Sound Shifting: From Soundscape to Soundshape

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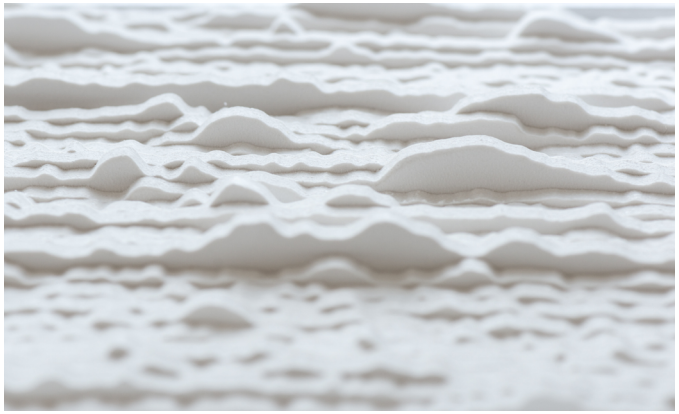


Figure 1: Detail, Soundscape of Linz, 2017
Photo © Katharina Anna Loidl

TEI '19, March 17–20, 2019, Tempe, AZ, USA

ACM ISBN 978-1-4503-6196-5/19/03.
https://doi.org/10.1145/3294109.3301257

Abstract
Sound Shifting is an artistic research project that focuses on the physical representation of sound – this means the visualization and materialization of invisible phenomena that significantly shape our perception. We present a system that allows the transformation from sound into form in real-time by using a newly developed machine, the *Audio Foam Cutter*. This machine converts sound into polystyrene stripes that are arranged into sculptural objects. The resulting sound sculptures provide information about the represented sounds by their shape and aesthetic features and expand the range of our auditory perception to the tangible domain. The sound sculptures are snapshots of our soundscape and form a physical archive of sound representations. The *Sound Shifting* project aims to create an awareness of the materiality of sonic movements and affects.

Author Keywords
Sound Shifting; Hybrid Art; Sound Visualization; Sonic Materialism; Data Visualization.

CCS Concepts
Human-centered computing~Human computer interaction (HCI); Human-centered computing~Interface design prototyping

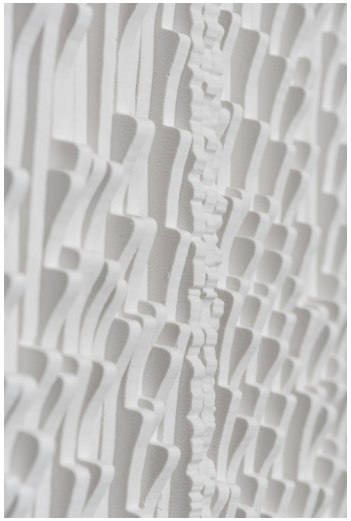


Figure 2: Hells Bells 2017
This piece refers to an incident from 2015. A man from Linz, Austria sued the Catholic Church to stop nighttime chiming. [2] The sound reliefs show 12 hours of chiming of the New Cathedral in Linz.

Photo ©Katharina Anna Loidl

Introduction

How does sound look like as sculpture? At present, we are constantly surrounded and pervaded by a wide variety of sounds. We communicate with our environment by deciphering the meanings of these sounds and acting accordingly. We often associate sounds that we experience in different situations with certain memories and feelings. [[1]] Therefore, we pay particular attention to the sounds of everyday life and their repetitions. These sounds of everyday life are very important, and our goal is to find new ways of making these sounds tangible as sculptures.

At the center of the *Sound Shifting* project is the study and representation of everyday and characteristic sounds from an artistic perspective. In order to achieve sculptural results, various methods of making sound three-dimensional are tested - from rapid 3D printing (to test formal qualities) to traditional casting techniques (to preserve the sound sculptures for many years to come). The use of new rapid prototyping processes, such as 3D printing, offers new methods for implementing the sculptural qualities of sound.

Another focus of the *Sound Shifting* project is the current discussion about sound in public space as part of the neo-liberalization of our cities. The project aims to call attention to and discuss this topic through the physical representation of problematic sounds. (Figure 2) The poetic aspect of these works is that sound is made graspable and tangible in its most natural movement with techno-scientific precision.

Sound Shifting creates an awareness of the materiality of sound by showing it as sculptural collages from the traces of a medium that is fleeting and marginal. Sound is placed into a framework, and so its hidden essence unfolds a mystical transcendence by making its energetic impressions, its gravitations and its currents visible in space. These "sound blocks" (Gilles Deleuze & Félix Guattari) seem as organic as they are discreet, as mystical as they are futuristic, cryptic, yet equally simple and obvious. They show the inner tensions of the sound itself. You can see and grasp the (sound) shadows of the waves and experience the rhythm not as an impact, but as a point of the highest compression of a single flowing sound wave. The existence of sound is brought to light in these multi-sized sculptures and reveal a sonic materialism.

Related Work

From the 70s on, we have seen many approaches to representing sound or music visually. [3] Currently, there are a number of digital and analog processes for visualizing sound on screen. Less common methods try to represent sound as a physical object. Highly relevant research has already been done in the context of the physical representation of data. [6,7] The introduction of 3D printing technology has expanded the possibilities for experimenting with objects based on sound. Through the use of modeling software, sound models are generated and transformed into sculptures by 3D printing. An interesting project in the context of the physical representation of sound is *Microsonic Landscapes* [[4]] by the Mexican artist group Realität. They have visualized music albums and songs by famous bands such as Portishead or Einstürzende Neubauten as physical objects. Also, the artist Luke Jerram is working with this transformation process. On the basis of an audio recording of the Hiroshima atomic bomb explosion, he produced a sculpture by stereolithography. [5]

