

Architecture as a Time-Based Art : Iannis Xenakis' Polytopes

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Subtitle	Iannis Xenakis' Polytopes
Lead-in / Abstract	This paper deals with the 'Polytopes', a series of large-scale multimedia environments conceived by the composer and architect Iannis Xenakis during the 1960s and 1970s. It is argued that these cybernetic installations offer challenging examples of a time-based and dematerialized architecture where the very notions of space and place become an expressive medium in itself. Doing so, the Polytopes bring a new element in the discussion on what role is left for architecture in the era of multimedia and Virtual Reality.
Participants and speakers	Sterken, Sven (BE)
Short biography of participants	Sven Sterken (°1975) is an engineer-architect and researcher, affiliated with the University of Ghent (BE) and the Jan Van Eyck Academy in Maastricht (NL). In 2004, he obtained a PhD in architectural history with a dissertation on the architecture and multimedia work of Iannis Xenakis (1922-2001).
Full text	I. Introduction <i>Polytopes</i> is the collective name of a series of large light and sound spectacles

conceived by the composer **Iannis Xenakis** (1922-2001) during the 1960s and 1970s¹. The word *Polytope* is Greek and has to be interpreted literally: *poly* means 'a lot, several', while *topos* means 'place'. Furthermore, every *Polytope* bears the name of the site or the city where it was installed (e.g. *Polytope of Montréal*, *Polytope of Cluny*, ...). The name of these automated spectacles thus already indicates that here, we are dealing with an art that not only integrates different media, but that is equally concerned with the notions of 'space' and 'place'. Xenakis's attention to space is not surprising, since for a period of 12 years (1947-59) he worked as an engineer and architect in **Le Corbusier's** office in Paris. Amongst other projects, he participated in the legendary Philips Pavilion and the *Poème Electronique* (the multimedia show that was projected inside the Philips Pavilion) at the 1958 Brussels World Fair². His collaboration in this project would provide the blueprint for the future *Polytopes*.

This essay deals briefly with the notion of virtuality in both the *Polytopes* and the *Poème Electronique*. Virtuality is understood here as "an imagined or simulated immersive space that does not exist in reality"³. More specifically, the question will be raised what role architecture is able to play in the creation of such immersive experiences. It will be argued that Xenakis's *Polytopes* bring forward some original ideas about the possible relationships between physical and virtual space. More specifically, these automated spectacles introduce an innovative conception of space as a dynamic system and of architecture as a time-based art.

II. From the Philips Pavilion to the H²O Pavilion

Keeping in mind the predominance of commerce and technology in our contemporary society, it is not a coincidence that the Philips Pavilion, one of the icons of twentieth-century avant-garde architecture, is a temporary multimedia exhibition pavilion. Commissioned to Le Corbusier by the Dutch company Philips for the 1958 World Fair in Brussels, the Philips Pavilion was to illustrate the superior quality of Philips's products in the field of light and sound equipment by means of an overwhelming multimedia show. In this respect, the Philips Pavilion perfectly illustrates a fundamental conceptual shift in the World Fairs of the post-war era. Instead of displays of products for the education of the public, most exhibition pavilions became machines generating sensory experiences, thus reflecting the transformation from an industrial to an information and leisure society. From the Brussels World Fair on, the principal vector in most of the pavilions' designs was no longer structure, but the spatial implementation of media. This search for the creation of 'augmented spaces' reached its climax at *Expo 70*, the 1970 World Fair in Osaka, where a veritable blurring occurred between real and virtual spaces: most displays aimed at immersing the visitor in a certain atmosphere by means of projections, colored lights, music and even smoke, so as to make him forget the outside world and to weaken his sense of reality.

