Ola Nordal

The sound sculpture *Ode to Light*: Arne Nordheim's first project at the Studio Eksperymentalne

This article presents a study of Arne Nordheim's music for Arnold Haukeland's sound-sculpture *Ode to Light* (1968).[1] The sculpture is one of the longest-playing electroacoustic sound installations in the world, and it holds a significant place in Norwegian art history.[2] It is a collaborative artwork in the interdisciplinary spirit of the 1960s, bringing together plastic and aural dimensions to one aesthetic whole, as well as forming a multisensory experience with the surrounding landscape and weather conditions. The project also exemplifies the philanthropic ideas and technological exploration so often seen in the arts in this period.

Previous studies of *Ode to Light* have focused on the plastic aspects of the sculpture.[3] In the following, I will present the first comprehensive study addressing the history, aesthetic and technology of the aural side of the work.

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[1] The Norwegian name of the sculpture is *Ode til lyset*. I have used the English translation throughout this article.

[2] *Ode to Light* is mentioned in most accounts of modern Norwegian sculpture. See e.g. Ole Henrik Moe, 'Toner, form og farge' [Tones, form and colour], in Ingrid Sammingsen et al. (eds), *Norges kulturhistorie* [The cultural history of Norway], vol. vii: *I velstandens tegn* [Under the sign of prosperity] (Oslo, 1981). There are some earlier examples of sculptures containing electronically mediated sound, most notably the 'spatiodynamic' towers built by the French sculptor Nicolas Schöffer in the mid 1950s, some of which contained electronic sounds by Pierre Henry. However, most of those earlier sculptures were taken down after some years of operation, and to my knowledge none have had the same life span as the Nordheim-Haukeland collaboration. *Ode to Light* was renovated in 1995, and the original tape material was replaced with new sounds in keeping with Nordheim's then digital aesthetic. It is this 1995-version of the material that can be heard on-site today. My analysis relates to the original tape material from 1968.

[3] Svein Aamold, *Arnold Haukeland: Liv og verk* [Arnold Haukeland: life and work] (Oslo, 1992).

I divide Arne Nordheim's electroacoustic output into four periods, roughly coinciding with the places he was working: 1) early (Oslo 1960–1967), 2) main (Warsaw 1967–1972), 3) intermediate (Oslo, Warsaw and Stockholm 1972–1983) and 4) late (Oslo 1983–2006). In this article, I will argue that *Ode to Light* was one of the most significant commissions that Nordheim received in his second electroacoustic period. The sculpture is important not just for its artistic merit, but also because the project inspired Nordheim to start working at the Studio Experymentalne in Warsaw. Further, *Ode to Light* was Nordheim's first sound installation, and several of the techniques and principles used in this project point towards his later sound artworks. They include the use of tape-loops and various interactive principles in order to provide works of infinite duration.

The article has five parts. First, I will review the background to the commission as a philanthropic-turned-controversial art project. Then I will explore Nordheim's visions for what he wanted to make. Thirdly, I will investigate why Nordheim decided to go to the Studio Experymentalne and analyse some of the material he conceived. Finally, I will give a description of the principle governing the interactivity and sound diffusion of the project and the so-called 'Music Machine' that Nordheim conceived in cooperation with the Acoustical Laboratory at the Norwegian Institute of Technology in Trondheim (today NTNU).

The historical context: A monument for the blind king

The blind pop singer and accordionist Erling Stordahl (1923–1994) enjoyed great success in Norway during the 1950s and 1960s, releasing more than 120 records and touring intensively all over the country.[4] He had far-reaching philanthropic ideas. The bulk of his earnings were donated to the Norwegian Association of the Blind and Partially Sighted. He realised a remarkable number of large projects benefiting people with physical disabilities, most notably an international Health Sports Centre

[4] For the biography of Erling Stordahl, see Espen Andersen, *Erling Stordahl. Ildsjel og banebryter* [Erling Stordahl: enthusiast and pioneer] (Oslo, 2010) and Otto Johansen, *Ridderspranget: Erling Stordahl og hans verden* [Ridderspranget: Erling Stordahl and his world] (Oslo, 1972). Stordahl performed regularly with the singer Gunnar Engedahl (1919–1969).

at Beitostølen in Valdres. In 1957, Stordahl inherited the family farm of Storedal in Skjeberg, some 100 kilometres south of Oslo. There he started planning an art and culture centre for the visually impaired. The central element of the centre was a flower park where the blind could experience the texture and smell of a wide range of plants. In the multisensory experience he was preparing for his visitors, he also wanted to include art forms like music, drama and sculpture.

