

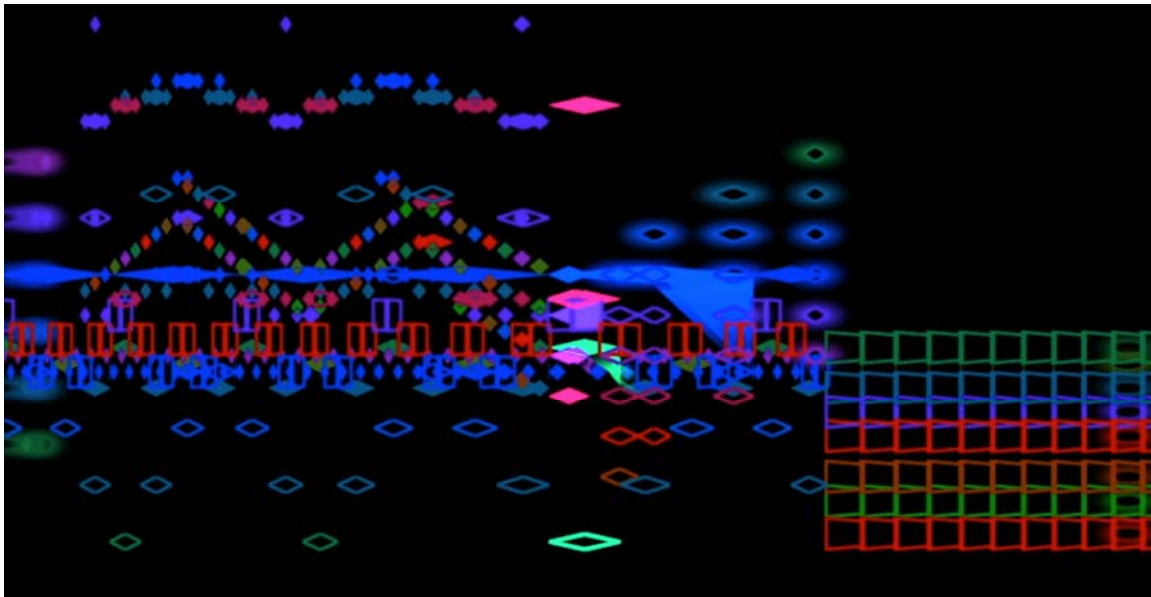
# *The Rite of Spring*

## Animated Graphical Score Video (Stephen Malinowski, Jay Bacal) Development Notes

### 1. Getting Started

To achieve synchronization between an audio recording and an animated graphical score, my first videos were based on recordings that were either generated synthetically or recorded from an instrument that produced both audio and computer-readable (MIDI—Musical Instrument Digital Interface) data. In 2009, however, I developed a method for synchronizing MIDI data with preexisting audio recordings, which meant that I was finally able to make videos of orchestral music.

In 2010 I began a collaboration with violinist, conductor and entrepreneur Etienne Abelin which included plans for a version of my software that could be used in live performance. In 2012, as the live-performance system was being developed, I started thinking about the possibility of a live performance of *The Rite of Spring*. I began entering various passages from Stravinsky's score into the computer to see what a visualization might look like. Samples like this ...