Happy to experiment with Philips's state of the arts equipment, Le Corbusier felt that the architecture of the corresponding pavilion would have to be no more than an inverted projection screen. Indeed, a darkened space was all he needed for his *Poème Electronique*, a collage of moving images, color projections and spatialized sound, each component developing independently over time⁴. In seven stages, it reflected the old master's vision on the history of mankind and its often perverse relation to technology. Le Corbusier asked Xenakis to design a temporary pavilion that would give expression to the futurist character of the show inside. Given total freedom in this task, the young assistant proposed a design consisting only of hyperbolic concrete shells⁵. In this architecture of continuity, the notions of depth and perspective disappear: floor, ceiling and walls all become part of one single and continuous spatial fold. In the impossibility to take a step backwards from the giant and moving images and the travelling sounds it was exposed to, the audience lost all sense of orientation. In this respect, the Philips Pavilion functioned as a machine that manipulates perception through overloading the senses with stimuli, which create a sense of disembodiment in the audience. Over a million people lined up to get into the pavilion, knowing (but undoubtedly not fully realizing) that their visit to the pavilion would change their perception of contemporary society.

To a large extent, the expressive effect of the *Poème Electronique* is based on the idea of discontinuity of space. By isolating a fragment of the environment and shutting it off from its surroundings, the architecture of the Philips Pavilion creates an opposition between an inside virtual world and an outside, 'real' world. To reinforce the effect of immersion and illusion, continuity or interference between these two levels of reality is avoided. The architect's role is reduced here to providing a curved projection screen that envelops a darkened room where an alternative, virtual space is installed by means of media. The immersive strategy deployed in the Philips Pavilion does not largely differ from the way virtual reality is

still often evoked today: the special glasses and headsets that are nowadays used to create a virtual reality, have the same function as the pavilion's shell. In this respect, the Philips Pavilion puts into evidence how in the era of multimedia, Internet and virtual reality, spatial illusions can easily be created without calling upon the classical tectonic elements of architecture (windows, columns, walls, ...). In other words, in a context of immersive multimedia, architecture somehow seems to become obsolete. Xenakis has clearly understood this; by reducing the pavilion's concrete shell to the absolute minimum of 5 cm, he seems to even want to abolish the very last characteristic of architecture in this project: its materiality.

A more recent example of such a crossover of media and architecture, the H²O-Pavilion by the Dutch architects Lars Spuybroeck and Kas Oosterhuis, raises similar questions⁶. This pavilion, conceived as a continuous fold in space, contains an interactive and pedagogic exhibition on different aspects of water. A sense of immersion is created here by establishing an interactivity between the visitor and the architectural environment. Contrary to the Philips Pavilion, the physical presence of the architecture is reinforced here: the visitor follows a trajectory determined by spouting fountains, projections and mobile or tilted parts in the floor. Based principally on their bodily reflexes, the audience's reactions are highly predictable. This causes the interaction to remain a closed and isolated system. Again, just like in the Philips Pavilion, architecture is called upon here to sustain the opposition between reality and virtuality; there is no interference.

From the two previous examples, we can conclude the following: when multimedia takes possession of space, it is as if the role of architecture is reduced to that of *shelter* (blacking out the surroundings), *sign* (to attract the audience) or pure *structure* (as support for the technical equipment). The organization of the interior space however is left to all sorts of media, whose aim it is to produce an impression of infinity, as if the interior space had no 'outside'. In other words, what we are dealing with here is a dissociation between the form of the interior space and its perception. This tension between 'hard architectural form' and 'soft media content' signifies a quantum leap in architectural design: no longer the laws of force, mass and weight are the governing factors in the design, but the laws of perception⁷. This raises two questions: is it possible to think about virtuality as an *extension* of reality (and thus not as a *substitute*), and is architecture able to intervene in the creation of such 'augmented spaces' without disappearing⁸?

III. The Polytopes

Xenakis's *Polytopes* add a new element to this discussion. As their name suggests, in these multimedia installations, several spaces of light, sound and color overlap continuously to create a multidimensional, dynamic and differentiated spatial impression. Contrary to Le Corbusier's *Poème Electronique*, where artificial light is used as a carrier of content in a mimetic context (thus following the logic of projection and screen), in the *Polytopes*, Xenakis is interested in the physical qualities of light and sound. Although inspired by natural and cosmic phenomena, the visual imagery of the *Polytopes* is fully abstract and based on the axiomatic entities of Euclidian geometry, namely points and lines. These elements are materialized by means of flashlights and laser beams respectively. In fact, light is treated here as if it were music for the eyes – the same stochastic compositional principles (a compositional procedure based on probability theory), rules the light and sound events.

