Lotus Sound, A Hanging Sound Scroll

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Abstract.

This paper describes the production of an interactive mixed-media format that utilises a compact six channels sound system, synchronised lights and a proximity sensor. The artwork in question, entitled Lotus Sound, has been produced by the author during the Visual Research Network (VRN) residency in September 2018.

For the last few years I (the author) have been working with mixed-media formats that could be used for sound art and other multisensory interaction in gallery settings. The first analogy I took for research was the one of traditional paintings, mainly rectangular wooden framed artworks. This approach generated an extensive production of a mixed-media format I chose to call 'musical painting'.

In the musical painting format, loudspeakers were hidden behind a specific canvas material that allowed sound to pass through without frequency loss. While multichannel music is often displayed in a circular surround fashion, this media allowed spectators to perceive sound spatialisation in a two-dimensional frame. In this format, studies of up to eight channels were realised, using different sound spatialisation techniques. The external physical appearance is of a traditional painting, with no visible external wires (battery-powered) nor visible loudspeakers. The visual aspects were of various types—monochrome, LED lights, photography and printed digital art. A conference paper entitled 'Framing Spatial Music'[1] describes this work in further details. It was presented at the 2017 NWCDTP conference at the Royal Northern College of Music in Manchester and

[1] http://artlyra.com/iancostabile/art/docs/

at the Sounding Out the Space conference realised in Dublin by the DIT Conservatory of Music and Drama, Dublin School of Creative Arts and GradCAM. Examples of this work have also been on exhibitions in the UK.

The development of the musical paintings series reached a stage in which other forms of material explorations could be useful, especially considering transportation of this media to conferences and for facilitating storage. It was by observing East Asian hanging scrolls used for painting and calligraphy that the idea of developing a sound scroll came through. However, in comparison to the musical painting format, this would require an even more compact audio system and a wireless structure, since audio components would have to be rolled without damaging the components.

I applied to participate in the Visual Research Network (VRN), which hosted an artist residency (twelve artists) and conference for PhD candidates who had interest in cross-disciplinary visual research. The VRN organisers claimed that:

> In order to enrich visual practices toward new disciplinary horizons, we therefore advocate for a visual, sonic, experimental, and more widely multisensory cross-disciplinary knowledge.[2]

This seemed a good opportunity for developing a sonic project that would also consist of visual and interactive elements. Hearing that my application was successful, I began to research and prepare materials to take to the residency site.

Research in relation to materials for scrolls was initially conducted. Magnetic paper, which is mainly used for banner display in motor vehicles, seemed appealing for this project due to its non-crease properties, strength and finishing. Adding red hardwood bars to the top and bottom of this panel provided a frame where strings could be used for hanging purposes.

[2] https://www.visualresearchnetwork.com

Considering sound components, the initial idea was to apply very compact speaker drivers, essentially 1W micro speakers (also known as miniature or sugar cube speakers) which are commonly integrated to smartphone designs. An electronic amplification circuit was designed for testing these speakers, using the LM4890 amplifier. In addition, a design for enclosure (baffle) for adequate amplification was experimented through 3D printing (fig. 1). The results, however, were still not satisfactory due to low performance level. The design in smartphones present more complexity and their high-level achievement is also due to the phone's enclosure. Another approach was necessary, and thus I considered slightly larger speaker drivers. 1W 8ohms miniature speakers of 36mm diameter were selected for their clarity and higher performance level.

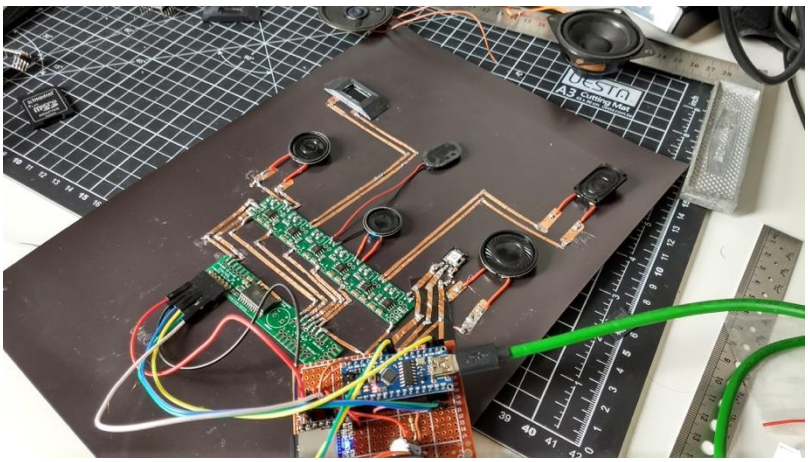

Figure 1: Testing circuits and speaker drivers

Two electronic circuits were designed for a thin PCB of 0.6mm and mainly SOIC package components. One circuit integrated six LM4890 amplifiers and the other a six-channel digital pot with control inputs and sound outputs. Control inputs could be connected to external wires and controlled by an Arduino. The sound outputs were directed to the six-channel amplifier circuit.

