



N_POLYTOPE:

Behaviors in Light and Sound After
Iannis Xenakis

An installation by Chris Salter
in collaboration with Sofian Audry,
Marije Baalman, Adam Basanta, Elio Bidinost
and Thomas Spier



N-Polytope: Behaviors in Light and Sound After Iannis Xenakis is a spectacular light and sound performance-installation combining cutting edge lighting, lasers, sound, sensing and machine learning software inspired by composer Iannis Xenakis's radical 1960s- 1970s works named Polytopes (from the Greek 'poly', many and 'topos', space). As large scale, immersive architectural environments that made the indeterminate and chaotic patterns and behaviour of natural phenomena experiential through the temporal dynamics of light and the spatial dynamics of sound, the Polytopes still to this day are relatively unknown but were far ahead of their time. *N_polytope* is based on the attempt to both re-imagine Xenakis' work with probabilistic/stochastic systems with new techniques as well as to explore how these techniques can exemplify our own historical moment of extreme instability.

150, 10 Watt LED's and 50 tiny speakers are suspended on 24, 20+ m stretched aircraft cables which form a ruled surface. While the behavior of the LED's create a changing space of bursting points, coloured lasers that bounce off the surface of fixed and changing mirrors generate fleeting architectures of lines and shapes that flicker and disappear before the visitors' eyes. Counter-pointing the visual scenography, multi-channel audio from the small speakers as well as the larger environment shifts between sparse natural and dense electronic textures. Across the architectural cable structure, the network of tiny speakers produce the behaviours of mass sonic structures made up of many small elements (sonic grains) creating swarms of tiny sounds that resemble a field of cicadas or masses of insects – akin to Xenakis's interest in the stochastic movement of mass structures.

The overall course of *N-Polytope* is that of an event that is partially scripted and partially indeterminate thus enabling the performance to continually move between order and disorder, tranquility and thundering chaos. The audience "feels" these algorithms as two forms of "life" – the behaviors in light and sound and the "life" of experiencing such a system evolving in the present.





TECHNICAL RIDER

NECESSARY SPACE REQUIRED

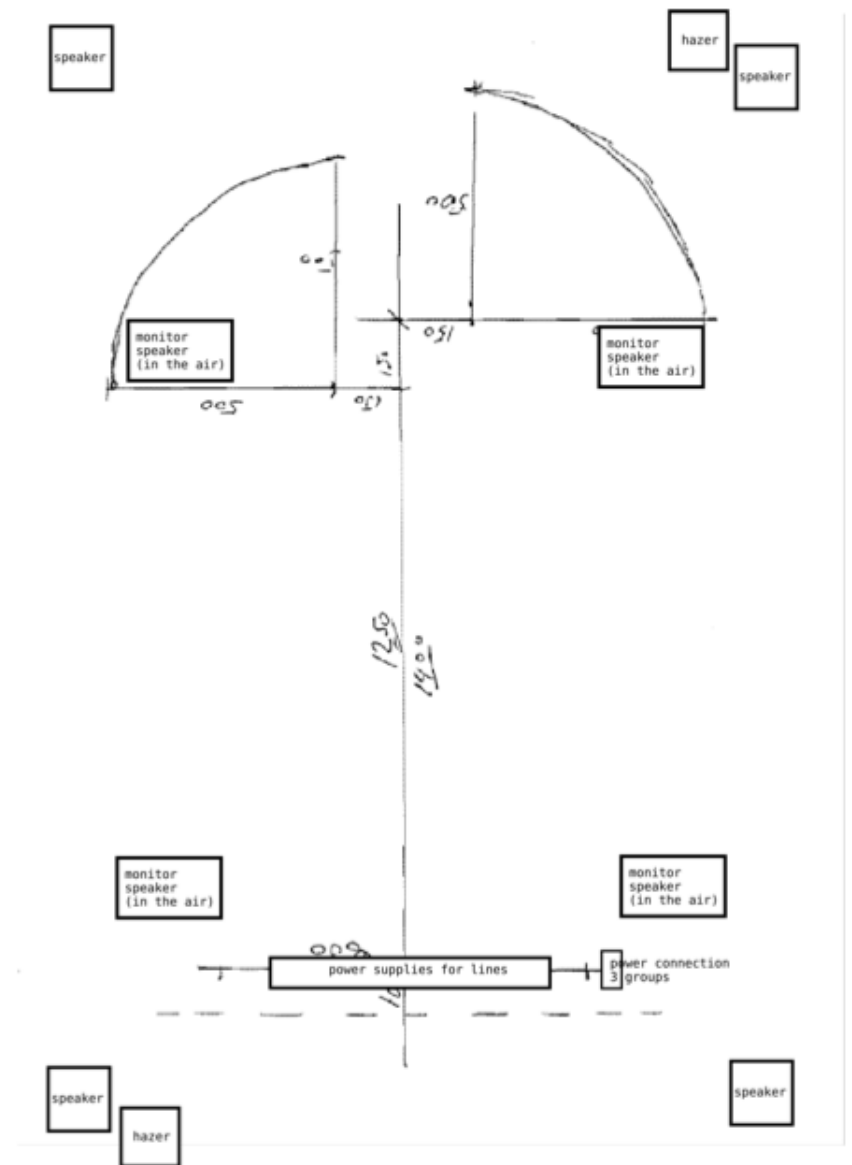
OUTER DIMENSIONS OF STRUCTURE:

21 m (L) x 13 m (W) x 5 m (H) (variable depending on venue height) - outer dimensions of structure.

OVERVIEW OF ELECTRICAL ELEMENTS REQUIRED

- 12 light and sound steel cables, each with 4 custom wireless units, including sensors, microphones and speakers, and 12 white, 10W LEDs.
- 1 LINUX Computer with custom software for control of all electronics via wireless communication; soundcard interface and DMX Hazer control.
- CLASS 3 Lasers (X 6)
- Fixed and motor variable mirror units (X 21)
- DMX controlled Haze machines (Looksolutions Uniq 2.0) (X 2)
- Multi-channel sound setup including subwoofer

OPPOSITE PAGE: FLOORPLAN LAYOUT OF STRUCTURE AND EQUIPMENT. THE END OF THE TOP OF THE DIAGRAM IS LOW TO THE GROUND. THE HIGHEST POINT IS AT THE LOWER END WHERE THE POWER SUPPLIES ARE MARKED. AT THE BACK OF THE ARC, SPACE IS NEEDED (APPROXIMATELY 4 METERS) FOR TENSION STRAPS THAT ARE MOUNTED IN THE FLOOR AND COUNTER THE TENSION OF THE STEEL CABLES ON THE ARC.



INSTALLATION ELEMENTS

LIGHT/SOUND CABLES

- Lighting (encased LEDs), sound and electronics units are pre-attached to 12 steel cables. These cables are attached with provided hardware to the structure. They alternate with steel cables without electronics.

NOTE: The electronics cables occupy the two furthest lines (outer) on each half of the structure.

- In the LABoral version, power supplies (x 6) were mounted on the verticle arc of the structure.

HAZERS

- DMX controlled Haze machines (X 2).

Hazers should be Looksolutions Uniq 2.0 or equivalent and capable of rapid volume fill in the space for laser visibility.

LASERS

- 6 Laser units in total (2 Green, 2 Red and 2 Violet). Each unit has a mirror with two servo motors and a wireless controller. These units need external power.

-The Green and Violet lasers run on a 12V DC (3.3 A) adapter, consuming around 1.5A on the AC supply.

- The Red lasers consume 1.5-2.0 A on the AC supply.

- The servo motor unit runs on a 12V DC adapter.

- In addition to the servo motor mirror units, there are a series of fixed mirror units used to bounce the laser beams around the space. The number of these will be determined based on the particular site specific mounting requirements.

- Each unit needs to be mounted on the wall or hung on suspended truss above the installation. The mounting and locations are dependent on the particularities of the venue. **FOR THIS REASON, WE WILL NEED GROUND, CEILING AND ELEVATION PLANS OF THE SPACE IN ADVANCE OF THE INSTALLATION PERIOD FOR DETERMINING THESE POSITIONS.**

MULTI-CHANNEL AUDIO

NOTE: THE CHOICE OF 4 OR 8 CHANNELS OF AUDIO IS DEPENDENT ON THE EXACT SIZE OF THE SPACE.

