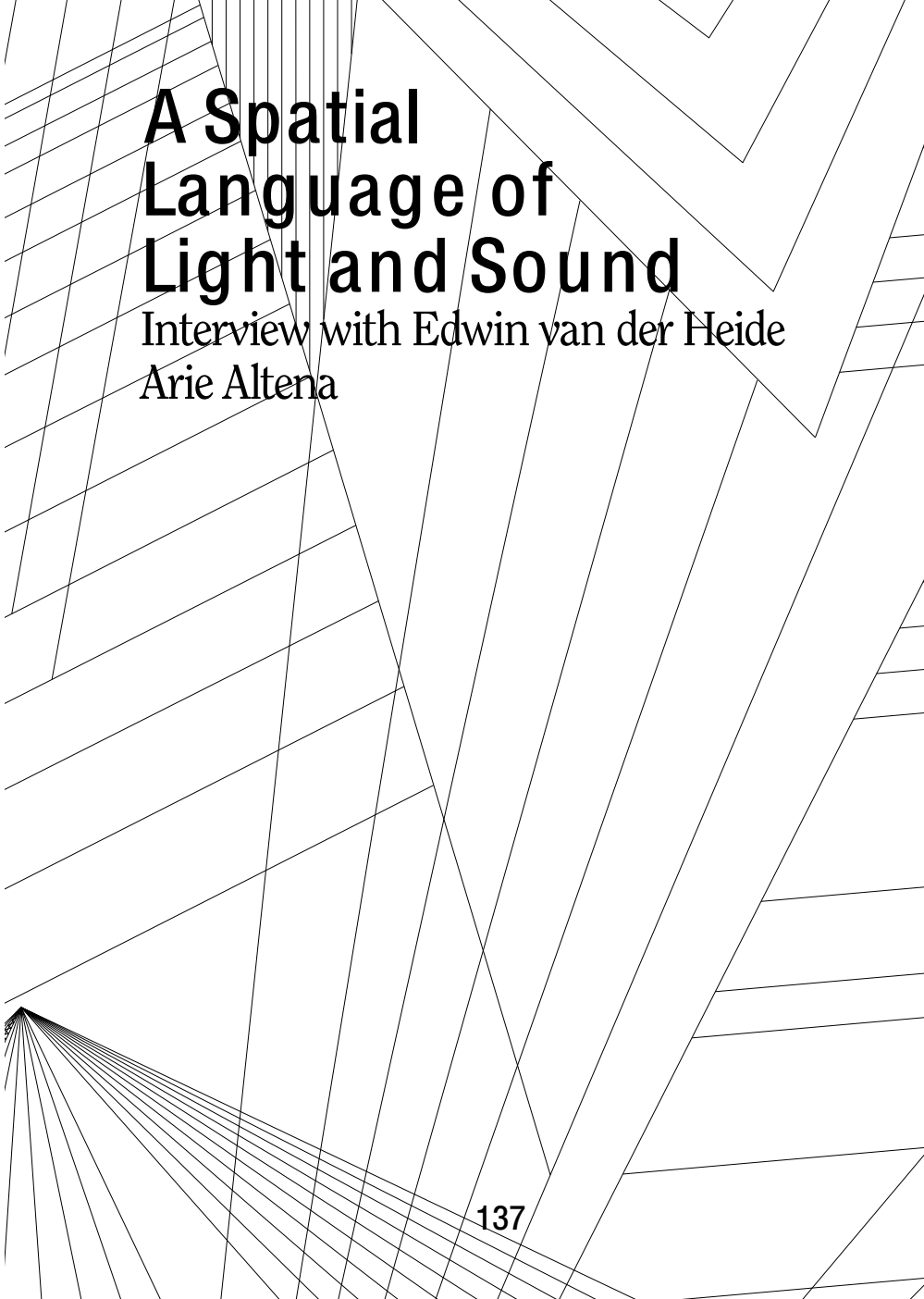off even as the technological nervous system of the planetarium extends to form a new kind of global self, already embedded within the intermedia environment, and occupying a space to which we are bound to return.