Contrary to a great deal of contemporary multimedia art, Xenakis' goal is not to find or create correspondences in and between the different ways of artistic expression; nor does he want to confuse the spectator by playing around with his corporality or to hypnotize him with sequences of familiar images. On the contrary, Xenakis' aim is to integrate as much differentiation and variation as possible, and to stimulate the spectator by playing with the *diversity* of the senses. The global formal logic of the *Polytopes* allows to dissociate fully the different layers of the spectacle and to develop color, rhythm and movement independently over time. In this respect, the spectator has to contribute actively to these art works, by making a personal synthesis of the poly-temporality of the proposed spectacle. Or, as Xenakis has put it: « The link (between the visual and aural dimension of the *Polytopes*, ss) is not *between* them but *beyond* or *behind* them. Because beyond there is nothing but the human brain – my brain. We are capable of speaking two languages at the same time. One is addressed to the eyes, the other to the ears »⁹.

Just like sound is able to move through the air or to fill a space, Xenakis's idea in the *Polytopes* is to occupy a given site with clouds of light. To this end, hundreds of flashlights are attached to a light steel structure, designed by himself. In the *Polytopes*, the projection screen explodes thus into innumerable dots of light. The

first *Polytope* for instance, the *Polytope de Montreal*, includes 1200 flashlights (800 white, 400 colored), attached to a set of steel cables. Suspended in the central void of the French pavilion at the 1967 World Fair, these steel cables act as the regulating lines of several large hyperbolic surfaces. Together, they form a transparent volume, six storeys high. Once every hour, during six minutes, Xenakis's music occupies the entire pavilion, whilst abstract lighting patterns, changing with a neck-breaking speed of 25 times per second, move feverishly through the central void. Beyond this limit, the human eye interprets change as a continuous movement. During the show, the audience can freely change its viewpoint from the balconies by moving around on the different floors. After these six minutes, the pavilion returns to its original state, only an abstract sculpture remains visible.

In the *Polytope de Cluny* (1972), installed in the Roman thermal baths of the Cluny Museum in Paris, Xenakis goes a step further; he draws a Cartesian grid, folded alongside the vaults of the existing space. Just like in the previous *Polytope*, this steel structure aids in creating a spatial experience, however without imposing itself. The main difference resides in the fact that the audience is now *in* the spectacle, witness of the temporary transformation of this historical site into a violent cataclysm.

Progressively, the mastering of the performance space becomes more and more important in the *Polytopes*¹⁰. For the last *Polytope*, commissioned for the opening of the Centre Pompidou in Paris in 1977, Xenakis designs the space of the show himself: the *Diatope*, a nomadic pavilion with a tensile canvas. This project actually closes a circle, since it is here that Le Corbusier's initial idea for the Philips Pavilion (i.e. to construct a simple scaffolding with a tensile covering) is finally realized¹¹. The *Diatope* houses a multimedia show composed by Xenakis (*La Légende d'Eer*) and is conceived to travel around the world as a kind of cultural ambassador for the Centre Pompidou. Its covering is composed of two layers: an external, semi-transparent canvas of red fabric and an inner metal net to which the light and sound sources are attached. Enveloping the audience, the latter can be considered as a 3-dimensional screen with the 1600 flashlights as its pixels. The translucent floor, composed of glass tiles, reinforces the impression of immersion; the audience seems to be suspended in the pavilion's interior.

The *Diatope's* double-layered skin (the 'façade') is not merely a projection screen; just like the steel cables of the *Polytope de Montreal* and the Cartesian structure of the *Polytope de Cluny*, it is a dematerialized architecture that functions both as the spatial enclosure of the spectacle and as its technical interface. Acting as a three-dimensional matrix, it transforms a given site into an isotropic space where each point can be articulated separately by means of light and sound. Thus, temporary modulations of the given site are made possible. This aspect reveals a fundamental difference between Le Corbusier and Xenakis regarding their understanding of the relationship between architecture, space and media: if in the Philips Pavilion, architectural spaces are replaced by cinematographically created illusionary spaces, in the *Polytopes*, the immaterial qualities that constitute the *topos* of a given site or space become expressive media in themselves. In other words, in the hands of Xenakis, new media become new tectonic tools in stead of avatars of architecture. Contrary to the Philips Pavilion, where all technical devices were hidden and the architecture almost disappeared during the spectacle, in the *Polytopes*, the architecture *is* the spectacle.

