

Xander Munc
Independent Project Proposal
Degree Project

The Physics of Light and Sound

I want to explore the science of light and sound. My projects will focus on creating educational and interactive tools and resources on the science and physics of light waves and sound waves. I want to develop educational tools to explore and define the characteristics of these waves, how they relate to each other, our perception of them, and their role in art. I also hope to explore the topics that connect light and sound to find a compelling throughline to carry the viewers through the work, focusing on the sequencing, refined presentation, and interactivity of the topics. I want to explore the math, the ways we organize and categorize the ideas of light and sound (the color wheel, circle of fifths, etc.), and the topics that connect and affect them (circles, time, gravity, space, medium, symbol, association).

Some questions I hope to explore are: the equations of light and sound waves (spatial and temporal), superposition, radio waves, neutron stars, gravities effect on light, light in black holes, the event horizon, Sagittarius A*, energy waves, light speed, light in space (from gas bodies), gravitational waves, LIGO and Virgo detectors, the Stellar Graveyard, gravity and parabolas, time and waves, time and the variable 't', escape velocity, the region of no escape, the flow of time around black holes, the perspective of time in the event horizon, star collapse, the quantum wave function (in its mathematical form, probability interpretation, the Schrodinger equation, and wave-particle duality), the electric field, photons (real part, imaginary part, and probability), density, circles as a throughline, the Penrose diagram, light and sound through mediums, the notation of light, Chlandi plate visualization, how animals perception of light and sound differs, the language around light and sound (harmony, complimentary [colors, scales, etc.], the use of circles), and association.

Some media I want to explore and have already started or previously read to help answer these questions are: *The Order of Time*, Carlo Rovelli, *Helgoland*, Carlo Rovelli, *Black Holes: The Key to Understanding the Universe*, Brian Cox & Jeff Forshaw, *Sing Like Fish: How Sound Rules Life Under Water*, Amorina Kingdon, *Waves in an Impossible Sea: How Everyday Life Emerges From The Cosmic Ocean*, Matt Strassler, *Ways of Being: Animals, Plants, Machines: The Search for a Planetary Intelligence*, James Bridle, the exhibition *Mathematica: A World of Numbers... and Beyond*, by Charles and Ray Eames, *The Elements of Typographic Style*, Robert Bringhurst, Cem Yuksel's Youtube videos on signal processing, point light attenuation, and color, and the podcast Twenty Thousand Hertz episode *Sound 101 with Bill Nye*.

A professional in the field of color, who is outside the major as well as outside the realm of graphic design, is head of painting and foundations professor at MECA&D, Philip Brou. I have reached out to Philip to explain my thesis and the roles of a mentor and asked him to be

my mentor on this project, he confirmed that he would be happy to. The reason I hoped he would be interested in this topic is because of his interest and spirit in color, its physical medium, and history. His perspective as a painter is very different from that of a graphic designer, and a perspective as strong as his, from outside the major, will hopefully lead me in directions I do not already expect. I am excited to have him as an experienced pair of eyes and mind on my work.

The four projects I would like to start at and explore are: Jan 30 **Glossary of Waves**, an interactive webpage acting as a resource for digesting the introductory content and throughline concepts to take through the projects (a refined version of my previous project). February 17th: **Interactive Installation Code Exhibition**, at least one well-coded, interactive installation to learn about a more specific quality of light and sound through the act of moving your body in space. March 6th: **Interactive Poster Series and printouts** for specific educational content that does not require a digital medium. Exploring ways of making print content interactive beyond just the turning of a page. March 27th: **Visualization and Animation**, a final conclusion project, to tie a bow on the sequencing of information. This could be a summary of the previous topics presented in an animated format or a final topic to conclude the information. Additional projects I have been thinking about are **Frequency and Wavelength Dice**, 12-sided wooden dice with the 12 colors of the color wheel and 12 tones of the circle of fifths, organized in 3-dimensional space, with their frequencies and wavelengths notated, to act as a learning tool for the similarities of the organization of light and sound. **A Light Notation System**, a system of notation for the wavelengths of light, similar to musical notation, explores how light might be “played” and emphasizes a difference in the way we use light and sound in art. **Chlandi Plate (?)**, a final idea for a project that could be animated, printed, or coded, is information about the Chlandi Plate experiment and how sound creates visual form as light creates color. This leads to the question of what light produces in an auditory world if anything, and continues the throughline of circles as a theme. I am happy to see any and all of these projects change as my understanding of the content evolves.