Stordahl constructed a unifying theme for his centre around the myth of the saga king Magnus the Blind. In the *Sagas of the Norse Kings*, Snorre Sturlason chronicles how the fifteen-year old Magnus inherited the disputed Norwegian throne after the untimely death of his father, Sigurd the Crusader, in 1130.[5] This sparked a period of civil war lasting more than one hundred years. After only five years as king, Magnus was caught by his enemies, blinded, castrated, partially dismembered and sent to a monastery in Trondheim, where he became a monk. A few years later, he reluctantly answered a call to support Sigurd Slembe, another claimant to the throne. But Slembe lost the ensuing war, and Magnus was killed in the battle of Holmengrå in 1139. The saga claims that as his servant tried to carry the wounded Magnus away from the battlefield, a single spear killed them both. Some readings of the sculpture interpret the two black pillars as hands reaching up towards the sky, and the stainless steel rod in the middle as the spear that killed Magnus and his servant (Figure 1).[6]

Family legend had it that Magnus was born on Storedal and was part of Stordahl's ancestry. Fascinated and proud of his heritage, Stordahl transformed this tragic story into a heroic allegory of blindness defeated. In his rewriting of the saga, Stordahl claimed that it was only after he had been blinded that Magnus could 'see for real' ('virkelig se') the flowers, plants and humans around him. Stordahl found in Magnus a man who through hardship overcame his handicap. This fitted Stordahl's life motto: 'through darkness there is always a path towards light'.[7]

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[5] 'The Saga of Sigurd, Inge and Eystein, the sons of Harald', in Snorre Sturlason, *Heimskringla: The Chronicle of the Kings of Norway*, tr. Samuel Laing (London, 1844).

[6] For a critique of this interpretation, see Aamold, *Arnold Haukeland*, pp. 193–8.

[7] For Stordahl's interpretation of the saga, see Erling Stordahl's audio drama *Fra Mørke Til Lys* [From darkness to light] (original production by NRK, 1970, re-released on CD as ESCD.0101 by Storedahl Art and Culture Centre, 2001).

Figure 1. *Ode to Light* in the flower garden at Storedal Centre for the Arts. Photo: Ola Nordal

Stordahl wanted to erect a monument to Magnus in his park, and in 1962 he contacted Arnold Haukeland (1920–1983), at the time one of the most renowned sculptors in Norway. Together they envisioned a monumental project: a twenty-metre steel sculpture and a series of bas-reliefs depicting scenes from Magnus's life. At some point, sound was included in the design, and Stordahl got in touch with the composer Geirr Tveitt (1908–1981). Tveitt was given three tasks: he was to provide music for an outdoor play about Magnus; he was to make short tunes for each of the flowers in the park (it was planned that the visitors should hear these tunes through small coin-operated 'telephones'); finally, the 'monument of blindness defeated' was to be 'made in material and tones'.[8] So the idea of having music as a part of the sculpture was clearly discussed before Nordheim became involved in the project.

[8] Quoted from a letter from Stordahl's correspondence assistant Otto Johansen to Arnold Haukeland's widow Randi, Oslo, 30 April 1992. Private archive of Otto Johansen at the National Archives of Norway, RA/PA-0939/D/L0008/0008. In the letter, Johansen quotes extensively from the correspondence between Tveitt and Johansen/Stordahl in the period 1963–1965. The original correspondence seems to be lost. All quotes in this article are translated to English by Ola Nordal.

As work on the monument progressed, it became increasingly evident that Haukeland had problems with the figurative reliefs. In the early 1960s, he was gradually moving away from figurative expression, and as his sculptures became more abstract he also became a more controversial figure. The fate of the reliefs became an intense point of debate, almost halting the entire project.[9] When Haukeland eventually stopped working on them, several members of Stordahl's team were enraged. Geirr Tveitt was the first to leave, stating:

> If the expression is unclear and abstract, I have no faith in the viability of the artwork. The abstract artists can say what they want, and overestimate their fantasy until they go blue in the face![10]

Tveitt was working in a national romantic style typical of the mid twentieth century in Norway, and he can be included among the 'traditionalists' in the then raging controversy over abstraction, tradition and modernism in the arts. In this light, it is striking that his successor was Arne Nordheim, one of the most outspoken 'modernists' in the debate. Nordheim had by this time an established reputation as an electronic music composer, in particular from his numerous works for the stage, radio and television theatre. He had also gained international attention for his mixed orchestral and electronic works *Katharsis* (ballet, 1962) and *Epitaffio* (1964). The appointment of this somewhat notorious figure was a clear indication of the aesthetic direction in which the project was heading.

Nordheim's visions

If it was initially Haukeland's idea to use sound in the sculpture, it was Nordheim who envisioned how it should be done. In November 1965, he wrote the following to Stordahl:

> As soon as Arnold Haukeland mentioned this project to me, I knew that the music/sounds should be controlled by the light. This is not difficult to achieve; it

[9] Johansen, *Riddersprangt*, pp. 61–77.

