

The RGBe Goldberg Machine: Synesthetic Synthesis for A/V and V/A stressing A/D and D/A: The backwards Color Organ and Gesture

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Abstract.

This paper and demo describe the methodologies and workflow of interfacing computer generated imagery and the modular synthesizer in live performance. My motivation is to work with a complete instrument that is equally audio *and* visual synthesis - each phrase and gesture in the sound or visual has an equivalent in the other. Because gestural performance involves the feedback of the tactile with information from the visual and auditory senses, I highlight the notion that synaesthesia itself and art that engages with it must discover arbitrary creative systems to translate the languages of different media and provide a meaningful gesture that resonates in both. I briefly discuss the technical framework for accomplishing a “synthesthetic system” via analogue and digital programmable tools.

Keywords synaesthesia, synthesizer, audio/visual, MAX/MSP/JITTER, animation, 3D, polygons, pixel, colour organ, Doepfer, MIDI, Expert Sleepers, Warner Jepson, video, John Whitney, Tom Boram.

Introduction: The Gesture and The Wet Nurse

Synaesthesia is a performance ideal because I think it represents a “higher” creative function in the brain, rather than a “broken” one. I imagine synaesthesia as a constant state of complex understanding (cinnamon’s smell can represent the number 11, a clarinet’s timbre looks like a triangle). It is a creating new meanings from sense and memory spontaneously. Therefore I think a live improvised performance that operates with the mechanics of synaesthesia could evoke high-level creative processes. However, the most logical combination - audio and visual - is a common practice but rarely developed in a way that simulates the radical hyperlogic of actual synaesthesia. I think the problem is one of gestural apathy and “VJ” thinking.

In terms of improvised performance, I view the “VJ” as a sort of wet nurse - at best a person whose gestures do not share a musician’s DNA, at worst a person who doesn’t even notice or understand musical gesture, performing an intimate duo as a matter of routine. Video or film with music generally uses pre-recorded media, which has a “canned” affect and gesture. The musician therefore has to provide the entire performance affect, trying to recontextualize the visual with a new performance gesture.

The improvisation duo of musician and dancer comes closer to a synesthetic performance because the body of the dancer is able to resonate the sound and the dance gesture has the logic of having processed the musical gesture. However, the problem here is that the musician in turn usually doesn’t resonate the gestures of the dancer. Keeping enough attention to a dancing body while playing music is difficult, unless the dancer is chewing the musician’s ankles or something similar. Often the musician treats the performance as a solo – expecting the dancer to “follow.” The duo cannot fully feedback and therefore can’t fully resonate. The performers don’t find a semantic bridge between their media. There are notable exceptions of course.

The solution to the problem of the media “wet nurse,” where one medium provides content without sharing gesture, is the “performance system.” In a system gestures are encoded so they can escape

their bounds. Each path across media and paradigms provides deeper views of the system. One medium can be transgressed into a new meaning in another medium – a synesthetic behaviour.

In terms of audio-visual performance a simple representation of such a “system” is the so-called “color organ.” More recently, tools like the analogue video synthesizer of the late 1960s and 1970s, and now modular software environments such as MAX/MSP/JITTER, provide more compelling ways to create performance systems for unique multi-media hybrids.

Organizing the Color Gesture

Learning the modular synth these past 15 years was transformative for me. In the late 90s, seeing people like Michael Johnsen (who now designs modules for Pittsburgh Modular), Thomas Lehn, Charles Cohen, and Jim Baker convinced me the programmable analogue synth was an “instrument.” This was helpful as a seduction away from guitar and piano, but I think the idea of the modular synth as an “instrument” does a disservice. For me it is better to think of the modular synth as a computer that is programmed by musical thinking and gesture. “Playing” it involves conceptualizing its computer nature – a machine capable of mechanically timed events, mathematical and logical determinations, random processes and complex interactivity of controls and signals.

All the while, though, the musical gesture is there – but reconsidered. I’ve grown to view gesture as something more like an “input” or a “seed” than a mere control. Therefore it has a broader meaning and can be involved a more complex process - a Rube Goldberg Machine where all of the voices and mechanisms of the band can be re-configured for need or whimsy.