The *Diatope's* textile covering does not really delimit an interior space: given the poor acoustic and thermic isolation and the lack of visual opacity of its shell, light, sound and cold enter from the outside. The change in prefix in this *Polytope's* name already announces this: *dia* signifies 'through'. This is also expressed by Xenakis in his sketch of the pavilion: the *Diatope* is open to the energetic waves that circulate in its environment. While the Philips Pavilion's concrete shells serve to mark off the limits of an interior space and shut out the surroundings, the double-layered membrane of the *Diatope* acts as a filter, delimiting a zone in the environment of a higher energetic intensity than its surroundings. As Xenakis suggests in his sketch, more than a building, his *Diatope* is to be considered as "an intensification of a continuous, borderless space"¹². Rather than creating a material boundary, Xenakis's architecture acts as a space modulator, establishing a dynamic equilibrium between the inside and the outside. As a consequence, inner and outer spaces melt into one another.

This fusion of spaces causes an imperfection in the virtuality Xenakis want to evoke inside the *Diatope*. During the 46 minutes of the spectacle, information from outside 'leaks' into the pavilion; one is constantly aware of what is going on outside. In other words: in the *Diatope*, there is no strict division between the virtual experience and the real world; there is continuous interference. This conscious 'imperfection' marks a fundamental difference between the *Diatope* and the two multimedia pavilions that have been discussed before. Indeed, rather than

opposed, to a certain extent, in the *Diatope*, reality and virtuality become amalgamated. As a result, the visitor is forced to be aware of the *simultaneity* of these situations. Xenakis takes thus advantage of new media not only to propose new and dynamic relationships between spaces, he also shows how in the era of media, Internet and virtual reality, the challenge for the architect is to learn how to combine different levels of reality.

IV. Conclusion

As the *Polytopes* show, in Xenakis's conception the boundaries of space are ill-defined; it is an open, variable system, composed of numerous dynamic sensory spaces that address the senses independently. In such a relativist conception of space, there is no longer unity of place, time and body; space is considered a dynamic system, in a state of permanent becoming. For this reason, the architectural component of the *Polytopes* does not impose formal boundaries; it functions rather as a dematerialized interface that allows to control the different dimensions of space independently. In this manner, Xenakis is able to dissolve a given site into a complex of asynchronously interwoven sonic, temporal and spatial parameters. Time becomes thus a fourth spatial dimension. In this respect, the *Polytopes* announce a new role for the architect: in the beginning of the twenty-first century, he is no longer solely a creator of spaces, but also the choreographer of the time-behaviour and the interaction between these spaces. The architect is thus no longer solely called upon to design static formal enclosures, but to define and control the principles that govern their aspect over time. In such a perception-based architecture, space is measured in terms of durations and plans are substituted by scores. As a consequence, architecture, once the most durable of the arts, becomes a true art of time.

Endnotes

- 1 _ This paper resumes the argument of a chapter devoted to the *Polytopes* in my doctoral dissertation, which deals with the architecture and the multimedia work of Iannis Xenakis (*Iannis Xenakis architecte. Analyse thématique de l'œuvre, suivie d'un inventaire critique de la collaboration avec Le Corbusier, des projets réalisés en tant qu'architecte indépendant et des Polytopes*. Ghent University, Department of Architecture and Urban Planning, 2004). I would like to thank Katleen Craenen for revising the English manuscript of this paper.

- 2 _ From 1956 on, after their successful collaboration on the Monastery of La Tourette, Xenakis had become one of Le Corbusier's closest collaborators. He was the project architect for the Philips Pavilion (1958), the Youth Center in Firminy (1956-65) and the Olympic Stadium in Baghdad (only partially realized in the early 1980s). For a general survey of Xenakis's architectural work, see my article 'Une invitation à jouer l'espace. L'itinéraire architectural de Iannis Xenakis', in François-Bernard Mâche, *Portrait(s) de Iannis Xenakis*. Paris, Bibliothèque nationale de France, 2001, pp. 185-195. Also published on <http://www.iannis-xenakis.org>.