[10] Letter from Geirr Tveitt to Otto Johansen, original date 23 November 1963, quoted after Johansen to Haukeland, Oslo, 30 April 1992.

> only needs thorough planning and solid technological preparations, electronically speaking.[11]

Nordheim focused on two principle ideas. First, he wanted to put multiple speakers into the actual sculpture. For this idea, Nordheim was inspired by Stordahl's ability to describe the physical properties of a room just by snapping his fingers and listening to the reverberation. Nordheim imagined that if the sounds moved from speaker to speaker, the non-seeing would somehow feel the physical properties of the monument. He also wanted the sounds to 'reflect the materials of the sculpture'; hard and metallic for the dark iron hands and bright and glimmering for sunlight reflected in the stainless steel.

The second main idea was to let the sun 'conduct' the behaviour of the sound material. Nordheim had observed how photoelectric cells could be used to control 'everything from elevator doors to streetlights'. so 'why can't they not also control sounds?' Nordheim wanted to use the intensity of the sunlight to control several parameters in real time: sound colour (filtering and ring modulation), pitch (playback speed) and loudness. He hoped that the natural light variations would change the perceived sound behaviour, and thus provide an aural effect similar to seeing light move over the surface of the sculpture. Stordahl seems to have been enthusiastic about Nordheim's synaesthetic vision, and he received full support, from both Haukeland and the park committee.[12]

As described by Aamold, several issues had to be resolved before financing was granted and the sculpture could be built.[13] It was only in July 1967 that the Norwegian Arts Council, after much debate, granted the proposed 340,000 NOK for the sculpture, including 70,000 NOK for the sound component. This sum was to cover everything from the technical equipment to Nordheim's remuneration. The sculpture was

[11] Letter from Arne Nordheim to Otto Johansen, 9 November 1965. Otto Johansen's private archive, National Archives of Norway, RA/PA-0939/D/L0008/0008. All quotes in this section are taken from this letter. Nordheim's vision was later refined in an article in *Morgenbladet* in July 1966: Arne Nordheim, 'Skulptur – Musikk' [Scupture – music], *Morgenbladet*, 1 July 1966.

[12] The exception was NRK's Arne Altern, who quit the Storedal committee soon after Nordheim was appointed as Tveitt's successor. The incident is mentioned in Johansen to Haukeland, Oslo, 30 April 1992.

[13] Aamold, *Arnold Haukeland*, vol. ii, pp. 260 ff.

built over the next year, and was officially inaugurated on 1 October 1968. The park opened two years later, on 12 August 1970.

The Studio Eksperymentalne and *Ode to Light*

In the following, I will focus on the two tasks that Arne Nordheim was faced with for the project: the production of the sound material and the design and implementation of the interactivity unit. As we will see, several of the initial ideas had to be modified in the practical realisation of the sculpture. Yet the main principles were retained: the sonic illustration of the sculpture and the use of the sun as 'conductor'.

Nordheim had realised most of his previous electroacoustic compositions in a small ad hoc electronic music studio at the Norwegian Broadcasting Corporation (NRK). I have found no documentation explaining why Nordheim did not want to use NRK for *Ode to Light*, but it is possible that either he was not granted enough studio time or, more likely, he wanted to move on to better-equipped facilities. In an official report that Nordheim wrote in 1973 on the situation of electronic music in Norway, he stated that 'the sounding result' of music produced in the NRK studio was of 'no interest in professional contexts'.[14] The generous budget for *Ode to Light* opened up the possibility to travel abroad to work. A document in the Stordahl archive indicates that Nordheim initially wanted to use the Studio di Fonologgica Musicale in Milan to produce the sound material, and that he was planning a trip to Italy already during the spring of 1966.[15] He also mentioned going to Stockholm to discuss technical implementation with Knut Wiggen, who earlier had made an interactive 'music machine' similar to the one Nordheim was envisioning.[16] However, none

[14] 'Utredning fra en arbeidsgruppe oppnevnt av Norsk kulturråd 1973: Studio for elektronisk musikk' [Report of a working group appointed by the Norwegian Arts Council 1973: the Studio for Electronic Music]. Archives of NRK, Correspondence with Norwegian Arts Council; Folder 23-8-28: Om norsk studio for lydopptak.

[15] Letter from Storedalstiftelsen to Norges Kulturråd, dated 7 June 1966. Copy of letters from the Arts Council Archives. Nordheim's papers at the Arne Nordheim Centre, Norwegian Academy of Music.

[16] Wiggen's 'Musikmaskin' is mentioned in Hugh Davies, 'Repertoire International Des Musiques Electroacoustiques', *Electronic Music Review*, 2–3 (1967), pp. 308. Nordheim never referred to Wiggen's project, but his use of a similar title indicates that he knew about it.

of those journeys took place, possibly because Nordheim had to wait for the project's financing to be settled.