Once I was able to think of the musical gesture as *information* in a complex system, it was easier to imagine creating a “color organ” that was powerful enough to provide satisfying results. Part of “playing” the modular synth is appreciating that it is as much the mechanics of *articulating* a sound as it is the mechanics of the sound generator itself. The means of articulation is foregrounded in a modular synth when compared to typical instrument (each patch renegotiates the means of articulation). It follows then that the “method of articulation” could be transposed to something else – *what if I used this same mechanism to run a blender instead of using it to make a sound? Likewise, what if I sub out the “method of articulation,” and instead use the blender to articulate the sound?* Modularity implies openness, an environment where the methodology can be transposed for a different result.

Engineering the Color Organ

The color organ occurs when the methodology of the musical instrument (one gesture equals one event) is applied to color or light, usually along with music. For example, the eighteenth century “Ocular Harpsichord” of Pere Louis Bertrand Castel was a harpsichord in which the mechanics of each key was augmented to briefly draw a curtain on a frame of coloured glass.¹ The result was a fixed vocabulary of gesture, light and tonality. This is the most straightforward methodology of an audio-visual performance system. This simple form of color organ has been implemented often.

Other audio-visual methodologies are possible though, for example John and James Whitney’s *Five Film Exercises* from the 1940s. They used a series of precisely timed pendulums that controlled light patterns, which were then recorded optically onto a film soundtrack. This device did not even make sound, only recordable patterns, which could later be played back as electronically generated sound.²

¹ Moritz, William. “The Dream of Color Music, and the Machines That Made It Possible.” *Animation World Magazine* 2, no. 1 (April 1997). Accessed September 2016. <http://www.awn.com/mag/issue2.1/articles/moritz2.1.html>.

² Zinman, Gregory. “James Whitney.” *Handmade Cinema*. 2011. Accessed September 2016. <http://handmadecinema.com/mobileview.php?id=77>. The “Handmade Cinema” project was part of Zinman’s dissertation in Cinema Studies at New York University

Though this method stands out as very special – a machine that articulates light, which is then transformed into another medium which can articulate sound. The Whitney's were truly thinking *through* their media and creating a unique hybrid instrument. What seems fussy and complicated was, at the time, a reasonable way to get electronic sounds before synthesizers. They won several awards for the *Five Film Exercises*.

The analogue video synthesizer is the obvious next step in audio-visual performance because it has the same workflow of voltage control that the analogue audio synthesizer does. Both instruments have compatible signals and, with some scaling and tuning, can control each other. The semantic transfer is incorporated into the design of both instruments. A classic example of a colour organ using modular synths is the 1975 *NCET* works by Warner Jepson, in which a Buchla Synthesizer is connected to a Templeton Video mixer.³ The voltages that articulate the sounds in the Buchla are altering the Chroma keying and scanning of the video signal, which incorporates a camera feed of Jepson himself.

MAX/MSP/JITTER provides a similar integrated environment for control of audio and visual as the analogue video and audio synthesizer, except in an entirely digital software framework. That MAX was initially intended to control to audio synthesis (MSP) is irrelevant when one considers the how transferrable the MAX op-codes are to other applications. MAX is used to control robotics, mechanical music, theatre lighting, art installations, and of course video (using JITTER op-codes). All sorts of colour organ methodologies are possible in MAX/MSP/JITTER. A traditional light organ could be easily implemented using an interface protocol like MIDI, or one could go farther and use MAX to scan weather forecasts from the Internet and use the dynamic streamed data to provide parameters for video and sound synthesis. Or one could synthesize sound by extracting data from a video feed of a dance performance. In addition, JITTER opens up to a whole universe of video that can only exist in the digital world - 3D animation, video-game type physics, and complex arithmetic are possible.

