International Conference on New Interfaces for Musical Expression

Loki's Pain

PerMagnus Lindborg

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Loki's Pain [NIME Art Installation]

PerMagnus Lindborg, City University of Hong Kong, HKSAR

Abstract

Loki's Pain is an immersive 3D audio sonification of seismological activity. Visitors take the place of Loki, who was punished by the gods and caused earthquakes. We designed an auditory display structure in the shape of a hemi-dodecahedron and built a prototype with a low-budget DIY approach. Seismological data were retrieved from the Internet. Location, magnitude, and epicentre depth of hundreds of recent earthquakes were sonified with physical modelling synthesis into a 10-minute piece.

Project Description

Loki's Pain (Lindborg 2020) is an immersive installation: a 16-channel 3D audio sonification of planetary seismological activity. Visitors take the place of Loki, who according to a Norse legend was “punished by the gods by being chained to three rocks in a cave using the entrails of his dead son, with a venomous serpent poised above his head. When the serpent’s poison fell on Loki’s head it caused him to shake uncontrollably, thereby unleashing an earthquake” (Allen 2020, p. 148-9). The installation is a physical structure, designed and built by the Author, in the shape of a hemi-dodecahedron. As show in [Figure 1](#), the LOKI structure envelops the listener, and the immersive space may be shared by two visitors. In *Loki's Pain*, they sit on a lightly vibrating subwoofer while listening to the sound of virtual cymbals, created by physical modelling, spatialised according to the geographical location of seismological events, as if they found themselves at the centre of planet Earth.

The LOKI frame holds 15 custom-built loudspeakers mounted so as to produce a 3D immersive sonic environment. The structure is suspended from the ceiling rig, not touching the floor. Visitors band a little and step inside the installation space, and sit down on a subwoofer, which is lightly vibrating. They listen to a 10-minute sonification of the most recently retrieved earthquake data from the Internet. Seismological magnitude and epicentre depth are mapped onto the parameters of real-time physical modelling synthesis with Modalys (IRCAM). Data from IRIS is retrieved from the Internet and pre-processed in R (R Core Team), and then sonified in Max (Cycling'74) using virtual cymbals that are spatialised with Spat (IRCAM).

Loki's Pain, binaural [KEMAR] (10:19)

Loki's Pain grows out of the author's previous work with sonification of geodata (Lindborg 2017, 2018). The artwork aims to remind visitors of the fragility of the Earth's crust, and the reality faced by people exposed to the terrifying power of earthquakes and volcanic activity.

'Guided tour' of *Loki's Pain* at Banga Gallery, Hong Kong (02:03)

Installation Notes

The LOKI structure is assembled on site from custom-made parts (aluminum profiles, acrylic supports, nuts & bolts, cable ties). The structure holds 15 loudspeakers. It is ~220 cm wide, weighs approx. 25 kg. Once assembled, the structure is suspended with four wires from the ceiling grid, and audio cables are run from loudspeakers upwards to the grid and to a small platform (concealed) holding playback equipment. There is a subwoofer at the centre, which the visitor(s) can sit on while listening to the immersive soundscape.

Loki's Pain produces sound during approximately 50 minutes of each hour. The 10-minute sonification is played four times, interspersed with shorter bits of subwoofer rumbling and silence. Because all loudspeakers are near-field monitors and placed close to the visitor(s), sound levels can be kept quite low so that sound spill to the outside of the installation is relatively unobtrusive.

Fig. 1. Two visitors listening to *Loki's Pain* at the Banga Gallery, Hong Kong, 23 November 2020.

Installation Requirements

Space Requirements

The installation should be made in a dedicated room or gallery separation measuring approximately 450 cm x 450 cm, ideally with suitable floor and wall acoustic treatment, in black colour, and a dedicated spotlight gently illuminating the metal structure.

Floor Plan & Logistical Requirement

See Figures 2 and 3 which show a concept draft and top view (floor plan) of the installation and its components.

Equipment Requirement

See Table 1 which lists equipment provided by the Author and parts that should be provided by the Organization [NIME].

Feasibility

The Author and his Assistant constructed the LOKI frame and installed it to play *Loki's Pain* at [Indra and Harry Banga Gallery](#), Hong Kong, as part of the *ArtMachines Past/Present* exhibition, curated by Richard Allen and Jeffrey Shaw. The exhibition briefly opened 23 November 2020, but was immediately obliged to close due to COVID-19 regulations. It re-opened in March and will be on until 23 May 2021 (Figures 5 and 6).

See Figure 4 with some photos from the setup process indicating key components of the installation. It takes approximately one full day to assemble the LOKI structure (i.e. the day before the conference/exhibition opens) and half a day to take it down (i.e. after the exhibition closes). For daily operation, there is a single AC on/off switch which can be maintained by exhibition personnel according to opening hours.