Notes

1. Manfred E. Clynes, 'Cyborg II: Sentic Space Travel' (1970) in Chris Hables Gray, Heidi Figueroa-Sarriera & Steven Mentor (eds.), *The Cyborg Handbook* (New York: Routledge, 1995).
2. See the liner notes to the 1959 LP, *Highlights of Vortex: Electronic Experiments and Music*, Smithsonian Folkways Records : Stereo FSS 6301 (1959).
3. See Cindy Keefer, 'Raumlichtmusik – Early 20th-Century Abstract Cinema, Immersive Environments', in *Leonardo Electronic Almanac*, vol. 16, issue 6-7, (2009).
4. Belson in Gene Youngblood, *Expanded Cinema* (New York: Dutton, 1970), p. 388.
5. As described in the program for Vortex IV, 1958. <http://www.o-art.org/history/50s&_60s/Vortex/Vortex_4.html>. Accessed 23 December 2009.
6. See Harriet R. Polt and Roger Sandall, 'Outside the Frame', in *Film Quarterly*, vol. 14, no. 3, (1961), pp. 35–37, and 'Music: The Sick Machine', in *Time Magazine*, 2 February 1959. <http://www.time.com/time/magazine/article/0,9171,894121,00.html>. Accessed 23 December 2009.
7. Clynes, op. cit., p. 38.
8. Ibid., p. 36.
9. Ibid., p. 37.
10. Ibid., pp. 38–39.
11. Ibid., p. 38.
12. Ibid., p. 38.
13. Ibid., p. 42.
14. John C., M.D. Lilly, *Programming and Metaprogramming in the Human Biocomputer* (New York: Julian Press, 1967), p. 33.
15. Ibid., p. 92.
16. Ibid., pp. 76–78.
17. Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism & Schizophrenia* (Minneapolis: University of Minnesota Press, 1987/1980), p. 342.
18. Félix Guattari, *Chaosmosis: An Ethico-Aesthetic Paradigm* (Bloomington/Indianapolis: Indiana University Press, 1992/1995).
19. Deleuze & Guatarri, op. cit., p. 343.
20. Ibid.
21. Youngblood, p. 160.
22. Belson in Youngblood, op. cit., p. 160.
23. Ibid.
24. Ibid., p. 162.
25. Ibid. pp. 151–56.
26. Belson in Youngblood, op. cit., p. 162.
27. Ibid., p. 171.
28. Youngblood, p. 159.
29. Belson in Youngblood, op. cit., p. 173.
30. Ibid., p. 158.
31. Ibid., p. 348.
32. Ibid.
33. Ibid.
34. Ibid.
35. Several of Lilly's publications deal with interspecies communication, dolphins in particular. In the case of alien contact, see John Lilly's 'Communication with Extraterrestrial Intelligence' (1966), revised and reprinted as Chapter 11 of *Programming and Metaprogramming in the Human Biocomputer*.

A Spatial Language of Light and Sound

Interview with Edwin van der Heide
Arie Altena

Edwin van der Heide's work focuses on creating, structuring and perceiving space, and is therefore difficult to describe in traditional terms such as 'music', 'sound art' or 'media art'. As an artist he researches the spatial aspects of sound, he works with laser projections that generate the illusion of multi-dimensional spaces, and he enables visitors to an exhibition to explore the space with the help of self-made extra-sensory receivers. This interview was conducted in the hangar he shares with the Rotterdam artist Marnix de Nijs. Edwin van der Heide received me in a container up at the top of the hangar, the 'clean room'. He uses the hangar to develop and test his installations and laser performances.

Can you explain what you intend with the *Laser Sound Performance*? In this piece you combine spatial sound with laser projections on smoke.