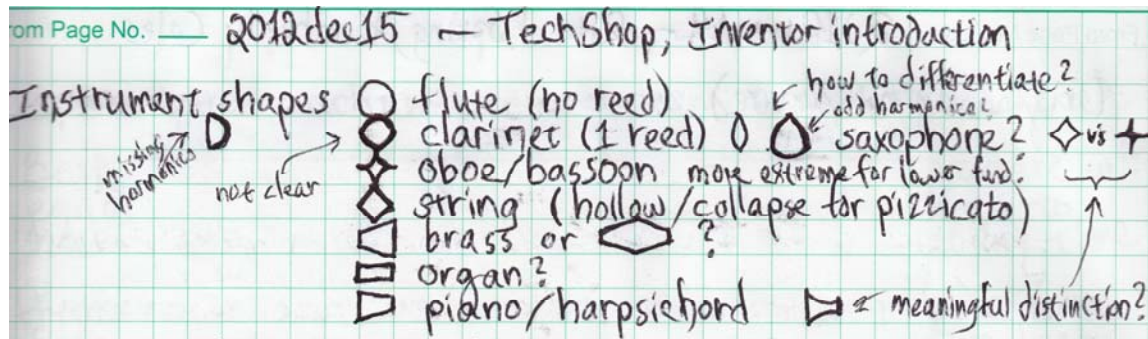


... suggested that the piece had potential, and I began looking for orchestras I might collaborate with. This led nowhere, and by the time the end of the year was approaching, I'd abandoned the idea of doing a live performance, and had begun focusing instead on doing a video. For that, I needed a recording, and I started looking for one that was available to license. No luck there, either—until about mid-December, when I learned that Jay Bacal, a master at making synthetic recordings of orchestral music, had done a wonderful rendition of *The Rite*. I contacted him, and he graciously gave me permission to use his work. Yay!

## 2. Too many parts!

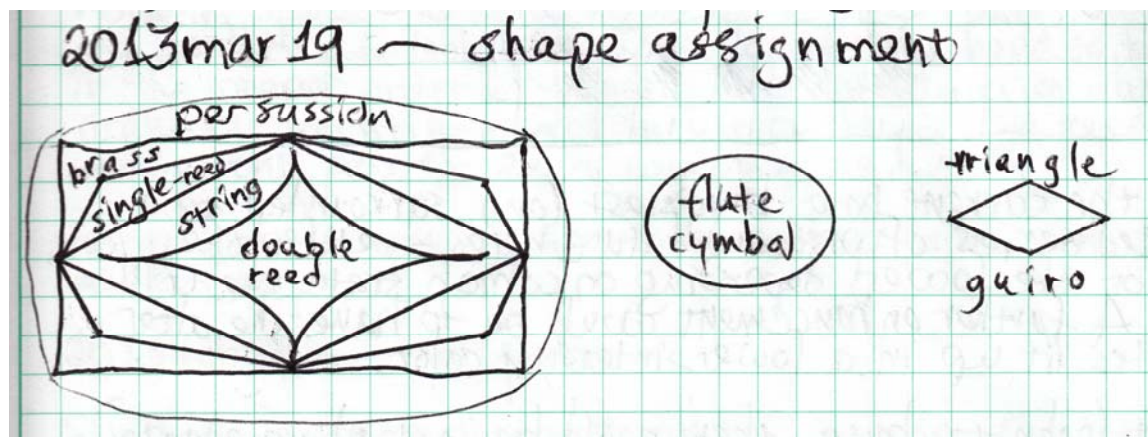
Stravinsky's *Rite* had by far the most complex orchestration of any piece I'd attempted: the score includes 86 separate instrumental parts, many using special effects (pizzicato, tremolo, flutter-tongue, harmonics, etc.) which are scored and notated separately in my graphical score, resulting in nearly 200 parts to be presented visually. The biggest piece I'd done previously was Beethoven 9th symphony which had only 33 parts (including 8 vocal parts). A major technical challenge, then, was to differentiate the instruments, even when many were playing together—and not just simultaneously, but at the same pitch.

My notebook from December 15, 2012 shows my first sketch of the idea I had for this ...



... in which the instrumental groups were distinguished by shape.

A later sketch shows the final solution ...