Other electronics selected for this project consisted of a proximity sensor (VL53L0X) and LED lights (WS2812b). It is important to highlight that all

connections were designed to be connected by copper tape, as wires were not an option since they could disconnect or be damaged when rolling the panel.

After material selection and circuit preparation, the production started at the VRN residency based in Brighouse, West Yorkshire. There were only five days for attaching all the components and copper tape to the panel. Considering that we had workshops every day and other activities, plus that the electronic circuit had to be programmed, time was limited. It was thanks to the voluntary help of other participants that the craft tasks were finalised on time. In addition, field recordings from the canals in Brighouse were selected for the artwork's sound material.

The art concept was decided during the residency, the idea of representing a lotus flower in the water in rotary movement. The sound spatilisation of six channels supported this idea. An interactive sensor was attached near the central light, so when users approached their hands the sound of splashing water would emerge, making the water sounds spin faster between the speakers (BPM increase) and lights change colours (fig. 2).

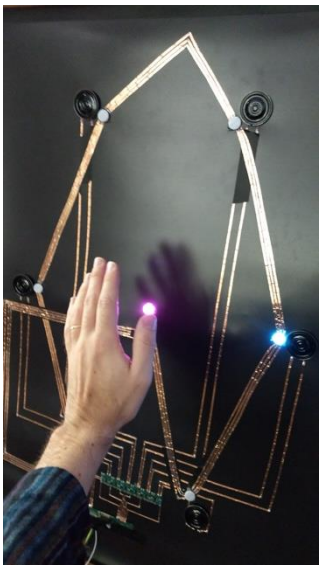

Figure 2: Hand gesture interaction

The result was exhibited at the VRN conference at the University of Manchester, on the 26th and 27th of September 2018 (fig. 3). Although the artwork was finalised, further changes are necessary to improve its performance. The sound levels are still not ideal and further experimentation with higher amplification must be approached. Other visual aspects could be modified for a more attractive finishing, such as painting the speaker drivers in another colour, allowing them to stand out in order to highlight the sound aspects of the piece. Overall, there is still room for improvement, but the experiment exhibited considerable potential for a new exhibition format which displays a sound panel where all integrated electronics can be clearly observed. In addition, aspects of transport and storage are simplified through this new format.

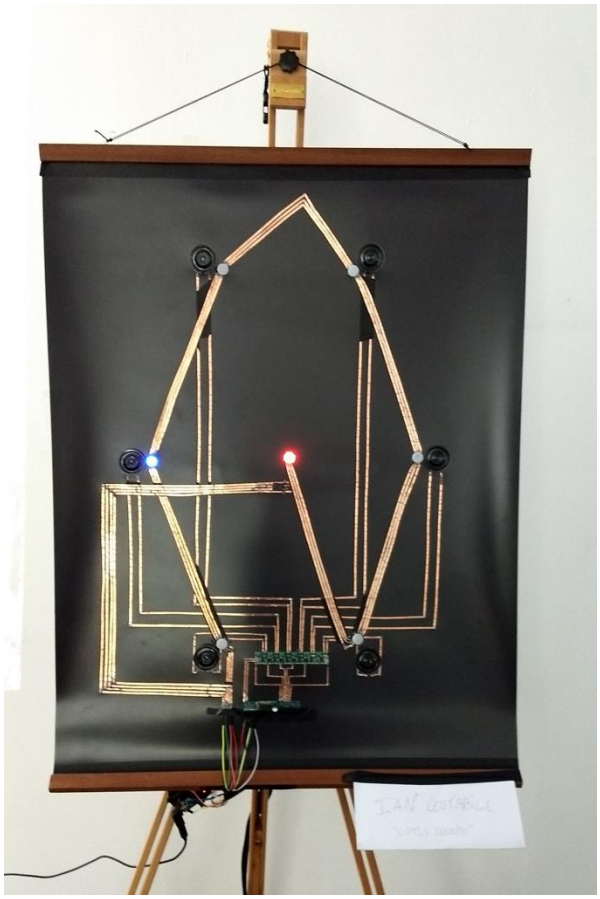

Figure 3: Lotus Sound on display at the VRN Conference 2018