Meanwhile, he looked for alternatives. On 15 April 1966, the newspaper *Morgenposten* reported that Nordheim had packed his red Volvo 123GT full of tapes and was leaving for a six-week study trip through Europe.[17] His travel plans included visits to several electronic music studios, and one of the stops on his itinerary was Warsaw.

There were several factors that had drawn Nordheim's attention to Polish Radio's Studio Eksperymentalne. In part, he knew of the studio through Krzysztof Penderecki's electronic work *Psalmus*, from 1961; Penderecki's distinctive transformations of voice recordings seem to have had an impact on the electronic material for *Epitaffio*. Nordheim was also well acquainted with the dynamic Polish music scene. *Epitaffio* had been performed at the Warsaw Autumn festival of 1965, and Nordheim had spent ten days in the city as an official visitor under the Norwegian-Polish cultural exchange programme. During his stay, Nordheim had been introduced to the studio director, Józef Patkowski, as well as the composer Włodzimierz Kotoński, with whom he became good friends. When the Norwegian branch of the ISCM, Ny musikk, invited Kotoński to Norway the following year to attend a performance of one of his pieces, he stayed in Nordheim's apartment.[18] Before his European study trip, Nordheim tried via Kotoński to get in touch with Patkowski, in order to investigate the possibilities of working on the material for *Ode to Light* in Warsaw.[19]

Visits to studios in Cologne and Utrecht seem to have come to nought, and while still in the Netherlands, Nordheim hurriedly wrote to Patkowski describing his preliminary plans and asking for a meeting:

> From our friend Kotonski have you heard that I am interested in the possibility of working in the Warszawa-Studio. As probably also Wodek have told you I am making a kind of music-machine, and the work I eventualy will do in the studio is a making of the basic sound-material for this maschine. […] I am especially hunting for pieces of hard metalic sound, and I am bringing with me som basic

[17] 'Polyfon studiereise med forhåndsarbeide' [Polyphonic study trip with preparations], *Morgenposten*, 15 April 1966.

[18] This piece was Trio for flute, guitar and percussion (1960), performed by the Danish ensemble Prisma. 'Prisma-ensemblet i Oslo' [The Prisma ensemble in Oslo], *Aftenposten*, 20 January 1966.

[19] Letter from Arne Nordheim to Włodzimierz Kotoński, dated Oslo, 10 April 1966. Arne Nordheim Centre, Norwegian Academy of Music.

> material as we eventualy can use for research and for my understanding of the working prinsip of the studio.[20]

On 2 May 1966, Nordheim arrived in Warsaw, in order to meet with Patkowski. I have found no documentation about the result of the visit, but knowing the later story the meeting must have been a success. By January 1967, all the formalities had been arranged. Patkowski calculated that the project would require 150 studio hours, and over the subsequent months Nordheim prepared for an extended stay in the city. He arrived in Warsaw in late August, less than two months after the financing of the project was granted, and it is likely that the sound material for *Ode to Light* was completed during his first sessions in the studio.[21]

The sound material

Just before leaving for Poland, Nordheim published an article about *Ode to Light* in the short-lived Norwegian art magazine *Kolon*. The article contained a graphical score – basically just a sketch – of the music he was envisioning (Figure 2). The sketch outlines the dramatic structure of the planned material, and the adjacent description gives some insights into his now more concrete aesthetic ideas:

> This composition is planned to pass through different stages of material, and will be built on modulations of these. It will extend over a suspension curve from soft and faint sounds to hard and loud. Over a span of about 30 minutes, the development will go from complexes of soft rustles, through increasingly purer electronic sounds (sine tone complexes), to more concrete sounds, where the manipulation of steel and metal sounds will make up the climactic point and core of the tape. It is intended that this point will be reached in the middle of the composition, after which a mirror-image dissolution process will start.[22]

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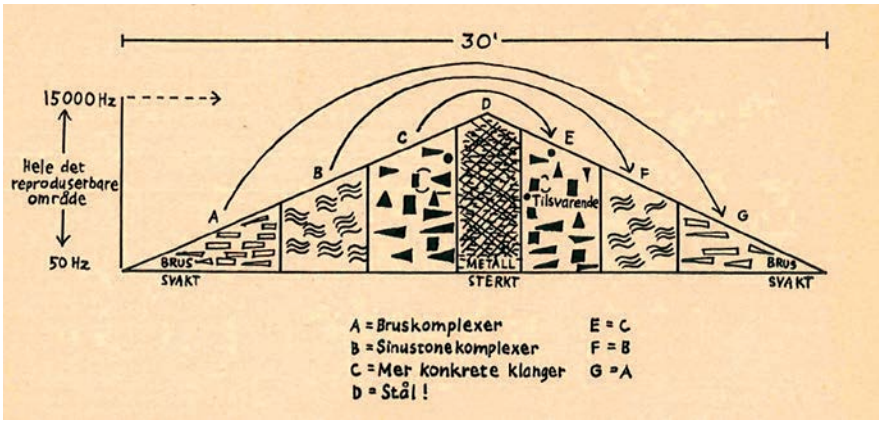
[20] Letter from Arne Nordheim to Józef Patkowski, dated Amsterdam, 22 April 1966. Arne Nordheim Centre, Norwegian Academy of Music. English in the original.