As far as spatiality is concerned, there is a vast difference between sound and image. Sound is spatial by nature: the audience at a concert is always in the middle of a changing sound space that results from the sound source and its reflections. This is not to say that sound is always used in a spatial way or that you always experience it as such. Image works differently: you perceive light in those places where it reflects and we usually aren't aware of the source at all. Furthermore, our perception is able to distinguish between a sound source and its reflections because of the relatively 'slow' speed of sound, a speed that our senses can perceive. The speed of light is far too fast for us to perceive light and its reflections in a temporal way. I use lasers and make their light visible in space by projecting on smoke, mist or spouting water. The audience stands in the middle of the projected image. I create a new transforming space in an existing space. Light acquires an architectural quality and becomes almost tactile. I use lasers to create a composed light space that I combine with a composed sound space. *LSP* is light, space, colour and sound.

Is *LSP* about exploring or delineating space?

It is not primarily about exploring space but I do use the specific characteristics of the space, because the possibilities of the performance depend on the situation and the location where I present *LSP. LSP* has a frontal view – you can look towards the lasers – but you can also look towards the rear. Sometimes the projection on the rear wall is an important component in the performance, because certain shapes are so complex that you cannot perceive them in the space, but you can see them as projections on the rear wall. Other shapes are not at all interesting as projections on the rear wall, but they do work as projections in the space. LSP has also been presented outside where there is no rear view at all. It is an abstract work. For me, *LSP* is not about telling a story or presenting immediately recognisable forms. I am interested in expanding the concept of composition – as in a musical composition – whereby the spatial experience becomes a central part of the piece. The basis for *LSP* is creating direct relationships between image and sound. By

doing this I introduce enormous restrictions. And it is certainly not the case that each sound generates an interesting image or each image an interesting sound. Only a few combinations actually work. I use these to create development during the performance. I keep discovering new approaches that work for both sound and image; in fact, the range of my material keeps expanding.

How does that work in practice?

The waveform of the sound directly influences the visual form of the projection. Some combinations of sounds and relationships between sounds work well, while others don't. They work in the sense that they lead to interesting shapes. Some relationships generate a static image, others a dynamic image. You can work from static forms towards dynamic forms, which is mostly how I begin. It's difficult to always concentrate on both the image and the sounds. During a performance there are moments that I want to achieve something specific with the sound, so the focus on the image becomes temporarily less important. Conversely, I may find the image so interesting that I pay less attention to the sound for a moment.

Is each performance of *LSP* an improvisation or do you use a score as a basis?

I regard my setup as an instrument that I play. I do have a certain idea about the form beforehand, which changes from performance to performance and depends on the location and the situation. During live performances I utilize all the freedom I possibly can. I also find it exciting to be confronted with the relationships between image, sound and space in a live situation. I do test the space in advance, but even then you have no idea how it will work out exactly. I play with the difference between the sound in close proximity to your head and the sound that seems to come from far away or from the loudspeakers. How successful this is depends on the sound system and the acoustics in the space, which are never the same in any two locations.

Composing spatial sound does not really play an important role in Western music. Do you regard this as your 'compositional turf'?

Yes I do, but I'm not looking for generic setups and solutions. I research spatial composition and approach it from different perspectives. One important consequence is that their is no predetermined role for the audience. If you remain seated on a chair you miss half the show. You could say that I compose an environment that is meant to be explored, one that works on several different levels and that you can only truly experience if you actively explore it. This does not necessarily involve large movements. A lot happens in a very small area, within one square metre around the visitor.

That's because you play with the positions of the nodes in the space?

One of the elements I play with is the movement of and the distance between the nodes and anti-nodes of the sound waves. They often travel in space, and this means you can experience them as if they go right through your head. *LSP* is largely about our perception and how I play with perception.

So it's not about tuning the sound and image to the space?

I develop my own spatial language of light and sound that forms the basis for a performance. Then it's all about developments, contrasts, and creating tension. I also play with the expectations of the audience. These are all aspects you normally consider when composing music: it's about development, allowing certain things to run in parallel, the contrasts you create, and so forth. I think that 'real' composers still make a clear distinction between creating a piece and its actual performance. For them the score is the piece. Because they are fixed by a score, such works cannot really be about space; they cannot truly make use of space. I perform live so that I can insert the piece into a space, and really use the space. Carsten Nicolai and Ryoji Ikeda frequently perform scored pieces, the image then remains bound to the projection surface. Only the sound of it enters the space. I hope that because of my more improvisation-based approach, my performances are more effective at penetrating space.

