

ISEA2024 Artist Talk: Vectorscape

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Abstract

Vector Synthesis has emerged as a prominent and effective creative medium for communicating audio and visual correspondence as a unified experience. It is a form of simultaneous sound and vision generation whereby a discrete stereo sound signal is developed to form the x and y axes on a visual Cartesian plane. Interestingly, the images appear based on phase and frequency relationships across the stereo field. Therefore the moving image presents snapshots of the sound generation based on multiple temporal perspectives. The medium, however, currently does not adequately visually reflect the way sound behaves in acoustic spaces. My research therefore investigates whether a form of audiovisual synthesis could be developed that will allow a more intelligible understanding of the intricacies of sonic experience. I will consider modes of extending the Vector Synthesis form through utilising Cymatics as a reference as well as through innovative technological approaches. This practice led research must consider significant works in the medium as well as the nature of perception. Human-machine compositional approaches will be discussed and create a framework by which the potential of this synergistic collaboration can be evaluated. This research is therefore increasingly relevant with the emergence and prevalence of machine-learning in creative works. This artist talk will include a presentation of iterative works completed by the artist.

Keywords

Vector Synthesis, Audio-visual, Sound Visualisation, Oscilloscope, Waveshape, Cartesian Plane, Technological Synergy, Interactive Composition, Three-dimensionality, Laser

Introduction

Technological processes where sound and vision can be generated from the same source have enabled the establishment of a fertile area of creative investigation as well as a rich cultural phenomenon at the heart of contemporary electronic art. In terms of there being a clear, observable and reproducible one-to-one relationship between sound and vision there is one key method that has emerged and is used by numerous practitioners to develop stimulating and provocative works since its original inception. Vector Synthesis, as termed by Derek Holzer, equally prioritises the development of visible patterns as much as sound/music. This is the form that I propose to extend based on the potential of hybridised visualisation techniques and acoustic rendering considerations.

Observation of Phenomena

Jules Antoine Lissajous' research in 1857 facilitated shapes determined from sound sources through a process whereby a beam of light was bounced off mirrors attached to successive tuning forks designed to vibrate at certain ratios to each other. One tuning fork developed the horizontal (x) axis and another developed the vertical (y) axis. This determined the mathematical figures that we classify by the scientist's name.

phase frequency ratio	0 °	45 °	90 °	135 °	180 °
1 : 1					
1 : 2					
1 : 3					
2 : 3					

Figure 1. Derek Holzer, Lissajous Figures. 2019

Practitioners have further developed this process in the electronic realm. Instead of tuning forks, the voltage that would be sent to the left speaker and right speaker in a stereo field are drawn with an oscilloscope to make up the x and y axes of a graphical visualisation respectively.

What was once merely a diagnostic test to determine phase relationships between two sources, has become the catalyst to creatively develop an innumerable galaxy of forms.

In a parallel discipline, the father of acoustics, Ernst Chladni, developed geometric forms from vibrations in 1787. Chladni created shapes by vibrating sand laden plates with a violin bow, witnessing that "the grains of sand are repelled by the vibrations of the vibrating parts and accumulate on the nodal lines". [1] Furthermore he notes that "vibrating sections separated by a nodal line always vibrate in opposite directions". [2] His research went on to develop frequency ratios by which certain forms are developed. Hans Jenny later named this approach Cymatics, meaning "matters pertaining to waves." [3]

Hans Jenny's A Study of Wave Phenomena and Vibration (1974) gives a thorough exposition of this research, describing in intimate detail the movement of particles and solutions in response to sound frequencies. This publication follows Hans Jenny's methods in empirical experiments, observations as well as discussion of the implications of this study. Here he discusses this mode of pattern observation as a means to uncover the periodic basis of our reality. Only by "getting inside the phenomena through empirical and systematic research", he writes, "can we gradually elicit systems in such a way that mental constructs can be created which will throw a light on the ultimate realities." [4] He presents an idea of the universal nature of periodicity from germs (microcosm) to the solar system (macrocosm). It is worth noting that Chladni's forms are known to be related to Schrödinger's solution for finding the orbits of single-atom electrons in the field of quantum mechanics. The mathematics describing Chladni's nodal patterns is specifically referenced by the physicist.