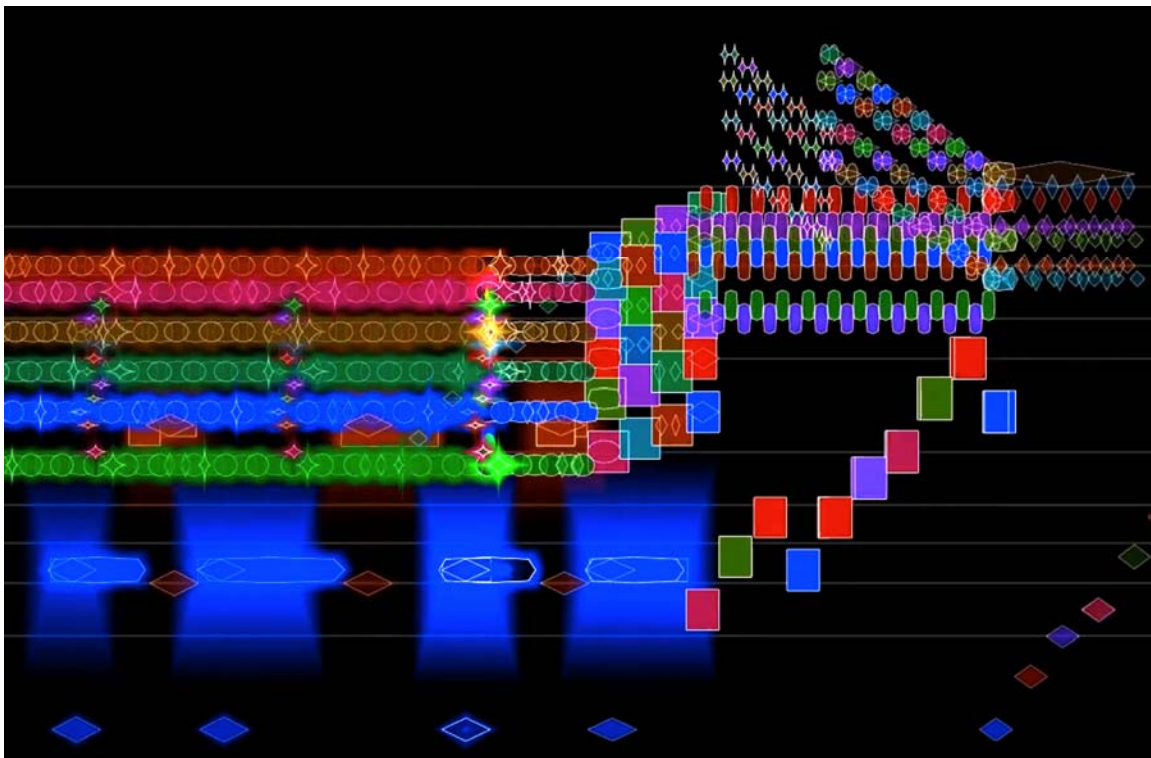
... which involves *nesting* shapes. By drawing the instruments from back to front (and from bigger to smaller), and using some graphics techniques to improve visibility (like outlining, transparency, and blurring), as many as six instruments could be playing the same pitch at the same time and still be distinguished.

Because percussion instruments are more *spectrally diffuse* (their pitches are not as well-defined), I chose to depict them with a blurred, cloud-like shape.

The final shape/instrument assignment ended up being like this ...

shape	continuous	pitched percussion	unpitched percussion
rectangle	vibrating skin (brass)	timpani	bass drum
octagon	single reed (clarinet, bass clarinet)		
ellipse	no reed (piccolo, flute, alto flute)	antique cymbals	cymbals, tam-tam, tambourine
rhombus	bowed string (violin, viola, violoncello, contrabass)		guiro, triangle
star	double reed (oboe, English horn, bassoon, contra-bassoon)		