[21] On 17 February 1968, Nordheim presented the sound material for *Ode to Light* during a live-electronic performance called *Machina* at concert in Oslo. The second round of sessions in Warsaw took place in March 1968. The dates are mentioned in a letter from Nordheim to the Arts Council of 18 December 1967. Arne Nordheim's papers, Arne Nordheim Centre, Norwegian Academy of Music.

[22] Nordheim, 'Skulptur og musikk', pp. 27–28.

Figure 2. Nordheim's 'score' for *Ode to Light*[23]



As several theoreticians on sound art have noted, most spectators visit a time-based artwork for an undetermined amount of time. Alan Licht writes that sound art 'belongs in an exhibition situation rather than a performance situation'.[24] Nordheim must have observed this phenomenon, because instead of providing a work with a clear beginning and end, he wanted a work of infinite duration. Nordheim envisaged that he could obtain this by copying the same material onto two separate tape loops, and running them in parallel at slightly different speeds. The result would be, according to Nordheim, a 'sort of two-part canon'.[25] Taken together with the interactivity principles described later in this article, he would make sure that the same 'sound image' would never occur twice.

Even though this description has lived on in various accounts of the work, what Nordheim actually composed was quite different. Instead

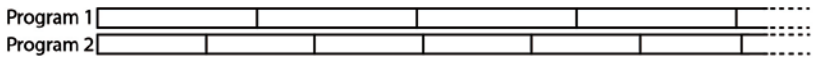
[23] Ibid.

[24] Alan Licht, *Sound Art. Beyond Music, Between Categories* (New York, 2007), p. 14. On a similar note, Brandon LaBelle has claimed that sound art shifts emphasis from the 'time of music' to the 'space of sound.' Brandon LaBelle, *Background Noise: Perspectives on Sound Art* (New York, 2006), p. 162. Salomé Voegelin notes that she is listening *in* instead of listening *to* a work of sound art: Salomé Voegelin, *Listening to Noise and Silence* (New York, 2011), p. 29.

[25] Nordheim, 'Skulptur og musikk', pp. 27–28. There are similarities between Nordheim's idea and Steve Reich's principle of 'phasing.' However, it is unlikely that Nordheim knew of Reich's work at this point. Reich's first phase work, *It's Gonna Rain*, dates from 1965, but was not well known in Europe at the time. Reich's first widely circulated recording (*Come Out*, Odyssey 32.16.0160), was not released before November 1967, at least one month after Nordheim's article.

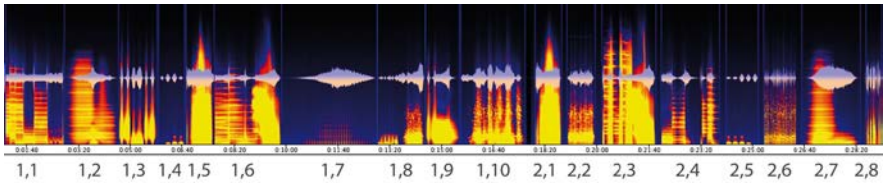
of a long stretch of music run in parallel on two tape machines, he composed eighteen discrete parts distributed between two different tape loops. *Program 1*, to use Nordheim's own term, contained ten parts and had a total duration of 16'42. *Program 2* contained the remaining eight parts, and lasted 11'24. As Figure 3 shows, the uneven length of the tapes ensured that the sync point would only rarely align in its initial position.

Figure 3. Approximation of the varying sync point for the two tape loops



The following figure shows a sonogram of the original 1968 version of the tape material for *Ode to Light* with my numbering of the eighteen parts.[26] The first digit indicates the program, and the second indicates the position internally on the tape. I don't have space here to go into all of the parts, but I will present some general observations and provide a couple of more in-depth examples.