Are cultural references such as Expanded Cinema and rock lightshows important to you, or do you only work purely from the basis of structural research?

There are examples of abstract films and Expanded Cinema that closely resemble my approach. Audiovisual rock concerts have a similar approach because, like my work, they penetrate space and immerse the audience. On the other hand, my approach cuts through all that. I base my work on the direct relationship between image and sound, and between sound and form, and I never deviate from that. I never make image to accompany sound, or sound for image. This doesn't only apply to LSP, but to my other works as well. For each work I research a specific principle. I strictly define my compositional research: what it is, and isn't, about. This sounds very serious but the resulting piece can be very playful.

Is that influenced by the Hague School of musical composition? By Dick Raaijmakers, for example?

'Perhaps. Dick Raaijmakers always raises very precise issues (what is the tiniest sound, the concept of falling), and he is usually less concerned with their independent compositional potential. Raaijmakers has a conceptual approach in which the concept is the subject of the piece. I work conceptually, but I am more concerned with an independent compositional elaboration; the original concept is less important. Questions that I pose are: how do I arrange it over time, how can I give a shape to space. In installations such as *Sound Modulated Light* and *Radioscape* I try to get the spatial behaviour of the medium so tightly under control and to understand it so well that I can create a spatial experience for the audience, whereby it is actually no longer that important that my starting point was a direct relationship between light and sound or the spatial behaviour of radio waves.'

*How does that work exactly in Radioscape and Sound Modulated Light?*

Radioscape began with an invitation from Japan to work with sound in a larger area outside the city. I started with the idea that acoustic sounds always merge in space – you have different sound sources and as a listener you move between them. This is only interesting if you design it properly. It is a misconception to think that if you arrange loudspeakers in a space, each transmitting their own

sound, it would by default be interesting to walk among them. I thought: what would happen if you transposed your sound upwards in the spectrum, so that it becomes electromagnetic (instead of acoustic), and then transposed it down to make it audible again? What happens if you transpose the sound signal up, amplify it, and connect an antenna (instead of a loudspeaker) to the amplifier, and receive that signal with another antenna (instead of a microphone), and then transpose the frequencies down to make them audible? This principle differs from a standard FM transmitter, because these make use of a carrier wave. I only transpose the sound frequency up and down without using a carrier wave. I expected that the transmitted sounds would merge. And that is what happened. You can indeed receive signals of different transmitters at the same time. Another element is the distance between the transmitter and the receiver: the sound is loud if you're close to it, and soft when you're further away. Using this principle it is possible to place different transmitters in an area of one square kilometre, each transmitter having its own sub-composition, and make a receiver for visitors walking through the space. I initially tested it on a small scale, and it worked. But upscaling it has turned out to be difficult. Acoustic sound and electromagnetic radiation have wavelengths; suppose that you use frequencies of around 100 MHz in the FM band, then you have a wavelength of three metres, that means that you get nodes (and anti-nodes) three-metres apart. This is something I didn't want in this instance because the piece would become too much of a fairground attraction: people would start searching for the nodes. I had to lower the frequency to make the wavelength much longer. The aspect of seeking out the nodes becomes less important, the volume changes become more gradual, and the behaviour of the sound improves. The surroundings also play a role in the behaviour of sound. Some buildings reflect electromagnetic radiation, or even become a conductor for it. You also have sources of interference, such as fluorescent lighting. But eventually the behaviour becomes controllable enough to create an interesting experience for the audience.