Fig. 2. Design draft of LOKI structure showing requirements for height under ceiling grid. At the *Banga Gallery* the available ceiling height was lower, which led to a solution where the visitors are seated (on a subwoofer) inside the structure.

LOKI installation [top view]

dedicated small room or separation, approx. 450 cm x 450 cm

the plan approximates the installation at Banga Gallery, Hong Kong, and can be adapted

Fig. 3. Floor plan of the installation at *Banga Gallery*.

LOKI installation

from the installation at Banga Gallery, Hong Kong, can be adapted

LOKI structure suspended above subwoofer. Note the equipment platform in the grid, above to the left.

The equipment platform conceals playback devices, pre-amplifiers, amplifiers, and cables

A ladder is essential during the installation!

XLR cable runs between subwoofer and equipment platform

Fig. 4. Snapshots from the installation setup process.

Fig. 5. LOKI structure, ready to play *Loki's Pain*.

Table 1.	Equipment Requirements
Equipment 1	Self: custom-made LOKI aluminum structure, with steel hooks, acrylic supports, bolts/nuts, rubber cushioning, cable ties;
Equipment 2	Self: custom-made audio system, with 15x loudspeakers, fixed-media playback devices, pre-amplifiers, amplifiers, cables;
Equipment 3	Self: tools for assembly;
Equipment 4	Self: bags and boxes for transport;
Equipment 5	[NIME]: 4x suspension points in ceiling grid suitable for aluminium structure, total weight <25 kg;

Equipment 6	[NIME]: 1x equipment platform in ceiling grid above/to the side of LOKI structure, e.g. wooden board approx. 50 cm x 40 cm (for playback devices, pre-amps, amps, weighing <5kg in total,);
Equipment 7	[NIME]: subwoofer approx. 45 cm tall, on the floor at centre of LOKI structure, suitable for one or two visitors to sit on;
Equipment 8	[NIME]: XLR cable between equipment platform and subwoofer (i.e. sufficiently long to run along floor, wall, ceiling);
Equipment 9	[NIME]: 3x power points (220 V, 13 A) at equipment platform, and 1x power point for subwoofer;
Equipment 10	[NIME], during installation: 1x ladder, 1x carpenter's level;
Equipment 11 (ideally)	[NIME]: exhibition carpet on floor, acoustic foam on walls;
Equipment 12 (ideally)	[NIME]: gallery-type small spotlight(s) mounted in grid.

Fig. 6. Visitor listening to *Loki's Pain*.

Media

- 3D movie of *Loki's Pain* at Banga Gallery; GoPro Fusion capture at visitor position:

Visit the web version of this article to view interactive content.

Loki's Pain [3D]

- Project documentation and all links: <http://soundislands.com/2021/01/21/lokis-pain/>

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Compliance with Ethical Standards

Not applicable.

References

- Allen, Richard (2020). *Art Machines, Past/Present* [catalogue]. Indra and Harry Banga Gallery, City University of Hong Kong.
- IRCAM (2021). Modalys, *IRCAM*. <https://forum.ircam.fr/projects/detail/modalys/>
- IRCAM (2021). Spat, *IRCAM*. <https://forum.ircam.fr/projects/detail/spat/>
- IRIS, Incorporated Research Institutions for Seismology, <http://www.iris.washington.edu/seismon>.
- Lindborg, PerMagnus (2020, Nov.). ***Loki's Pain***, immersive sonification of earthquake data. Commissioned by Indra and Harry Banga Gallery, for ArtMachine Exhibition, City University of Hong Kong, 23 Nov. 2020 - 23 May 2021, <https://www.cityu.edu.hk/bg/exhibitions/art-machines>
- Lindborg, PerMagnus (2018, Sep.). "Interactive Sonification of Weather Data for The Locust Wrath, a Multimedia Dance Performance". *Leonardo*, MIT Press. https://doi.org/10.1162/LEON_a_01339

Lindborg, PerMagnus (2017, Oct). "Pacific Belltower, a sculptural sound installation for live sonification of earthquake data". *Proc Intl Computer Music Conf*, Shanghai. <http://hdl.handle.net/2027/spo.bbp2372.2017.033>.

Lindborg, PerMagnus (2016-17). ***Pacific Belltower***. Surround sound installation for real-time sonification of Internet seismic data. System consisting of software retrieving earthquake data; sonification through physical modelling of virtual bells and spatialisation. Exhibited at Xuhui Art Museum, Shanghai [Official music selection for ICMC] 15-18 October 2017; Aalto University, Volume 2 Symposium, 22-25 November 2016; Yale-NUS, Singapore, 11-14 November 2016. <http://soundislands.com/2020/01/16/pacific-belltower/>.

Max, Version 8, Cycling 74 & Ableton.

R Core Team. "R: A Language and Environment for Statistical Computing." Vienna, Austria: *R Foundation for Statistical Computing*, 2020. <https://www.R-project.org>.