening experience within a proscenium setting. *Politics I* aims to overhaul this rigid notion of music-making by breaking down the barriers between composers, performers, and the audience and rendering audible the politics of aesthetic preference that exists within participatory music settings. In this new computer music system, audience members submit a text, the text is processed by the system, and then depending on the movement, this textual "action" impacts the music generated by the system in specific ways. Drawing on insights from musical semiology and political theory, I argue that this setting allows audience members to recognize the possible sonic effects of their own inputs and make choices that impact the aesthetic experience in real time. In effect, composer and audience determine the shape of *Politics I* together. Because this participatory setting provides the audience with agency to impact the musical work, the audience's interactions give rise to an internal discourse contained within the domain of the participating individuals and their submitted texts. This discourse, in turn, generates a concert-going, consensus-based public. Within the internal discourse of this public, audience members articulate a politics of aesthetic preference, wherein the sonic results that are preferred by more audience members can take precedence within the musical texture of the work.

The resulting politics of aesthetic preference is most easily recognizable through the interplay between groups vying to determine the shape and experience of the musical work, with the groups being generated through either spontaneous mimesis or pre-planned and coordinated action. To systematically analyze these discursive processes within the audience, and their potential to effect change within the music, the computer music system behind *Politics I* parses text messages submitted by the

audience through an array of natural language processing (NLP) techniques in Python. In SuperCollider, it then sonifies the analyzed content of the input messages while simultaneously displaying them visually. The system is customized to generate music such that distinct code-bases act as individual movements of a complete piece. *Politics I* has three distinct movements: "Digital Discourse," "Cybernetic Republic," and "Technoautocracy." Each of these movements serves as an analogy to a particular political system, with the purpose of musically representing how systemic structures influence political decision-making but can also be subverted through coordinated action.

## *Telluric Oscillation* (5′)

For SuperCollider with live coding

Concept and implementation: Eduardo García

'XNPM22 Part 08 Eduardo García Mexico Telluric Oscillation HD 720p HD 720p' (29 Mar 2023), *YouTube*, https://www.youtube.com/watch?v=jNhntqRzwM4&list= PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=9

Piece created by sonification of data from earthquakes registered in Mexico from 1970 to 2020 by the Servicio Sismologico Nacional (National Seismological Service) of UNAM (Universidad Nacional Autónoma de México). The piece suggests that the measured forms of these natural disasters resemble those of stochastic models, and communicates this hypothesis through sound.

## *Sarcophagus* (35′)

Dance with wearable motion sensors

Choreography: Danae Papadopoulou (Graduate of the Professional Dance School of Athens Conservatoire and member of Corporis Miracula Ensemble)

Assistant choreographer: Garifalia Kontrafouri (Senior at the Professional Dance School of Athens Conservatoire and member of Corporis Miracula Ensemble)

Sound design: Vasilis Agiomyrgianakis

Sensor design and development: Martin Carlé

Dance: Seniors at the Professional Dance School of Athens Conservatoire and members of Corporis Miracula Ensemble: Vasia Koutsilianou, Dimitra Filippaki, Marianinna Simatou, Viki Rondogianni, Evdokia Tzari, Sabina Mouratidou

'XNPM22 Part 09 Danae Papadopoulou Greece Sarcophagus HD 720p' (29 Mar 2023), *YouTube*,
https://www.youtube.com/watch?v=IyuETRA0uWU&list=
PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=10

The work *Sarcophagus*, choreographed by Danae Papadopoulou, aims to express through movement a fundamental situation in today's society, in which everyday life and friction within society devours human flesh. This work investigates the relationship between "man and society." Man appears as a part of the whole, a small but necessary part of a fractal. We are talking about an interactive relationship in which criticism, reward, punishment, acceptance and rejection are integral features and the causes of its erosion. The word "flesh," which is the first part of the compound word "sarcophagus," is used metaphorically in an attempt to approximate the process of decomposition of the human body (and soul?). Not in a superficial, temporary way, in which case we would probably use the word "skin," but referring to an in-depth, irreversible decomposition. The group that appears in the work seems to create a new language in its need to communicate the things that result from this slow-moving collapse. Through communication they create relationships and form a cohesive group, which forms a society. Each molecule of this group can express its inner world to others and free itself. Originating from primordial instincts, the language created by the creatures in the play arises from sounds that are inarticulate to us, but understandable to the group. The way these sounds are created is through the creatures' impulse in direct relation to "what their movement sounds like," but also through some form of randomness. Iannis Xenakis's revolutionary "contemplative music" and "music of sound masses" through mass *glissandi*, creates a sense of perpetual movement of huge masses. As he says in his book, he was inspired by mass phenomena such as the demonstrations he experienced as a resistance fighter:

> Everyone has observed the sound phenomenon of a crowd of hundreds or thousands of people at a political demonstration. The human river shouts a slogan in a uniform rhythm. Then another slogan starts at the head of the demonstration and spreads to the tail, replacing the first. [6]

In exactly the same way, these unarticulated sounds (language) are created by the group. The interplay of this music, varied through the sensors in response to the dancers' movements, combined with the peculiar language created by these archaic beings in the work *Sarcophagus*, could possibly lead to a very powerful audiovisual performance.

