Computational Sound with ShaderToy

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Description

This workshop will cover the physics of sound, and how to generate soundscapes through mathematics. Using concepts similar to those used to create shader visuals we are going to create audio with ShaderToy.

We will begin with creating simple noises, and ultimately build up to an additive synthesizer that can be used to create a complex soundscape.

Learning Objectives

- Demonstrate a basic understanding of generative sound
- Demonstrate an understanding of the physics of sound
- Understand similarities between writing code for shaders and computational sound

Questions

What is the period of a sine function?

- 2 * PI

What is a "concert pitch"?

- A4, or 440 Hz

What is an octave?

- A range of frequencies where the high end of the range is double that of the beginning.

What is a semitone?

- The smallest tonal increment in western music.

How many semitones/notes in an octave?

- There are 12 semitones and 8 notes in a frequency.

How can we change the pitch of a tone?

- By increasing the frequency of the wave.

Minutes	Content
0-10	Discuss questions, and establish fundamentals for lesson.
10-20	Go over ShaderToy interface, and create a tone using the Sine function
20-30	Create a function to use pitch notation to manipulate frequency, and go over the mathematics behind semitones. Using the new function, play a chord
30-40	Using the “time” variable, change the pitch over time, Add waves together to create a complex sound Bring everything together to create a repeating pattern
Floating 10	For questions, and play

Bring:

- Headphones
- Computer that can connect to the internet

Links:

- Example: https://www.shadertoy.com/view/4I2BW3
- Project Link: https://www.shadertoy.com/view/WIyXD3
- Graph Toy: https://www.iquilezles.org/apps/graphtoy/
- Sticker Sheet: http://paste.dy.fi/ZGH
- Inspiration + more info: http://www.graffathon.fi/2016/presentations/additive_slides.pdf
- Inspiration + more info: http://compform.net/music/

This is great for understanding the Fast Fourier Transform:
Three Blue One Brown Fast Fourier Transform