Implementation of OpenGL and GLSL Visualization

Mrs. Potts divides the audio file into three discrete data sets: beat, pitch, and volume. The extracted data set will be put into a C++ code that uses OpenGL and GLSL shader to visualize a teapot that changes in shade, size, and coloring. In order to do so, the code first checks the validity of the input file and values are each loaded into float vector that stores either timestamp of the beat or value of volume or pitch. The sampled time units (how many frames were sampled in 1 sec) for volume and pitch are hard coded. The two clock variables, 'start' and 'end,' calculates how much seconds elapsed from the start of this program. This allows the program to identify which volume, beat, pitch value to reference at that moment.

Beat - Pulse

Beat, the base accent in the music, is represented in pulse movement of the teapot. This is achieved by making the size of the teapot bigger with beat, and retracting back to original size (shown in the figure below: top left vs. bottom left). Using the time measurement, the enlargement of the teapot is gradually achieved but the reverting is done rapidly, making more pulse like behavior. At the beat, teapot gets up to 1.4 times of its original size, within 0.1 seconds. This is implemented through multiplying a scaling factor to x, y, z position in vertex shader.

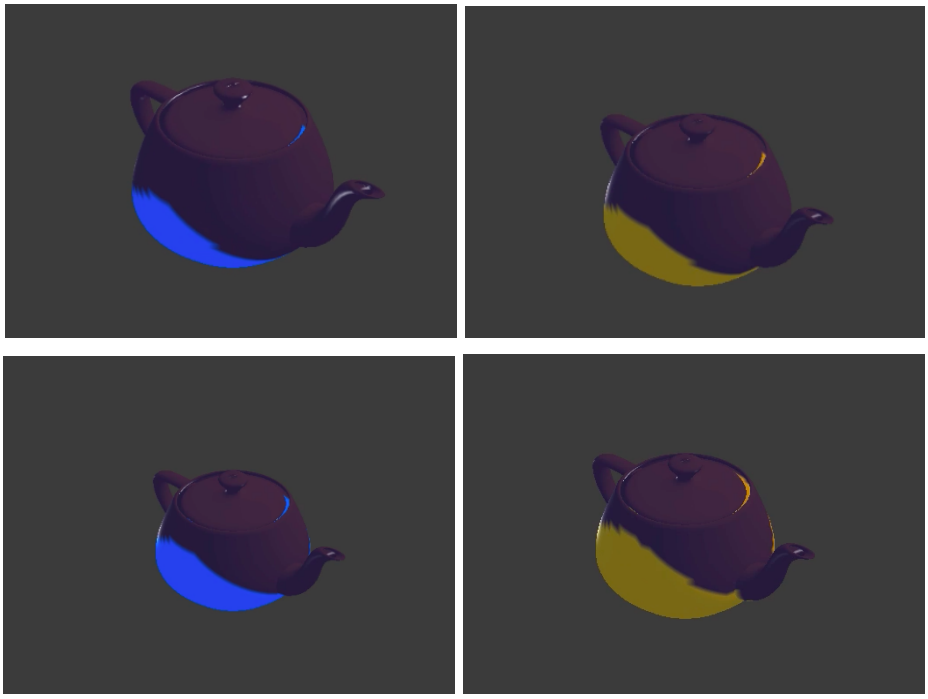
Pitch - Color Shade

Pitch is represented by 12 different colors, each covering equal width of window in C scale spectrum; A, A#, B, B#, C, C#…(shown in the figure below: top left vs. top right). The rgb value of each scale is hardcoded in vertex shader in function name `get_pitch_color(float pitch)`, which takes in the pitch value and output a vector with three fields, which represents rgb values of that color.

The used color scheme is inspired by Apple's rainbow color scheme, and it is used in order so that notes that are closer has similar color than notes that are further. For example, color of A and A# are far more similar than color of A and E.

Volume - Colored Area

Volume is represented by the z axis height of the sine wave, and the pixels with lower z value than the calculated z axis height will be colored according to the shade decided by current pitch. For example, if the volume is 0.5, then approximately only half bottom of the teapot is colored. If volume is 0.75, then approximately 75% of the teapot will be colored as the pitch color shade (shown in the figure below: top right vs. bottom right). Since z axis height difference is much more continuous compared to pulsing or using different shade of color, volume, which has much more dynamic change than beat or pitch, is well visualized using a bit jagged sine wave fluctuation.



Top Left: C, **on beat**, mid volume
Top Right: **D**, not on beat, mid volume
Bottom Left: C, not on beat, mid volume
Bottom Right: D, not on beat, **high volume**