---

6    Xenakis, 1992, p. 9.

## *Sieve Algebra Study for Groups of Unknown Size* (15′)

Networked live coding on SuperCollider

Concept and Implementation: Juliane Blum, Sebastian Fecke-Diaz, Dennis Scheiba, Julian Rohrhuber (Algebra Ensemble, Robert Schumann Music University Dusseldorf).

'XNPM22 Part 10 J. Blum, S. Fecke-Diaz, D. Scheiba, J. Rohrhuber (Germany) Sieve Algebra' (29 Mar 2023), *YouTube*, https://www.youtube.com/watch?v=YfgUC4eJTIs&list= PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=11

At the crossroads of time and frequency, this piece departs from the sensitivity of composite formulas and follows the compass of Xenakis's sieve algebras into a combinatory logic of sound.

## *Heartland* (5′)

For dancer and SuperCollider controlled by wearable EKG sensor

Concept, sensor interface, dance: Vilelmini Kalabratsidou (Athens Conservatoire Professional Dance School, graduation year, Athena Research Center)

Choreography consultant: Iris Fousteri

Dramaturgy Consultant: Garyfalia Kontrafouri

Programming and data sonification: Iannis Zannos

Research consultant: Katerina Elraheb (Athena Research Center)

"XNPM22 Part 11 Vilelmini Kalabratsidou Greece Transparent Heart HD 720p" (29 Mar 2023), *YouTube*, https://www.youtube.com/watch?v=o5nkPPv_8Y0&list= PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=12

*Heartland* is a land where the rhythm of music is not determined by a fixed metronome but by a vital organ that changes and adapts to the needs of the body movement. Here, the heartbeat augments in the world of dance and, along with live percussion instruments, it creates music. The question is, does the rhythm of the music determine the movement or does the movement affect the heart and therefore the music?

## *Brain Dead Ensemble: BDE* (30′)

Live performance with networked audio feedback

Performers, members of the Brain Dead Ensemble: Alice Eldridge (feedback cello), Chris Kiefer (feedback cello), Thor Magnusson (Threnoscope)

"XNPM22 Part 12 Brain Dead Ensemble BDE UK, Iceland HD 720p" (29 Mar 2023), *YouTube*,
https://www.youtube.com/watch?v=K7wkz8yOtjI&list=
PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=13

The Brain Dead Ensemble are an acoustically networked feedback quartet/assemblage in which the structural, acoustic feedback pathways within and between "open" instruments create a fundamentally distributed musical agency. The current ensemble consists of two feedback cellos, a feedback bass, and a Threnoscope, acoustically coupled to form a multi-instrument, multi-channel system—an expanded music interface. The feedback cellos and bass are electro-acoustic-digital resonator instruments. Each instrument has pickups under each of its strings, and one or more transducers built into the acoustic instrument body, inducing electromagnetically-controlled feedback which can be subject to digital processing. The classical model of a bowed instrument is inverted: the player no longer controls and excites the strings to produce sound, but negotiates with an ongoing, lively, self-resonating instrument. The Threnoscope is a software system created by ixi audio for drones, live coding and microtonal, spatialized composition. All the instruments are networked acoustically: the seven channels of the Threnoscope are diffused to a quadraphonic PA plus the integral speakers of the string instruments. The acoustic result of these feedback processes is characterized by a variety of sonic colors including airy microtonal micro-melodies, serene yet colorful drones, complex spectral gestures, and vast explosions surfacing gradually or unpredictably into screams. Performances are improvised; an emergent, negotiated form of performance which involves the steering and shaping of evolving, distributed, sonic energies rather than the instigation and exchange of discrete musical ideas. No one is in control, although everyone is playing.