- 3 _ Katie Mondloch, 'A Symphony of Sensations in the Spectator: Le Corbusier's *Poème Electronique* and the Historicization of New Media Arts', *Leonardo*, vol. 37, n° 1, 2004, p. 57. As Mondloch points out, the concept of virtuality is often written about as a phenomenon specific to computer-reliant technologies. Nevertheless, the complete immersion of the observer into virtual surroundings has a rich history ranging from Baroque Chapels over Wagners concept of the Gesamtkunstwerk to 1960s experiments in expanded cinema.

- 4 _ The *Poème Electronique* consisted of three parts, each developing independently over time. The main component was a slideshow with black & white images. Projected on the curved walls of the pavilion, the images seemed to be folded around the audience. Independent from these images, a succession of 'ambiances', colored light projections, filled the entire pavilion with red, blue, green, orange or combinations of these colors. This established a link between the projections on the walls and the audience, reinforcing the effect of immersion. The third component of the *Poème Electronique* was a musical score by Varèse, based on recorded and transformed sounds (bells, voices, sirens, etc.). This music was spatialized throughout the pavilion by more than 300 loudspeakers, allowing the sound to travel alongside the walls.

- 5 _ Even though hyperbolic paraboloids in concrete were a common feature in 1950s architecture, the Philips Pavilion is one of the only buildings ever to be composed with *only* this kind of surfaces. Apart from his participation as an

architect, Xenakis also composed also a 2-minute interlude, called *Concrète-PH*.

■ 6 _ This interactive multimedia pavilion, opened in 1998, has been commissioned by the Dutch government to celebrate the achievement of the important water works in the South of the country, one of the biggest public works ever in European history. On the link between this pavilion and the Philips Pavilion, see Bart Lootsma, 'En Route to a New Tectonics', *Daidalos* 68, 1998, pp. 35-47.

■ 7 _ I dwell here upon an idea developed by Martin Pawley in his survey of Expo '70. See his article 'Architecture vs. the Movies', *Architectural Design*, June 1970, pp. 289-293.

■ 8 _ On the notion of 'augmented space', see Lev Manovich, 'The Poetics of Augmented Space: Learning from Prada' (http://www.manovich.net/DOCS/augmented_space.doc). As Manovich explains, the term 'augmented space' is derived from an older and already established term 'augmented reality' (AR). Coined around 1990, the concept of 'augmented reality' is opposed to 'virtual reality' (VR). In VR all the work is done in a virtual space; physical space becomes 'unnecessary'. By contrast, AR helps the user to do the work in a physical space by augmenting this space with additional information. This can be achieved for instance by overlaying information over the user's visual field.

■ 9 _ Xenakis, in Andras Balint Varga, *Conversations with Xenakis*, London, Faber & Faber, 1996, p. 114.

■ 10 _ Xenakis has also proposed several outdoor *Polytopes*. Conceived as abstract outdoor choreographies, these can be considered as musical land art pieces. Staged in the ancient ruins of Persepolis in Iran (1971) and Mycenae (1978), these *Polytopes* manipulate all perceptual parameters by means of laser beams, electro-acoustic music, huge camp fires, children choirs bearing torches, animals and giant anti-aircraft light projectors. This highly expressive confrontation between technology and archaism followed a precise scenario, written by Xenakis and guided by himself during the show with the help of only a simple walky-talky.

■ 11 _ Le Corbusier's words when accepting the commission from Philips have become famous: "I will not make a façade for Philips, but an electronic poem. Everything will happen inside: sound, light, color, rhythm. Perhaps a scaffolding will be the pavilion's only exterior aspect." (Le Corbusier, *Le Poème Electronique*, Paris, Editions de Minuit, 1958, p. 23).

■ 12 _ Philipp Oswald, *An Architecture of Densities*, in Makis Solomos (ed.), *Actes du Colloque "Présences de Iannis Xenakis"*. Paris, Centre de documentation de musique contemporaine, 2001, pp. 213