- **8 (+ SUB) or 4 (+ SUB) channel sound setup.** If the installation is tight within the space, a 4 channel system will be sufficient. If the space is double the size of the installation (+40 meters), an 8 channel system will be required.

- **4 channel setup:** 4 Full range (Meyer UPA-1 or equivalent - operating frequency range of 80 Hz- 13kHz) loudspeakers. These are placed at the far corners of the installation on the ground.

- **8 channel setup.** 4 Full range (Meyer UPA-1 or equivalent - operating frequency range of 80 Hz- 13kHz) loudspeakers placed on the ground at the far corners of the installation + **4** medium range fill speakers (active). These are suspended, face down in a quadrophonic configuration within the installation area (see diagram on page 4).

COMPUTER EQUIPMENT

- 1 Linux PC running custom written software + Ardour, SuperCollider, py-donhive (all software will be installed by artists).

- 1 Entec DMX USB Pro + USB cable (for DMX Hazer control)

- 1 Wireless network coordination board + USB cable

- VGA computer monitor (17"), mouse and keyboard (USB)

POWER REQUIREMENTS

- 6 power supplies (provided by artists) run on 120-240 V AC @ 6 A. Each outputs a variable voltage of between 10.5-13.8V. Each power supply can source up to 28 A.

- Due to the maximum amount of current the installation LEDs can draw at full brightness, we need one fuse/phase of electricity per two power supplies (artists can supply pre-built fuse box).

ARTISTS PROVIDE

- Architectural structure, steel cables, trusses, mounting platforms and all mounting hardware.
- Computer/sound I/O, Entec Pro, wireless coordinator.
- LED/electronics cables + power supplies
- Laser/servo mirror units + power supplies
- Tools for electronics (mounting/repair)

VENUE SHOULD PROVIDE

- VGA Monitor (17"), mouse, keyboard
- Hazers (**x 2**) and DMX cable for interfacing with Entec USB Pro controller. Hazer should be Looksolutions Uniq 2.0 or equivalent. We need hazer NOT fogger or smoke machine. NOTE: The number of hazers will be dependent on the size of the presentation space.
- All loudspeakers (active) or in the case of passive, appropriate amplifiers and cabling for connection to sound I/O (6.3 mm Jack/1/4" output).
- Electricity points at all locations for speakers, lasers, hazers, computer equipment, steel cables with mounted electronics.
- Tools for mounting architectural structure. NOTE: Due to the traction force on the cables, the steel structure will need to be mounted into the floor. This requires cement drills. Holes will need to be drilled into the floor.
- Access to scissor lift or appropriate rolling scaffold (minimum 5 meters depending on mounting strategy).
- Cable covers/gaffers tape for securing of cables.
- Setup crew for structure mounting.
- Qualified electrician from venue who knows power requirements of venue. **NOTE: THIS IS VERY IMPORTANT GIVEN THE ELECTRONICS SETUP.**
- Internet access during the installation period for software updates.

PRESENTATION VENUE REQUIREMENTS

- OUTER DIMENSIONS OF STRUCTURE ARE 21 m (L) x 13 m (W) x 5 m (H).
NOTE: WHILE THE LENGTH AND WIDTH ARE SET DUE TO THE LENGTH OF THE PRE-FABRICATED CABLES, THE HEIGHT MAY BE ADJUSTABLE BASED ON THE PARTICULAR CONFIGURATION OF THE VENUE.
- In the case of using the arc structure (5 m height), the top height of 5 m is only reached at the highest point of the structure. SEE PAGE FOR MOUNTING INSTRUCTIONS.
- The installation should be set up in a quiet environment. There should be no direct sunlight and the space should be darkened at all times.
- The installation should be at ground floor or, if installed at higher floors, there should be a freight elevator large enough to transport the truss structures.
- Depending on the eventual height of the structure, there should be cushions or equivalent installed under the highest point of the structure so that visitors can lie on their backs underneath the installation.

