Musical Connections and Heterophonic Maps

Brian Evans
University of Alabama
brian.evans@ua.edu

1 Introduction

Maps are metaphors. Metaphors are building blocks in the construction of knowledge. They are the bridges we use to connect novelty or new experience to what we already know. We call this connection learning. When we learn, we successfully match (map) patterns received through our senses to patterns already stored in our memory.

In my work I explore the process of mapmaking. Specifically I make digital maps that connect image and audio, bridging sight and sound. It is possible to go in either direction, but once sound is introduced into a mapping process, time is too. For example I can map the frequency ratios that we recognize as Beethoven's *Ode to Joy* into a trigonometric formula and then visualize the formula. It is necessary to incorporate the rhythmic dimension of the tune (the duration and temporal placement of each note) into the phase component of a sine function in order to see the tune as a static image. Time maps into space. See Figure 1.

A musical score, when performed, works in reverse—a still image is made into sound—space mapped into time. In creating a sound score from an animation, one approach is to track individual location points on the picture plane to make a score of notes, each point is a separate voice, each new value at that location is mapped into sonic dimensions such as pitch. [Evans 1989] Another approach, the one I explore here, is to make a score from a time slice—a 2D still image reduction of an animation.

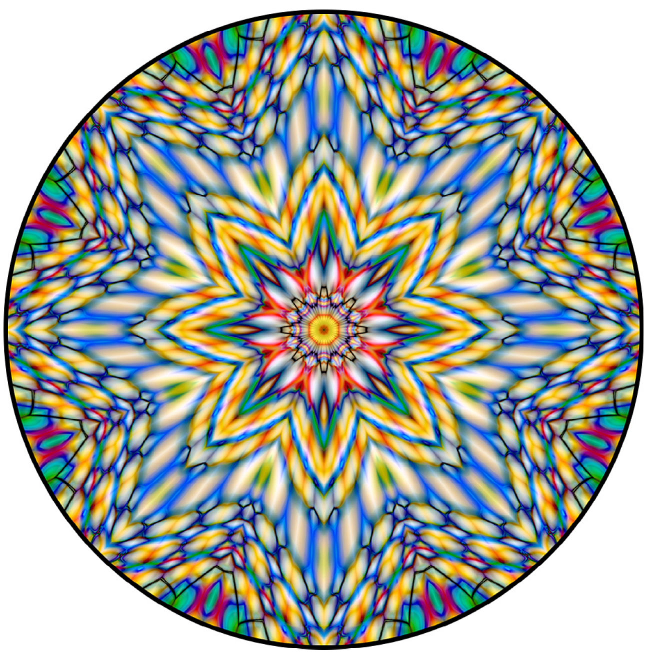

Figure 1: *Ode to Joy* visualized as a still image.

2 Time Slice as Musical Score

In creating the sound score for my animation *calidri* I started by making a time slice. A time slice is a static image built by extracting a single line from each frame of the animation and stacking these lines sequentially. Figure 2 shows a representation of an animation as a series of rectangular frames with time represented as depth. The time slice is constructed as a 2D cut through the time axis. Placing these scanlines on a single image, one after the other, gives a picture of the evolution of the animation on that line. With time represented on the x-axis, this image is in a form similar to the visual representation of dynamic audio spectra often called a sonograph.

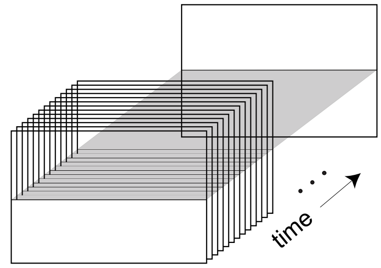

Figure 2: Time slice through a scanline of a series of frames.

Through an inverse Fourier transform the sonograph can become sound. The image data is mapped into audio data. The image becomes a music score and the composer "performs" the score by making choices in the mapping process. (The sonic maps for *calidri* were created using U & I Software's *Metasynth* music synthesis software.)

3 Mixing Heterophony

The Oxford English Dictionary defines heterophony as the "simultaneous performance by two or more singers or instrumentalists of different versions of the same melody." I use data mapping and time slices to create heterophonic music scores for my animations.

The base time slice for *calidri* is seen in Figure 3. I created several unique sonifications or sonic maps of the time slice using a variety of mapping approaches and audio synthesis techniques. The sonic maps were made equal in duration to the animation. Each sonification became a single track or voice in a multi-voiced heterophonic texture. The voices were mixed together, output as an individual audio file, and combined with the animation frames to create a completed work.

In this approach correlation between image and audio is assured. We hear and see aspects of an abstract process unfold. (The process is a simple mathematical one, so in truth it too is a metaphor. I map maps.) Sound and image are bridged, a connection made, each a metaphor for the other. Inside the brain image and sound cohere. They contextualize each other. We hear the colors. We listen with our eyes.

4 References

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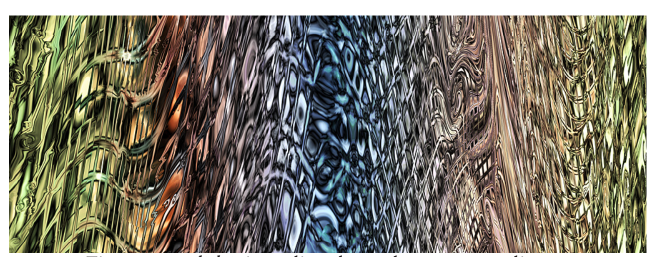

Figure 3: *calidri* time slice through center scanline

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