*You give shape to the interaction between the audience and the piece...*

A crucial question for a piece like *Radioscape* is how much the public has to do before a change in the sound becomes audible. You shouldn't have to walk around endlessly to experience something, and conversely, just a small movement should not produce a huge variety of shifts. What you hear must guide your next move. The piece has to provoke the audience into action. I recently opened *Sound Modulated Light* in Poland. There was a very varied public in the museum who didn't know what to expect. Some visitors stayed in the installation for half an hour and explored everything in detail. Others only stayed for five minutes, but came back later. If that happens, the piece is a success. *Sound Modulated Light* has undergone substantial changes during its development. Initially it did not function spatially as well as it does now. In *Sound Modulated Light* I connect a lamp to an amplifier: light becomes the carrier for sound. I started working with rows of lamps layered behind each other to ensure that the light always overlaps. In an earlier version some people only listened to each individual lamp in turn, without going into the space. In *Radioscape* and *Sound Modulated Light* I create parallel worlds with their own spatial qualities. You can see the *Radioscape* receiver as a new sense that you can use to explore a world that was made for that sense.
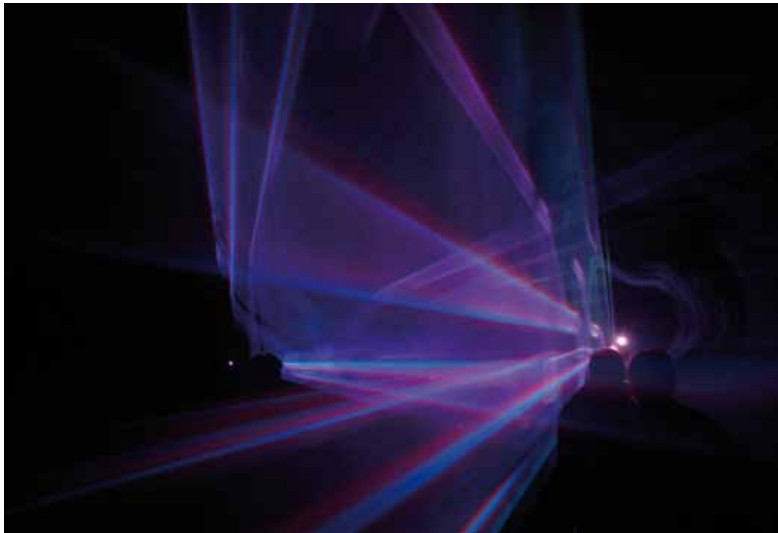
Top – Edwin van der Heide, **Laser Sound Performance**, Avantgarde Tirol, Seefeld, Austria, 2007.
Bottom – Edwin van der Heide, **Laser Sound Performance**, Hypersounds, Madrid, 2009.
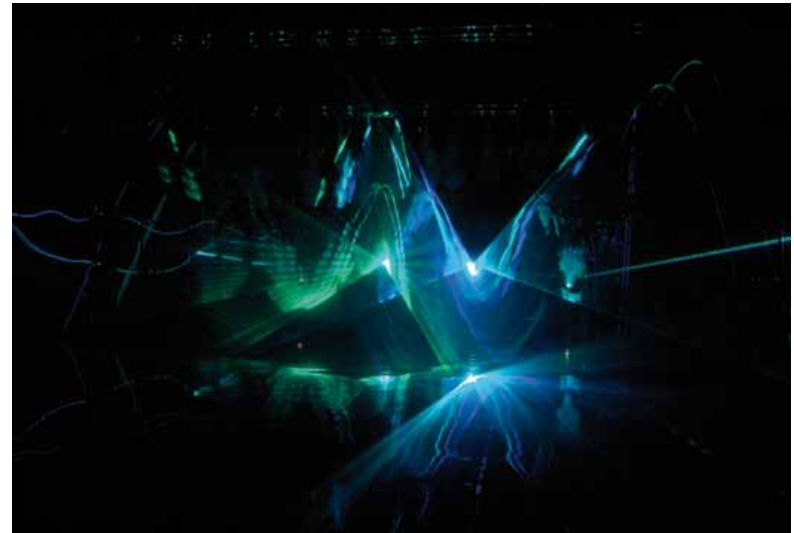
Edwin van der Heide, **Laser Sound Performance**, alveole 14, Estuaire 2007, Saint-Nazaire, 2007.