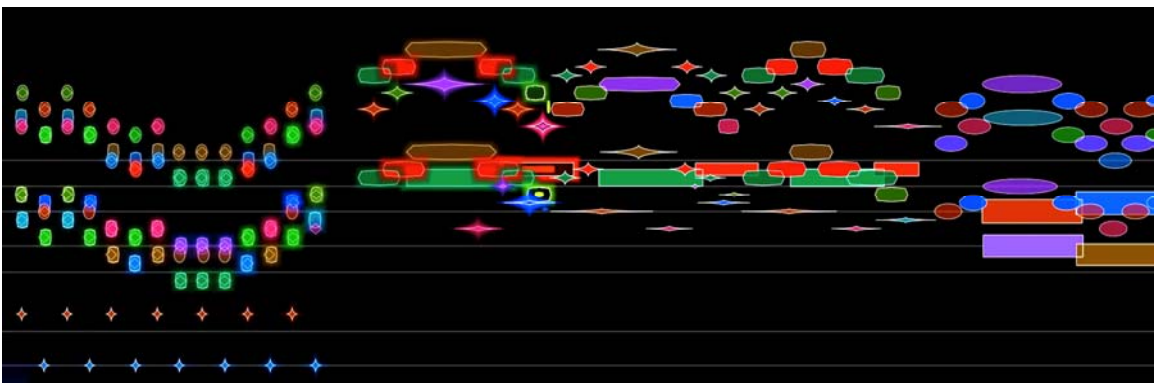
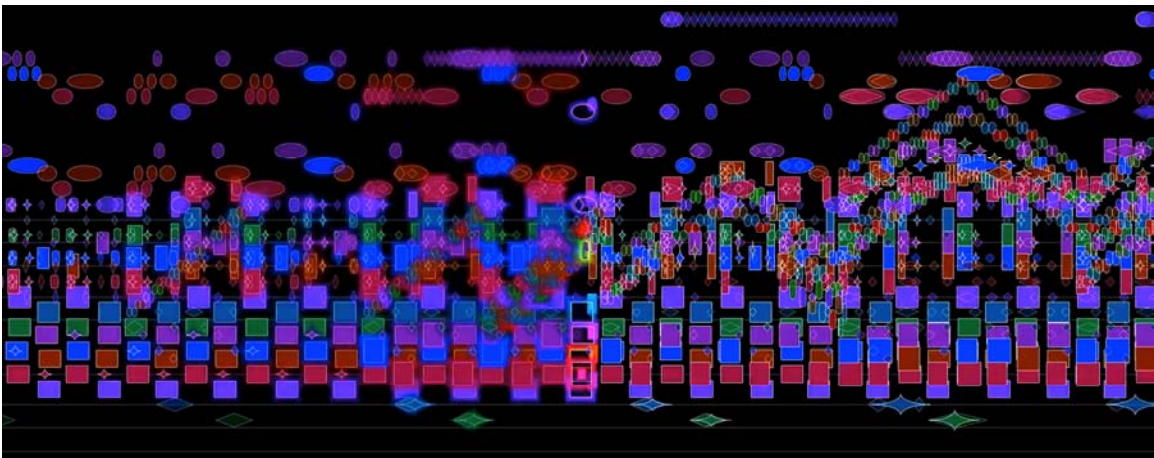
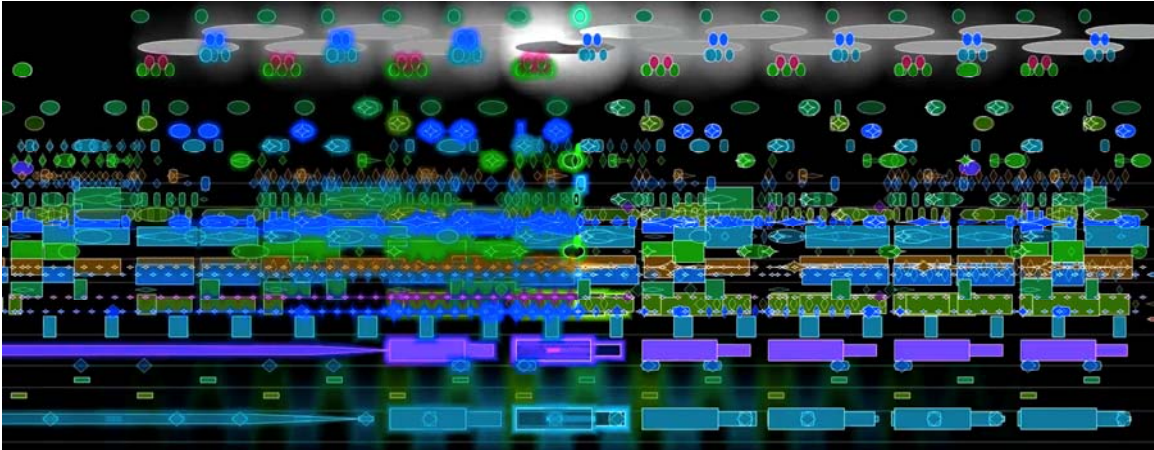
Here's an example of how that looks in practice ...