Figure 4. Spectrogram of the original *Ode to Light* tape



Each of the parts contains only a few sonic elements. Some of them are divided into several sound layers (maximum three), but most are

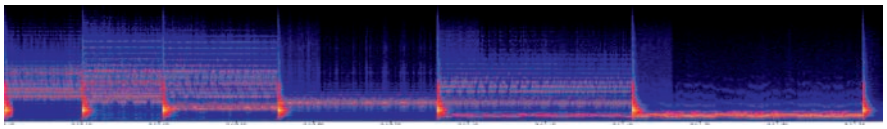
[26] For some time, the original tapes of *Ode to Light* were thought to be lost. In 2011, I discovered a copy of the master tape in the basement of the acoustics group at NTNU. Later, another master tape was uncovered in the archives of the Studio Eksperymentalne. The Warsaw master has been released as *Ode to Light (sculpture) – Studio mix 1* and *Studio mix 2* on the CD *Sounding the Body Electric* (Bołt Records, BR.ES10, 2013). The material on the two masters is identical, but the ordering of the parts is slightly different. My numbering is based on the Trondheim tape, since it probably has the most correct ordering. A stereo mixdown of the two programs that Nordheim realised in Warsaw (released as *Ode to Light* on the CD *Solitaire*, Bołt BR.ES11, 2014) follows the ordering of the Trondheim tape. The same is true for the music examples presented in a 50-minute documentary about *Ode to Light*: Eva Brustad (dir.), *Lydskulptur*, NRK TV, 25 October 1968.

focused on only one or two sonic ideas. More complex sound textures are obtained by mixing the two loops. There is a slight difference in character between the programs. On a general note, one can say that *Program 1* has background character. Several of the parts are atmospheric or textural, often being made of static surfaces with unchanging dynamics. The parts are also slightly longer (median 01'41) than on *Program 2* (median 01'14). The breaks between the parts are short (1' to 4'), and the almost constant flow of sound on this loop glues the composition together. On *Program 2*, the sounds are more distinct and gestural, and thus have more foreground character. The breaks between the parts are also longer (9' to 11'). It must be stressed that this foreground/background division is not absolute. Sometimes the role changes, and sometimes two parts with background character or two parts with foreground character are played at the same time.

Part 1,1 can be used as an example of a part functioning as background texture. This part is composed as six successive 'moments', each separated by a loud dystonic impulse, possibly a clapper or some other concussion idiophone.[27] The impulse functions as a sort of 'moment divider,' strikingly similar to the form-dividing technique used in works like Stockhausen's *Telemusik* (1966) and Lutosławski's *Jeux vénitiens* (1961). Each 'moment' is a static sound surface where the partials of a sustained stratified sound slightly undulate in intensity and pitch. I wish to call this technique a 'resonance arpeggio', since the perceived effect is that of arpeggiating randomly over a collection of pitches. Similar 'resonance arpeggios' can be found in *Parts 1,6* and *2,4*. The resonant frequencies do not follow the ratio of the harmonic series, and it is probable that they relate to the inharmonic spectrum of a bell. As one can observe in the spectrogram (Figure 5), the resonant frequencies are for the most time packed together in the upper part of the register. The result is a metallic and piercing sound.

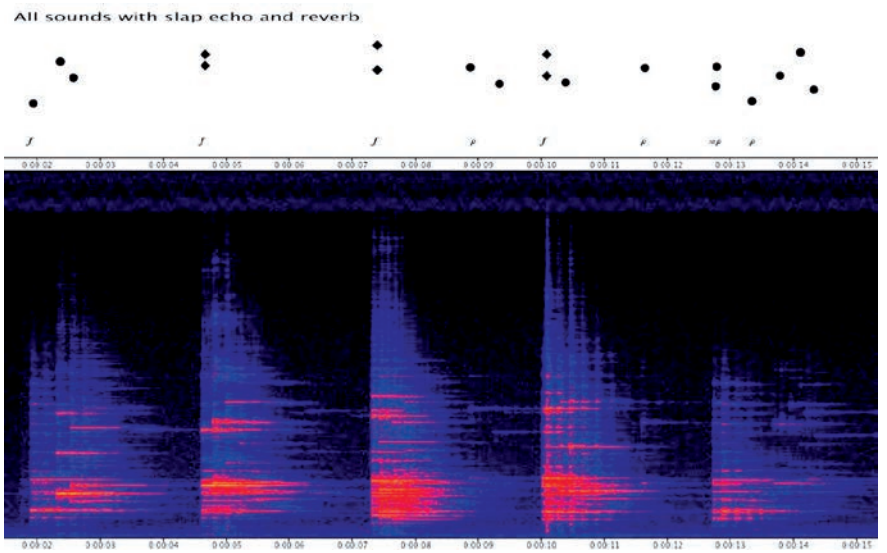
[27] Some of the analytical vocabulary in this article is based on Lasse Thoresen's adaptation of Denis Smalley's concept of spectromorphology. See Lasse Thoresen and Andreas Hedman. 'Spectromorphological analysis of sound objects: an adaptation of Pierre Schaeffer's typomorphology' *Organised Sound*, 12/2 (2007), pp. 129–141 and Denis Smalley, 'Spectromorphology: explaining sound-shapes', *Organised Sound*, 2/2 (1997), pp. 107–126.