Edwin van der Heide, **Pneumatic Sound Field**,
pavilion designed by Lars Spuybroek, Synthetic Times, NAMOC, Beijing, 2008.

Top – Edwin van der Heide, **Sound Modulated Light III**, Voltage Festival, Kunsten Centrum BUDA, Kortrijk, 2008.
Bottom – NOX and Edwin van der Heide, **Son-O-House**, interactive sounding architecture, Son, 2004.

You also work quite regularly with the architect Lars Spuybroek. What does that type of collaboration involve?

The collaboration with Lars Spuybroek is always content-oriented. This ensures that we don't infringe on each other's practice. Among our collaborations is the *Waterpaviljoen*, a building incorporating 60 loudspeakers, and *Son-O-House*, a permanent, interactive sonic architecture. There is little point to literally translating the shape of the building or a space into sound. I don't create compositions in which a curve in the wall corresponds to a specific sound. That doesn't work, and visitors to a building certainly don't experience it that way. Rather, the question is where interesting overlaps or interesting contrasts occur. My approach is not to provide the public with a sonic experience that parallels their journey through a building; in fact the reverse is true. With sound I try to create an environment which is as tangible as architecture. I do this by 'pulling on' the visitors by means of sound. In *Son-O-House* I very consciously work with interferences in the space so as to liberate the sound from the speakers. Acoustically the structure contributes very little because it is very open. It only has a concrete floor that reflects sound. I was determined to get away from the notion that sound is emitted by a loudspeaker, because once you're inside the building and see a loudspeaker you would think, 'That's where the sound is coming from'. That would be disastrous.

Lars Spuybroek designed a pavilion in Beijing for your installation *Pneumatic Sound Field*. Can you explain the principle behind that piece?

Pneumatic Sound Field often creates the impression that it is interactive. This is why some people keep moving about in it. I think they do that because the sound experience in the installation is very physical. It is different from the sound experience you have with loudspeakers. Because the sound is emitted through valves, it feels like the sound is close by and it stays that way even if you move to another spot. This sometimes results in the misunderstanding that the sound is following you when it isn't. *Pneumatic Sound Field* consists of a surface measuring ten metres by twenty metres with 42 valves, which is suspended four metres above the public. Movements take place in that field. I use pulses that I send through the field, sometimes slow, sometimes fast. You could probably make a valve organ with the same installation, where each valve produces a different tone. But I never use a valve for its own sake. Each sound is produced by all the valves. It is the timing between the valves that defines how it sounds. The piece is about the transformation from a slow movement to a faster one, and how you perceive this spatially. At a certain point it goes so fast you no longer hear that there is movement and you only perceive a profound spatial quality. You could compare it to film. If the frame rate is too slow you see the film flickering and the illusion of movement is lost. If the frame rate is fast enough you see a continuous image. Our hearing also recognizes a similar transition from the moment you hear the individual clicks in a rhythm change into a continuous tone. The work is also about a movement from the inside to the outside, and vice versa. I play with perceptions and the transitions within them, from inside to outside in the spatial field and from pulse to tone. Sometimes you have the feeling that the sound space becomes larger, that it is being expanded.