TRANSPORT/SHIPPING

- The structure and electronics equipment are stored at the LABoral Centro de Arte y Creacion Industrial in Gijon, Spain. This is the shipping pickup and dropoff location.
- There is an ATA Carnet for the electronics. There is, however, no ATA Carnet for the aluminum structure and its hardware. Based on country shipping requirements, a Carnet will need to be obtained for the shipping of the structure.
- The structure is palletted. In addition, two flight cases (76.2 x 76.2 x 106 cm each) hold the cabled electronics and lasers and other equipment.
- For the loading and unloading of the truck and pallettes, at least 2 persons are required.

EXHIBITION RUN

- N_Polytope runs in 2 modes: a 15 minute performance mode and an ambient mode which is slower and less dramatic in terms of the light and sound actions. The two modes are configurable. In its initial run at LABoral, the installation ran 5 times daily on the hour in the performance mode and the rest of the time in the ambient mode. The system is easily configurable and automated to switch between modes during the exhibition period.

- The installation should be switched on at the start of the day and is automated to start up all required software. Instructions are provided by the artists.

- In case of problems or troubleshooting, Marije Baalman (technical director) is available for on-line or on the phone consultation.

TEAM CONTACTS

For all technical inquiries, contact Marije Baalman.

For all architectural/construction inquiries, contact Thomas Spier.

For all artistic/financial inquiries, contact Chris Salter

Chris Salter (Berlin/Montreal) - Project Director (clsalter@gmail.com)
Marije Baalman (Amsterdam) - Technical Director (marije@nescivi.nl)
Thomas Spier (Berlin) - Architectural Director (t.spier@apollovision.de)

**SETUP SCHEDULE
DAY 1**

CATEGORY	TASK	RESPONSIBLE
STRUCTURE	Determine structure position and mounting points in space; prepare fixing points on ground (AM)	SPIER + 2+ PERSONS
CABLES W/ LEDs	Unpack and layout each of the 12 wires to check for damage during shipping/ strike and repair if required; test each wire for functionality/repairs, if needed.	BAALMAN
SOUND	If required, speaker hang (note that once structure is mounted it will be very difficult to access ceiling area)	SALTER + 1 PERSON FOR HANGING
LASERS	Unpack and mount lasers on walls or trusses as determined by pre-planning.	SALTER + 1 PERSON FOR HANGING/MOUNTING
	Install hazers in appropriate locations	
	Provide power to lasers and mirror units so that laser beams can be switched on to determine location of fixed mirrors and mirror units	
	Adjust trusses to final height; test functioning of all units	
COMPUTERS	Setup computer equipment for testing of electronics and laser units	BAALMAN/SALTER
	SUPPORT CREW NEEDED : 2+ PERSONS FOR MOUNTING OF STRUCTURE+LASERS	

**SETUP SCHEDULE
DAY 2**

CATEGORY	TASK	RESPONSIBLE
STRUCTURE	Mount cables (both with and without electronics) to structure; continue	SPIER + 2+ PERSONS
	power wiring begun in Day 1	
	Begin setup of structure as described in accompanying document with the exception of cables	
CABLES W/ LEDs	Connect to power supplies on structure; connect power to fuse box at base	BAALMAN + ELECTRICIAN
	of structure (electrician required); testing of each line	

**SETUP SCHEDULE
DAY 3**

CATEGORY	TASK	RESPONSIBLE
SOUND	Position speakers; wire and test all speakers (balance/EQ)	SALTER + 1+ PERSONS
	Adjust mix EQ; adjustments to speaker placement	
HAZERS	Test DMX control of hazers	BAALMAN
LASERS	Adjustments and tests for all servo settings	
ALL SYSTEMS	TEST ALL SYSTEMS; CLEAN SPACE; CABLE DRESSING	ALL (ARTISTS+LOCAL CREW)