Figure 5. *Part 1,1,* dur. = 01'55



Part 1,1 can be contrasted with *Part 2,6* (Figure 6), which has more foreground character. It consists of regular bursts of semi-pitched impulses – a much more gestural sound. The entire part contains only this single sound category. This very sparse use of categories contributes to the uniform feel of the composition.

Figure 6. The first 15 seconds of *Part 2,6*



Both examples contain sounds that 'reflect' the material of the sculpture. As mentioned, the partials in *Part 1,1* seems to relate to the inharmonic spectra of bells. When listening back to *Part 2,6* on one-quarter speed, one can recognise the source material as being a series of bell recordings drenched in echo and reverb. Even though the manipulation removes the direct mimetic link to the bell, the metal-like quality of the sound is retained. This is typical of the sounds in the work. Although several sounds can be traced back to the striking of concussion

idiophones, bells and pieces of metal, they are rarely giving precise extra-musical references. We can say that they are associative, but not directly referential. It is the aural quality of the sound that is in focus, and not its mimetic content. This is markedly different from the sound material used in Nordheim's first electroacoustic period, which often blends the acoustic and electronic sound worlds by deliberately referring to sounds clearly produced by the human body, like the use of voices in *Epitaffio* (1964) and *Favola* (19675) or the manipulation of musical instruments in *Response* (1966) and *The Little Prince* (1961).

The interactive elements of *Ode to Light*

I will now move on to the interactive elements of the sculpture. According to Asbjørn Krokstad (b. 1931), Nordheim had heard during one visit to the NRK that if he ever needed complex audio equipment, he should get in touch with the newly opened acoustical laboratory at the Norwegian Institute of Technology in Trondheim.[28] Nordheim heeded the advice and made contact in January 1966. Krokstad, the laboratory director, was a conductor and double bass player, and served as the chairman of the ISCM branch in Trondheim. He was immediately enthusiastic about the project. They met several times during the year, and when funding was finally secured, the whole laboratory got involved. An engineering student, Odd Erik Resell, was assigned to the project full-time for a year. The laboratory not only saw the project as an exciting challenge (they had to push their technical creativity to the limits and developed several new circuits and systems), it was also a prestige project that gave the new laboratory national media coverage.[29]

Krokstad's first task was to translate Nordheim's somewhat far-flung artistic ideas into something technically feasible.[30] The greatest change, which diverged strongly from Nordheim's initial visions, was to use fixed media playback only, instead of real-time manipulation of the tape material. As we have seen, Nordheim had wanted to use on-site ring

[28] Krokstad interviewed by Ola Nordal, 10 October 2011. The institute opened in 1965.

[29] For instance, the illustrated magazine *Aktutell* ran a large feature on the joint artistic and technological project. Bjørn Bjørnsen, 'Ny Norsk Lyd', *Aktuell*, 29 July 1967.

[30] Krokstad interviewed by Ola Nordal, 10 October 2011.

modulation, filtering and transposition. Now instead he had to finalise the material in the studio and only leave the sound distribution to the interactive elements. In that sense, the 'music machine' must be seen as an intricate playback and sound diffusion unit, and not as a sound-producing machine. Several other ideas, like movable directional speakers and individual photocells for each speaker, were also abandoned.

Figure 7 summarises the working principle of the 'machine' built in Trondheim.[31] A photoelectric cell was used to measure lux in one point at the top of the sculpture. The input data from the light sensor was used to control the speed of a rotating glass disc. Printed on the disc were randomised control patterns for a 12-channel voltage-controlled matrix amplifier. The tape programs were played back from two Tandberg TB-1300 tape-loop machines, mixed together, fed into the amplifiers, and then routed to the speakers in the sculpture.[32] The disc with the control patterns would rotate more quickly at high light intensity, making the sound levels change faster in a seemingly random or 'stochastic' pattern.[33] The result was that the stronger the light, the more intense the sonic activity on the sculpture. The different character of the speakers would result in a constant shifting of the material's sound colour. Thus, even though the two sound programs would sometimes align in a previous position, the exact same sonic image would never occur twice.

Concluding remarks

Ode to Light embodies the experimental and interdisciplinary spirit of the arts of the 1960s. It was a great philanthropic project, bringing current trends in the plastic and sonic arts to the visually impaired. At the same time, it was a great technological project, bringing together the latest developments in audio research and electronic music production. In this article, I have followed the history of the sound material in *Ode to Light*,

[31] Krokstad interviewed by Ola Nordal, 10 October 2011.

[32] The TB-1300 could play back Fidelipac 'Endless' tape loop cartridges, each holding approximately 16–17 minutes of sound. *Operating Instructions Tape Recorder 13–22* (Oslo, 1967). The decision to use the TB-1300 is mentioned in a letter from Nordheim to the Norsk Kulturråd of 18 December 1967, quoted in Aamold, vol.ii, p. 271.

[33] The word 'stochastic' was used by Krokstad when describing the working principle of the machine. It does not seem to correspond to Xenakis's use of the term.