## *Acts for Hacks* (20′)

For conductive paint, custom-made sensors, Raspberry Pi, SuperCollider

Composition and performance: Vasilis Agiomyrgianakis (Ionian University), Haruka Hirayama (Hokkaido Information University)

Acting: Konomi Kaneko (Drama theater DOMO)

Technical Support: Yuto Fukuda (Hokkaido Information University)

"XNPM22 Part 13 Vasilis Agiomyrgianakis Greece, Haruka Hirayama Japan Acts for hacks HD 720p" (29 Mar 2023), *YouTube*,
https://www.youtube.com/watch?v=9JGm1oQOcVo&list=PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=14

*Acts for Hacks* is an interactive-telematic performance which combines traditional art such as painting and acting with computer music (real-time sound synthesis and manipulation) and electronics (microcomputers and sensing technology) suggesting new relations between senses, subjects and technologies.

## *Duel Revisited* (15′)

Python, SuperCollider

Concept and Implementation: Stefano Kalonaris

Coding for Networked Implementation: Iannis Zannos

Live Coding: Iannis Zannos, Georgios Diapoulis

XNPM22 Part 14 Stefano Kalonaris (Japan) Duel Revisited HD 720p" (29 Mar 2023), *YouTube*,
https://www.youtube.com/watch?v=dWEIZWcJ_Oc&list=PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=16

*Duel* (1959) is based on a finite zero-sum game and it is the earliest of three pieces that Iannis Xenakis composed inspired by game theory, the other two being *Stratégie* (1962) and *Linaia-Agon* (1972). *Duel* stylizes a conflict between two conductors who direct their respective orchestras in the execution of musical scores (events). Conductors choose which event to play conditioned upon the choice of the other conductor and on the payoff value that the resulting strategy tuple yields according to a game matrix designed by Xenakis.

In this revisited version of Xenakis's piece, the conductors are modeled computationally by means of probabilistic automata that can choose according to different rational strategies viable from a game-theoretical viewpoint. However, they also possess some subversive states that simulate aesthetic preference and attitude, allowing for less obvious solutions (albeit numerically sub-optimal). Performed by orchestras in the original piece, the musical scores/events are instead, in this implementation of the piece, rendered via means of a popular audio synthesis programming language, by interpreting the instructions regarding the events' musical content given by Xenakis in *Formalized Music*.[7]

---

7    Xenakis, 1992, p. 113–30.

## *hipercuboLab LiveSet* (5′)

For SuperCollider and TouchDesigner

Sound design and live coding: Michel Soto

Graphics: Aidé Aspicit

"XNPM22 Part 15 Michel Soto and Aidé Aspicit Mexico hipercuboLab LiveSet HD 720p" (29 Mar 2023), *YouTube*,
https://www.youtube.com/watch?v=FjqB6sRHaEc&list=
PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=16

*hipercuboLab LiveSet* is an algorithmic system inspired by mathematical techniques described by Iannis Xenakis in his book *Formalized Music*.[8] A 3D environment is controlled in real time by the live-coded changes made in the generative musical system. Markov chains, weighted random systems, machine learning processes, 3D geometry and real time animation are controlled using SuperCollider and TouchDesigner.

## *Sound Ping-Pong* (5′)

Smartphones and SuperCollider

Concept: Hidehiro Fujiwara

Implementation support: Iannis Zannos

Sound design and live coding: Hidehiro Fujiwara and Iannis Zannos

"XNPM22 Part 16 Hidehiro Fujiwara Japan Sound Ping Pong" (29 Mar 2023), *YouTube*,
https://www.youtube.com/watch?v=er2cNDlU0Sw&list=
PL1yHvCYr9BvbSJyrNX3cdY2xwt3CHM9Bb&index=17

*Sound Ping-Pong* is a telematic, participatory sound installation work using a computer and smartphones, where information from the smartphones' sensors is sent to the computer via OSC communication, and sounds are generated by the music programming software SuperCollider.

- Player 1's sound is output from the L speaker.
- Player 2's sound is output from the R speaker.
- A smartphone (iPhone or Android) is used as a table tennis racket and music is created by answering each other's ball-sound to continue the rally.

---

8    Xenakis, 1992.

- The players can be anywhere in the world. Their movements are transmitted over the internet regardless of the distance.

- Instead of competing to win or lose, the players work together to weave together a piece of music, which they can then enjoy together after playing.

## References

HARLEY, James (2008), *Xenakis Edition 8-Kraanerg*, Liner notes, CD (mode 196), New York, Mode Records.

XENAKIS, Iannis (1992), *Formalized Music: Thought and Mathematics in Music*, additional material compiled and edited by Sharon Kanach (rev. ed.), Stuyvesant, New York, Pendragon.

XENAKIS, Iannis (2008), *Music and Architecture: Architectural Projects, Texts, and Realizations*, compilation, translation, and commentary by Sharon Kanach, Hillsdale, New York, Pendragon.