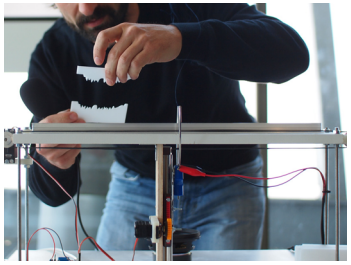


Figure 5: Live Demo @ Ars Electronica Center, Linz, 2016

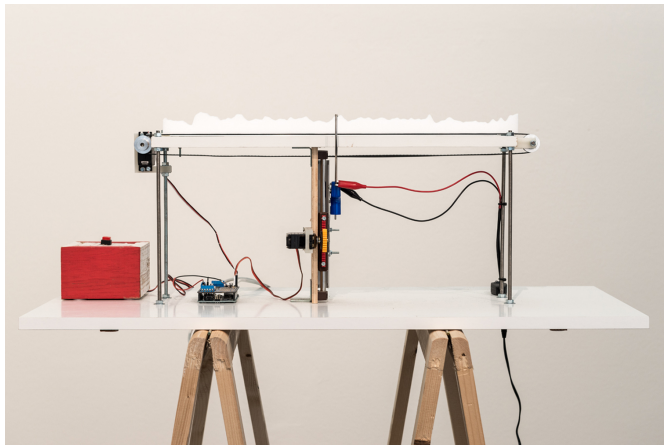


Figure 3: Audio Foam Cutter (2016); Photo ©Katharina Anna Loidl

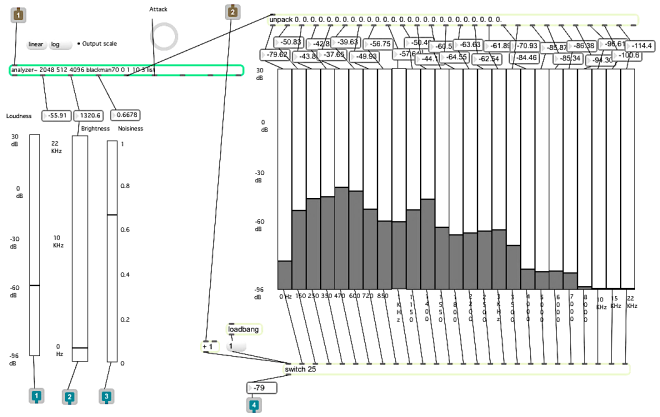
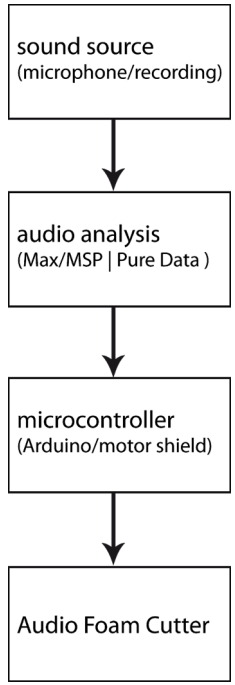


Figure 4: Screenshot of audio analysis software



The components of the system and the audio signal flow.

Implementation

The *Audio Foam Cutter* (AFC) transforms sound into polystyrene and other similar materials. The device consists of a hot-wire cutter mounted on a servomotor that is controlled by audio signals. This combination allows users to cut the sound input vertically and in real-time into the material as it is passed through the machine. The speed with which the material passes through the machines can be adjusted and is approximately one second per centimeter. The resulting cutouts are used to create casting molds for different-sized objects. Furthermore, the polystyrene stripes can stand alone as tiny sound sculptures. The software currently controlling the AFC and analyzing the audio signal has been programmed with Max/MSP.

AFC projects depict sound sculpturally through its wave troughs and heights, its traces and depths, its vibrations and pulsations. They divide the time of the music into timelines and stop the time of music by capturing and presenting it in sculpture. They break down the frequencies, the volumes and the harmonies and reassemble them in a cluster, in a sculptural track, in a physical spectrogram. Currently, we are working on prototypes to read out and play back the sound of these physical objects. For that, we are trying different approaches such as the use of lasers or RFID devices. Thus, in the end, the objects would become sculptural records that can be replayed again.

Video Link to AFC

https://vimeo.com/193745588

Figure 6: *Eisenbahnbrücke*, 2016

The Linz railway bridge was one of the three bridges across the Danube in Linz. In the summer of 2016, the bridge was demolished. The sound relief contains the characteristic sounds of this bridge.

Photo ©Katharina Anna Loidl

Figure 7: *Sound Barrier*, 2015

1. Sound: Record characteristic sounds. This is based on a research phase that investigates current topics of our auditory environment.

2. Analysis: The sound recordings are analyzed using a specially developed software, and the appropriate frequencies and volumes are adapted and calibrated for the cutting process.

3. Cutting: The AFC hot-wire cutting device enables real-time transformation of the sound tracks into polystyrene. The louder the sounds, the higher the cut amplitude.

4. Casting: The cast is carried out with ceramic casting powder or bronze. Finally, the polystyrene strips are removed from the mold and the relief is cleaned.

Presentation

In the exhibition setup, people are invited to interact with the AFC and transform their own voice into a small piece of polystyrene. Additionally, we present the work process and the resulting archive of transformations of sounds into small three-dimensional objects. (Figure 7)
We also hope that we can demonstrate the new machines for playing back the sounds cast in the objects. In summary, the exhibition demonstrates how invisible sonic phenomena can be represented sculpturally and help to overcome the widespread idea that sound is ephemeral and immaterial.
The project has been presented at numerous festivals and exhibitions, such as Ars Electronica, Linz; ADAF, Athens; LAB 30, Augsburg and Traklhaus in Salzburg.

Acknowledgements

We would like to thank the Kunstuniversität Linz for its support of this project, as well as the Linz Culture department.

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