Personal Discovery

After experimenting with sending signals directly into the composite input of analogue televisions to generate sound reactive patterns, I learnt about rewiring the actual mechanism of cathode ray tube televisions (a process which is extremely dangerous due to the residual charge held in the capacitors of CRT televisions - even when disconnected from mains power). With this method I ultimately created a rudimentary oscilloscope, a device for visualising voltage and current originally for electronic component diagnostic purposes. Using this device enabled more sophisticated articulation, creating intelligible shapes clearly corresponding to the audible material. Further research has revealed the extensive history of this phenomenon and significant breadth of creative works utilising this particular display method. Composing for both audio and vision simultaneously became the impetus for developing expansive generative systems. In this scenario the generation of the work is reliant on a complex web of interactions across different formats and technologies. This form of working with self generating automation forms an important aspect of my work.

Community of Practice

As part of this talk I will discuss the community of practice from artists that helped form this creative approach to pioneering contemporary artists working in this field. This includes New York based video artists Steina & Woody Vasulka, known for developing a distinct process utilising scan processing, to Robert Henke, in his Lumière series utilising laser display technologies, as well as Carsten Nicolai's work including his curious collaboration with Ryoji Ikeda in *cyclo.id* (2011). Finally I will discuss the groundbreaking work of Australian audio-visual artist and mentor, Robin Fox, from his oscilloscope work in *Backscatter* (2004) to his iterative laser works.

Extension of Vector Synthesis Process

I have developed a series of works using iterative systems specifically designed for this medium. These incorporate digital and analogue synthesis where signal phase can be freely manipulated as well as a real-time performance based sampler. Simultaneously, the visual component is prototyped in node based visual programming language, Touchdesigner. Notably, particle physics modelling has been implemented as an overlay to vector based synthesis, in *Vectorparticle* (2023), to give the impression of three-dimensionality. Furthermore, a distinct system using laser projectors to articulate both light and sound from the same underlying data has been established. A system is currently being developed that creates a composite visualisation and interaction between laser and video projections. The merits of these systems and outcomes in relation to the intentions of the research will be considered and analysed against other artists working in the same fertile area. Particularly, the work focuses on compositional approaches involving machine collaboration and hence discusses the field of Cybernetics. Through investigational rigour, the aspiration is that this work will initiate a unique development for this field.

Links to Artist's Relevant Video Works

Vectorscape I (2022)

<https://vimeo.com/650926563>

[5 minutes, 51 seconds]

Vectorscape II (2022)

<https://vimeo.com/765163399>

[6 minutes, 2 seconds]

Vectorparticle (2023)

<https://vimeo.com/834381660>

[9 minutes, 20 seconds]

Author Biography

Vijay Thillaimuthu is an electronic composer/performer and audio-visual artist of Tamil Sri Lankan heritage informed by the rich history of analogue sound synthesis and electromagnetic phenomena. Often performing under the moniker Xenosine, he creates unique immersive environments that can be experienced across different sensual distinctions based on synergistic approaches with technology. This is largely enabled through the open ended architecture of modular synthesisers and visual programming languages.

Vijay has collaborated with Robin Fox and performed alongside Suzanne Ciani, Keith Fullerton Whitman, Richard Devine, AtomTM and Dasha Rush. Amongst a range of diverse outcomes, Vijay Thillaimuthu has presented work for Unsound, the Melbourne International Film Festival, Liquid Architecture, Red Bull Music Festival, The Banff Centre - Canada, Subliminal Impulse - Manchester and the Tokyo Festival of Modular. Vijay currently works at the Melbourne Electronic Sound Studio and is a PhD candidate and educator in interactive composition at the University of Melbourne.

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