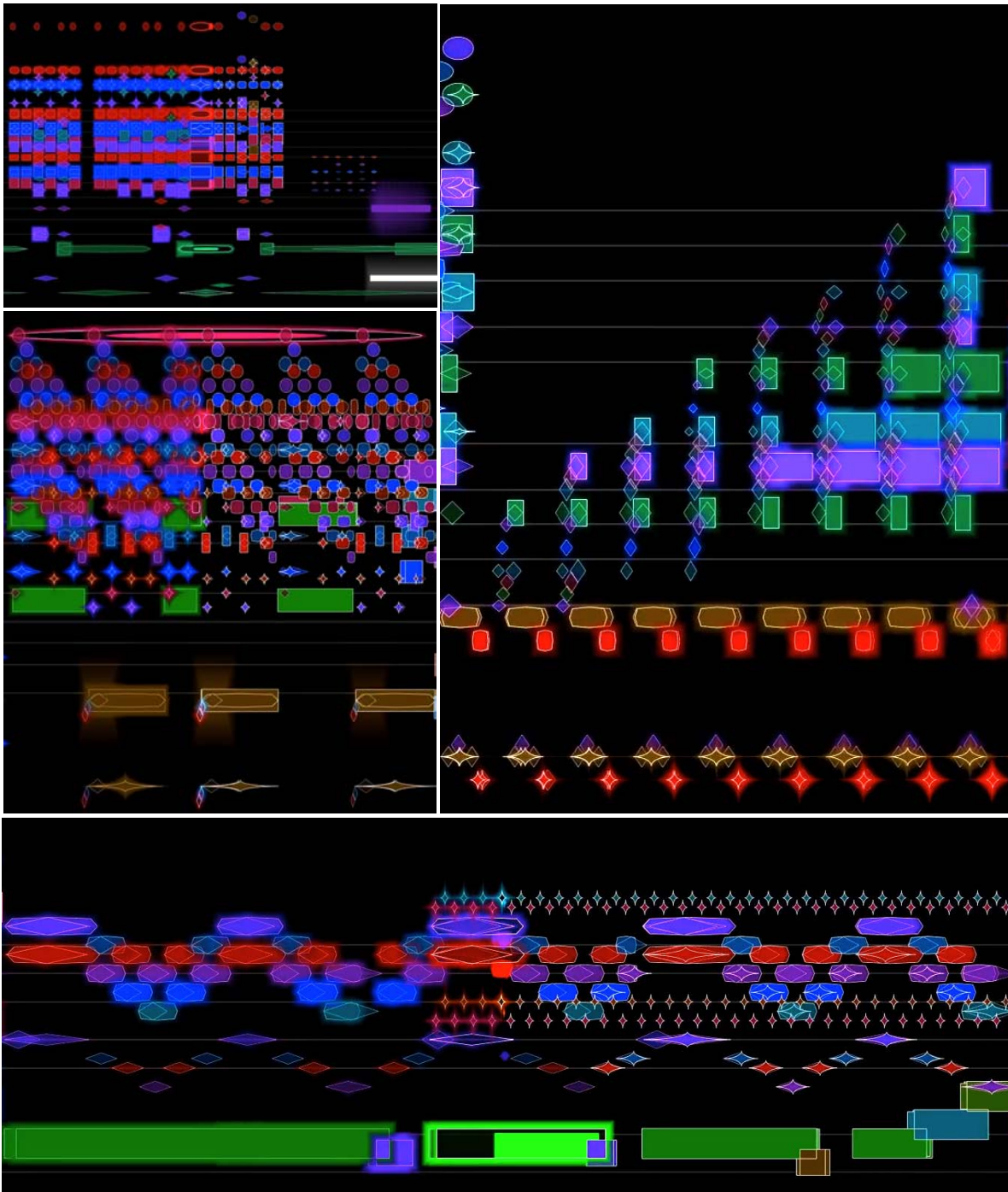
Even with all these techniques, in the densest passages, it is not easy to see all the notes clearly (however, since it's not easy to *hear* all the instruments in those passages, either, it could be argued that this is a *feature* and not a *limitation*).

### 3. Tonality

Using shape to distinguish instrument meant that I was free to use color to show tonality. In a method I call *harmonic coloring* (because it shows changes in harmony and tonality—it has nothing to do with *harmonics* in the sense of *overtones* or *partials*), the twelve musical pitches (as ordered in the musician's *circle of fifths*) is mapped to twelve colors (as ordered on the artist's *color wheel*). Unpitched instruments (bass drum, cymbals, tam-tam, triangle, guiro) are shown in gray. With this mapping, changes in tonality and harmony correspond to changes in the color palette. For example, the differences in tonality between these passages are easily apparent ...



Another aspect of Stravinsky's use of tonality that's made visible with harmonic coloring is *bi-tonality*. In these passages, the contrasting tonal regions are easily distinguished ...



#### 4. Last word

The credit for this graphical score being as interesting as it is goes to Igor Stravinsky.

— *Stephen Malinowski, July 24, 2013*