You are also researching the behaviour of overtones, and if I understand it correctly, you are investigating what happens when overtones become autonomous?
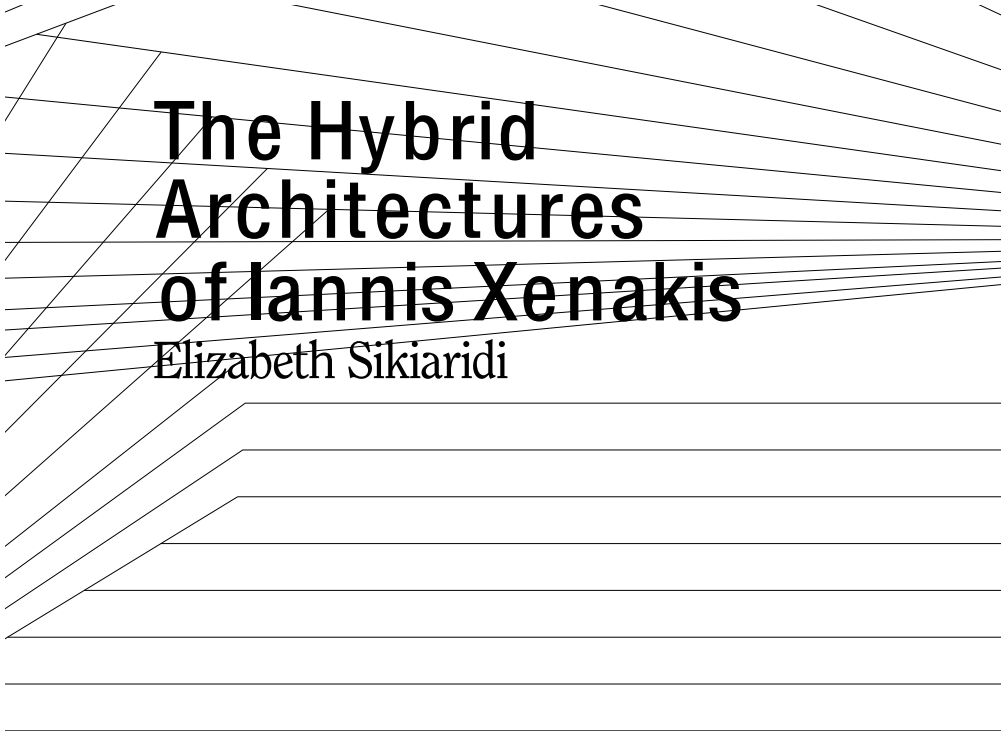
You can only answer the question of what happens if overtones become autonomous by making something that makes this perceivable. I will make a grid of 96 tiny speakers for the facade of the V2_ Institute for the Unstable Media in Rotterdam. My question is: what happens if you a take a sound – sounds always consist of overtones – and pull it apart spatially. What happens if each overtone becomes autonomous, and behaves in its own unique way? The sound is then the outcome of a specific arrangement and the specific behaviour of overtones that can also be viewed individually. Just like a molecule is made out of atoms, a sound is made up out of overtones. You could use the metaphor of a dandelion parachute ball: the dandelion is the sound, and if you blow it, the seedlings scatter throughout space. In my case they are distributed throughout the grid of 96 tiny speakers. Of course, it doesn't sound like that, but I think it's a good visual analogy.

Are there other composers who have investigated sound in a comparable way?

You can think of the spectral music by Tristan Murail and Horatio Radulescu. There is also a sound synthesis technique, SMS (Spectral Modelling Synthesis), where everything is created from overtones. But both spectral music and SMS were conceived from the perspective of sound. I have a different question: what can you do with autonomous overtones, and what happens at the transition point between, on the one hand, a hierarchical organization of overtones, and on the other, between really autonomous overtones? I focus on autonomous behaviour that I can occasionally steer in a different direction once in a while. In that way a dandelion parachute ball is sometimes created from scattered seedlings.

Although your work is concerned with sound, your approach has few similarities with the acoustic ecology of R. Murray Schafer. And yet, last year you taught a class in 'earcleaning', a term coined by R. Murray Schafer whose activities focus on learning how to listen to ambient sounds in a better way, as well as on combating noise pollution in a technological society. What spurred your interest in the idea of earcleaning?

The Earcleaning class is about learning to listen and learning to perceive. It is about aspects of sound-colour, space and experiencing your surroundings and really becoming aware of them. How I teach earcleaning is only partly related to Schafer. It is concerned with the surroundings, about the outdoors, the public space, but also with electronic sound and the spatiality of sound as I approach it in my work. Schafer was concerned with learning a new way to listen to your surroundings and what is happening in them. I am not so involved with acoustic ecology – for me the most important aspect is that you can make the step to listen to the surroundings and sound itself, and to learn to perceive it accurately. Earcleaning is a fantastic term, of course; isn't a good earcleaning what everyone wants?

The Hybrid Architectures of Iannis Xenakis
Elizabeth Sikiaridi