**SETUP SCHEDULE
DAY 4 (last full setup day)**

CATEGORY	TASK	RESPONSIBLE
SYSTEMS CHECK	Test all auto startup/shutdown procedures	BAALMAN
	COMPOSITION TESTING/REWORKING	

n-Polytope

INSTALLATION PROCEDURE

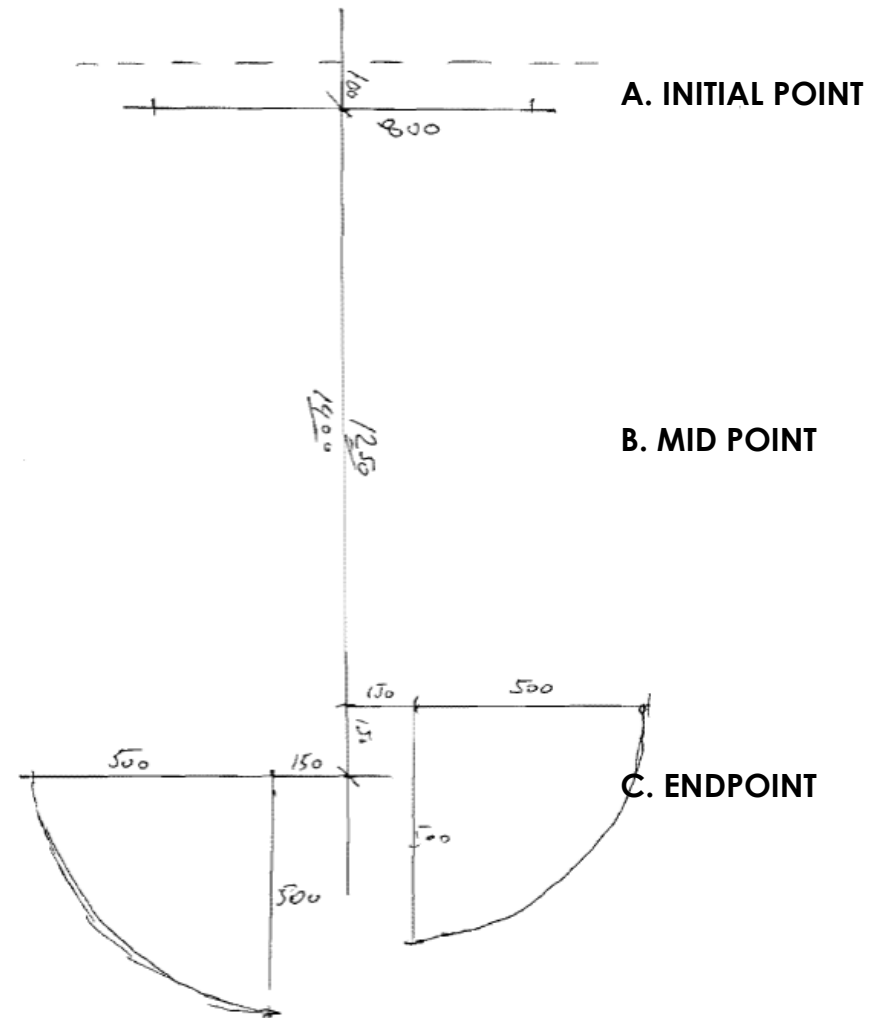
Structure composed of 3 connection points for the suspension of 22 steel cables in air:

A. Initial point: 3 retractable slings or straps for heavy loads anchored to the intermediate structure with 3 aluminum clamps supported by 3 stainless steel plates anchored to the ground.

B. Midpoint: Semicircle of aluminum tube truss, dimensions in its principal axes $\varnothing 50 \times 2$ mm, tube $\varnothing 16 \times 2$ for the braces interior alloy AL 6082-T6 of triangular form united together, forming a turn angle of 45° . The semicircle arch is **8 meters** in diameter with two support bases to swivel 180° of 45 cm high, forming a semicircle of 530 mm with radius equal to the truss. It bears a load uniformly distributed per kg / m for a 3m light amounts to 400 kg.

C. Endpoint: 2 semicircles of radius 5 m, anchored to the floor each 350 mm by spits of 8×100 mm, consisting of plate 70×8 mm, 60 mm spacers the same material and fastening flanges tube of 50.8 mm in stainless steel AISI 304.