Figure 7. Working principle of the 'music machine'

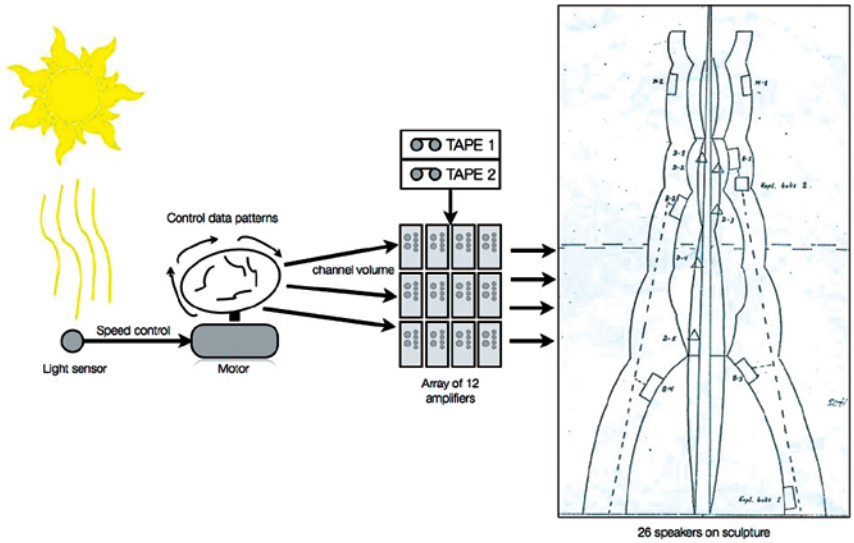
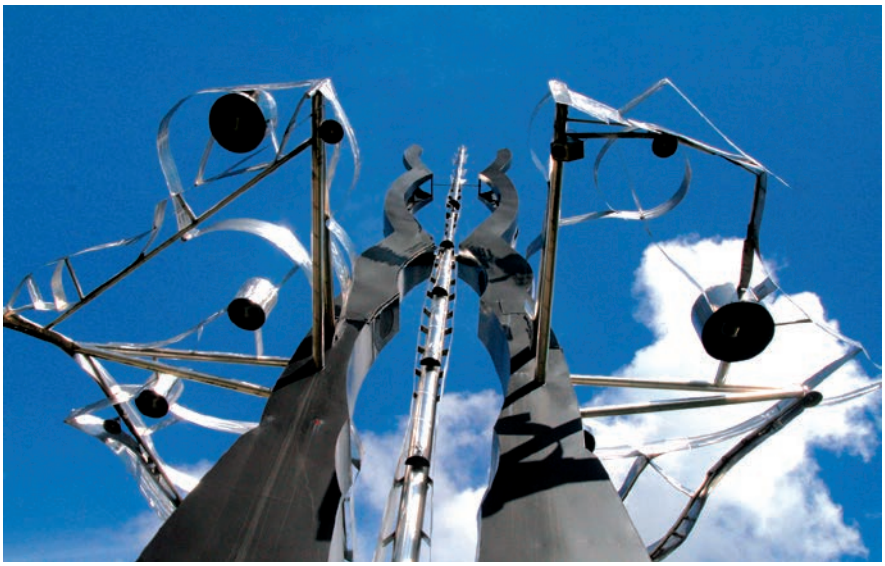


Figure 8. Detail showing some of the speakers in the sculpture. Photo: Ola Nordal



from vision to production. I have shown how Nordheim responded to Stordahl's ideas with a synaesthetic vision for making the sound material and the sound behaviour relate to sunlight and the physical properties of the sculpture. I have also shown how the project prompted Nordheim to go to Warsaw to produce electronic music – a move that benefitted later Nordheim works like *Warszawa* (1968), *Solitaire* (1968), *Colorazione* (1968), *Pace* (1970) and *Poly-Poly/Lux et Tenebrae* (1970). One can see *Ode to Light* as a transitional work in Arne Nordheim's electroacoustic catalogue. Not only was it his first project at the Studio Eksperymentalne, it was also his first sound installation. *Ode to Light* provided the palette for many of Nordheim's later approaches to sound art. The principle of parallel tape loops was expanded to six tapes for his installation *Poly-Poly* at the Japan Expo '70. The use of external input as a decision-giving element was used in later installations like *Gilde på Gløshaugen* (2000) and *Dråpen* (2001).

In the 1960s, much emphasis was placed on the *experience* of art. The only way to fully grasp this wonderful sound sculpture is to visit it in Skjeberg, preferably on a sunny summer day. Even though the current sound material is Nordheim's revised digital version from 1995, the aural interpretation of the physical sculpture is retained to great effect. It sings its electronic song, over the fields, the flowers and the trees, in harmony with the wind and the birds.