Sound Spirals

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1. INTRODUCTION

Sound Spirals are part of an ongoing project attempting to interpret sound in a physical medium: sculpturally, mathematically, and irreversibly. They demonstrate different processes for creating data visualisations of recorded audio in the form of 3D printed sculptural art using open source programming tools and audio software (Processing and Audacity) and contemporary 3D printers including the MakerBot and Objet.

This practice-led project looks at returning the physical form to different sounds such as human voices, physical actions such as walking on gravel paths, and insect sounds in interesting and possibly even contradictory ways to provoke us to think about the process of creating, deconstructing, and then reconstructing elements of the soundscape around us. The main aesthetic of the spirals is one of proportionality, periodicity, and materiality, which are all intrinsic to the creation of sound waves. They are complex objects that are intended to be seen from a variety of angles and also, in some cases, to be in tactile exhibitions that highlight their materiality and physical texture.

The forms are intended to be indexical art and not iconic representations such as Edison Cylinders, in the same way that photographs are representative of reality but cannot be reverse engineered to re-create that reality (Alexenberg 2006:42).

2. VISUALISING SOUND DATA

People have been graphically representing waveforms for hundreds of years (Feaster 2012), but two notable modern practitioners are Thomas Edison with his wax cylinders of recorded sound that eventually evolved into modern day records and his predecessor Édouard-Léon Scott de Martinville who in the 1850s invented a machine

that recorded sound as pictures using a moving stylus and soot from a burning candle.

Many digital audio editing programs default to a fairly straightforward view of sound data, such as with Audacity (Figure 1). In this approach, data audio files (in the form of sound volume vs. time) are almost directly plotted onto the screen, with some perceptual scaling of the volume data to fit closer to how humans perceive it.

Figure 1: An audio recording of walking on stones visualised in Audacity

With this approach, a lot of important detail about the frequency makeup of the sound is hidden and requires further analysis to uncover, but if the scaling of the data is done skilfully, it arguably gives a viewer a sense of the periodicity of a sound and a sense of the material that is resonating. Proving that this is both possible and also compelling is one of the goals of creating these sculptures.

This project runs parallel to other practice-based investigations of embodying data as object such as “Data-Objects: Databronze” (Gwilt et al. 2013); Emoto, the sculptural visualisation of London 2012 Olympic tweets (Studio NAND 2012); Luke Jerram’s “Rings” and “Japanese Earthquake Sculpture” (Jerram 2005).

4. GENERATING THE SPIRALS

Bespoke software written using the Open Source programming environment Processing (Processing 2015) takes recorded sounds with personal significance to the artist and turns them into 3D visualisations, which are then 3D printed into physical objects in different materials such as metals and plastics. These objects have a direct mathematical relationship to the original sound and also represent artistic intent in the choosing of appropriately repetitive sounds, different mathematical formulae and attributes to visually represent them, and appropriate materials from which to construct the 3D forms.

The audio file is loaded into the software and the RMS (root-mean-square) volume is calculated at a specified time resolution that can be changed according to the user's preferences and then normalised to a range between 0 (no volume) and 1.0 (maximum volume). Vertices for an underlying 3D spiral mesh are generated and then the audio volumes are mapped to the length of the spiral and extruded across its length, filling in holes to make sure the geometry is closed and contained and can be exported as a single mesh for printing.

The viewer can preview the result by rotating it and scaling it in 3D, and modify the parameters as needed. When they are satisfied with the form, an STL file with the resulting 3D mesh is exported for printing on a 3D printer such as a Makerbot using Makerware.

For this artist, the criteria for a successful form were the intrinsic mapping of the periodicity and materiality of the sound source to a visual form.

Figure 2: A 20 second long sound of insect noises at night recorded in upstate New York, USA

Figure 3: A 25.66 second long sound of the artist walking on a metal bridge in London

Figure 4: Printing a spiral on a Makerbot

3. REFERENCES

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