DIAGRAM



INSTALLATION OF THE STRUCTURE:

Arrangement of elements in space according to the diagram:

1. Installation starts from the intermediate point (B) of the structure:

Assemble the truss on the floor at the final location: the truss is divided into 4 equal parts of 314 cm length and 450mm in length basis, using for their union a conical tip with safety locks.

2. Check the location of the clamps with the marks in the truss tube. The marks signal the exact position of the clamps from both sides: Both sides of the clamps in the truss and plates are marked.

3. Anchor the triangular plates of bases of the truss to the floor (spits)



4. Lift the truss with a point of reinforcement from the keystone: It can be with a pulley system from the ceiling or with an anchor point from below.

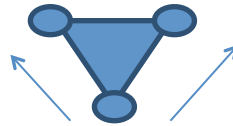
NOTE: This attachment must not be withdrawn until both, the slings to the initial point and end point cables, are properly mounted and fairly tensioned (final strain of the cables must be made with this support point removed)



5. Location of the clamps and slings at the mid-point: The support of connecting cables between the intermediate and initial and final points is set by eye bolt clamps for tube tensor of stainless steel quality AISI 316 for M5 cable.

Angle position of clamps in the truss:

Cable clamps the end point: from the base to the top of the ring 28 cm



Slings clamps to the initial point: from the base to the top of the ring 24 cm

6. Anchor the plates (2 units) of the **endpoint (C)**:

- i. Place the plates according to the diagram
- ii. Each of the semicircles is divided into three parts, assemble them by aligning the code lines of the base.
- iii. Anchor to ground with spits of 8x100mm



Anchor the plates for the **initial point (A)**: 3 plate structures in stainless steel quality AISI 304, 70x8mm, 3 spacers of 60mm and stainless steel tube of 50.8 mm length, forming a semicircle of 53 cm radius equal to the truss with ER-30 aluminum intermediate.
* The position of these plates can vary as required for the space taking into account the length of the slings. In LABoral they were located in an arc of radius 600 cm from the base of the truss with a center to center distance between the plates of 150 cm.

- i. Place the plates according to the diagram and anchor to the floor with spits of 8x100mm.



INSTALLATION OF CABLES

From midpoint(B) to the endpoint (C): 22 M5 Steel wire, 11 symmetrically located on either side, with eye and tensor of stainless steel tube at both ends. 11 of these cables have power and data cord, speakers and leds.

1. Cables from intermediate point to final point are numbered
2. Cables shall be installed from the keystone alternating both sides. Installation has to start from one side, the next cable to be installed shall be the simetrical at the other side of the keystone.
3. **Midpoint:** Attach the cables to the clamps of the truss with the eyebolt shackles.
4. **Endpoint:** Attach the cables to the clamps of the plates with the eyebolt shackles.
5. Tighten the cables one by one from each side where necessary to avoid catenary.

At the end, once the slings to the initial point are placed and the support point is removed, cables must be re-tensioned.

NOTE: tensors have a limited extension, check the length before starting the installation to avoid them coming loose once installed.



From midpoint (B) to initial point (A):

3 slings or retractable ratchet straps for heavy-duty with bases (hooks), corresponding to the model NP3500 with minimal resistance before sewing of 5250 kg.

A. Hold the hooks to the clamps placed at the back of the truss



B. Hold to the plates



C. Tighten with the ratchet. The truss must be tilted about a meter from the base of the midpoint to the initial point



D. Remove the support point of the truss and tension cables to the endpoint.

E. Tighten the slings with the ratchets.

STRIKE / TAKE DOWN

Structure

- 1.** Unplug the cables from the power supplies and uninstall the power supplies.
- 2.** Fix the support point to the keystone.
- 3.** Loosen a bit the slings from Midpoint to initial point with the ratchet.
- 4.** Take down the cables from midpoint to endpoint. The first cable to take down should be the lower one (cable ref X) and then the symmetrical to this one at the other side and proceed alternating sides. Do not uninstall the clamps.
- 5.** Wrap cables with electronics for flight case.
- 6.** Untie the slings and bring the truss to the floor.
- 7.** Undo the truss and the plates of end point for shipment.