MAT 201B
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Audio-Responsive Visual Performance Instrument, from Max to Allolib visuals

The goal of this final project was to create a program that, communicating from Max to Allolib, would generate visuals based on some utilization of audio parameters. These visuals would be generated by converting the pixels of images into points in a mesh, and then making further transformations upon those meshes (changing the images, interpolating between meshes, displacing the points of the mesh, moving the points of the mesh into color structures, etc.); essentially an extreme extension of the concepts of in Assignment 1 of this course.

Much like my last project in MAT 240A, this project sequences its audio data from an FFT analysis, which outputs the volume data from a set of 10 frequency bands; however, unlike my last project, this project is intended to have actual user interactivity control aspects of the visual generation; rather than just leaving the program be and watching the generated visuals unfold. In order to accomplish this, I divided my program into 3 distinct "modes," each of which having their own parameters (some "unique," or exclusive to that mode only, others universal) and offering different visual features, which the performer can change from at will. Each mode is essentially a complex visual algorithm that specializes in some unique aspect of the visual generation: Mode 1 generates random images & meshes from onset data, Mode 2 displaces the points on the z-axis depending on their individual brightness (luminance) values, and Mode 3 manipulates the interpolation factor between meshes transforming into one another. As stated before, each of these modes has a plethora of their own unique (or universal) parameters, that the performer is free to explore and modify at their own will. "Mode 0" will turn off all automation settings, and leave the performer to manually hit buttons or change parameters without the aid of the automatic features of a mode.

The advantage of an automatic mode is that the performer can set up the parameters they like (that they think fits the sonic aesthetic) and then don't need to control any additional parameters that isn't already being automated by the mode. If they do want to modify additional parameters, I've found that hitting some of the universal buttons "Random Image & Mesh," "Random Mesh," or "Random Image" to emphasize major moments, or "Random" from Mode 3 to emphasize minor moments. Or, if the music is increasing in speed or energy, increasing the "Manual" from Mode 3, while in either modes 3 or 1, works really well; as the interpolation between meshes will become much faster, and they will "explode" quickly from one to the next (some of the parameters will have animated function even if Mode 0 is activated, like "Manual" or "Random" Image Interpolation; some parameters under a mode are not exclusive to that mode). Of course, while the program is operating under a mode, some of these buttons will be triggered algorithmically according to the underlying code I've set; but having the eye of the performer involved definitely makes for more interesting visuals and responses.

Mode 1: Low-Bass Onset Image Change

This mode is quite simple in its usage, but is very effective on occasion; it assesses the "Low-Bass" frequency range (60-120 Hz) for onsets, and bangs a random Image & Mesh on onset. This mode is very useful for tracking the onset of a kick drum, and provides more usefulness than assessing the Low Bass frequency in Mode 3, because the performer can easily switch between the two (for emphasis on particular moments) and the visuals will look transition seamlessly. The "Random Mesh" and "Random Image" buttons do exactly as they say; they each change that exclusive parameter of the ongoing visual, and are not exclusive to just Mode 1, despite being under its category.

Mode 2: Point Brightness Z-Displacement

This mode displaces the pixels in accordance with their brightness data (brighter pixels are more displaced), and according to continuous frequency data being fed from the FFT analysis (a higher volume in the data will displace the pixels more, a lower volume less, and this value is continuous so the pixels will jump and move in response to the volume of that particular frequency band). The performer can change which frequency band to receive data using the Frequency Displacement Range. Options for changing other aspects of this Mode lie in the "Multiplier" and "Intensity" sliders; the Multiplier changing the maximum height of the displacement, and the Intensity changing the "sharpness" of the displacement (for whatever reason, intensity higher than 5.0 has been very glitchy). Slide X and Slide Y determine the speed at which the displaced points "rise" (Slide X) and "fall" (Slide Y). Hitting any of the circular "toggle" switched will reset those parameters to their default values. The "Random Image: No Interpolation, No Mesh Type) is useful for Mode 2 because it keeps the interpolation at 0; the images remain static. However, the user is open to having interpolation while displacement is being done (but it hasn't shown to be effective).

Mode 3: Image Interpolation

This modes manipulates the interpolation factor between meshes; when one mesh is activated following a previous mesh, they will continuously "interpolate" and move between each other. When this mode is activated, meshes will receive random interpolation values according to onsets within the frequency band determined by the Frequency Onset Range slider. The "Chance of Onset" modifies how frequently onsets from that frequency range are read; the lower value denotes a Higher chance of onsets, and vice versa. After a certain number of onsets are detected in that frequency band, the mode will then change the image and mesh; and the probability for this to occur can be modified under "Image Change Probability," which again, the lower value denotes a higher change of image change, and vice versa. The "Random" button will set a random interpolation value to the mesh, and the "Onset" button will count as an onset within the "Image Change Probability;" essentially doing the same thing as "Random" but with the potential to change the image upon pressing. The most useful parameter here is the "Manual" interpolation, which will change the actual interpolation value between meshes (higher value is more interpolation, lower is less). The user must enable Manual interpolation by clicking the square toggle next to its parameter; and if they would like to reset its value, they can do so by clicking one of the two buttons on its right: the left button resets to 0., the right resets to 0.05, the interpolation's default value.