Most interesting to me is that MAX and JITTER can be interfaced with technology and workflows outside of the computer. I found this empowering, because I wanted to take advantage of multi-media options that could include my modular synth. In fact I think working *across* technological media is more compelling than using a single integrated platform. Translating media helps the artist understand the media and get new meanings from both in the process. I have never heard sounds from synth as those I hear when interfacing it with MAX/JITTER. It has everything to do with *seeing* the music as understood within the rules of the system. Likewise, the visuals have more meaning when viewed as related the mechanism that is generating sound

My *Busbytron* video performance involved using JITTER to texture 3D objects with movie clips - a 1930s Busby Berkely musical dance sequence and a scene from the 1984 version of *TRON*.⁴ These objects and textures were then modulated with voltages from the modular synthesizer via MIDI control. Although MIDI is often thought of as a simple digital to analogue control, especially for DAW to synth, it works quite well in reverse. This somewhat odd workflow makes perfect sense in JITTER, as a serial interface.

The *Busbytron* took advantage of the voltage to MIDI of the Doepfer A-192 synth module. JITTER's 3D graphics offer many parameters to control - one can modulate the virtual space the objects are in, the virtual camera in the space, the virtual lighting, and the objects themselves. The task of the *Busbytron* was choosing the most important synth inputs, for example human gestural controllers or primary modulators such as an amplitude-controlling envelope, and how to distribute them within the video part of the system. Each time the *Busbytron* was performed the hardware and software patches were altered to accommodate new ideas or address problems in previous iterations.

³ "Warner Jepson." National Center For Experiments in Television. 2009. Accessed August 2016. <http://ncet.torusgallery.com/jepson/jepson.html>.

⁴ This is ironic considering I've already critiqued the use of "canned" video by VJs. In my defense, this footage is used as texture and animation along with the linked control by synth CVs and MIDI. The system foregrounds the modulated sounds and 3D graphics, not the textures. If desired, the textures can control synth functions too.



Fig 5. Screen capture from a *Busbytron* performance.

The *Busbytron* was a basic “color organ” workflow. It doesn’t “feed back” for more complex meanings in the system. The synthesizer can in turn be controlled by many things in JITTER that were changed as a result of the synthesizer’s own control signals, such as by-products of gravity and physics in the virtual space and collisions of the 3D objects. This would be a “completion” of the loop of control, where the player inputs gesture into the system, and the system reacts in both media, the visual and audio, and then those reactions influence each other and resonate in the performer, whose gestures are now also in the loop.

Reverse Engineering the Reverse Color Organ.

A very thoughtful synth designer working today is Andrew Ostler of Expert Sleepers. He seems to be thinking *through* media by designing AD/DA interface tools. This has practical applications such as the aforementioned workflow of DAW to modular synth voices, but it also has the ability to make clean transfers of numeric data in software environments like MAX/MSP/JITTER to analogue voltages and vice versa. It allows for direct access to the DAC and ADC. This is like a semantic transfer between software and synth that makes the path between media transparent. This allows for quite a lot of feedback and interactivity in my hybrid computer/synthesizer system, and the results have more than enough depth to invite my exploration as a performer.

Perhaps the most compelling “colour organ” methodology I’ve used with this system is the *Pixel Organ*. The *Pixel Organ* uses a small video web camera as a gestural input, via feeding back the image on the screen. By severely pixelating the webcam feedback in JITTER, and increasing saturation to the point of introducing excessive amounts of color and noise into the system, one can use the camera feedback gesture to “play” the synthesizer, while of course creating a modulating video signal. The RGB values of each pixel in JITTER are easily extracted as numeric data.

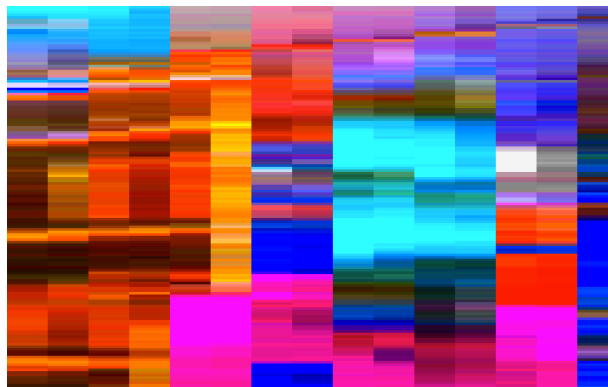


Fig 6. Screen capture of the original *Pixel Organ*.

When interacting with the synthesizer, the results are something akin to a “random voltage generator” or random event generator, yet one which can be influenced and altered by gesture. Certain light resonances can be found, however, and colour patterns and semi-stable musical events are possible. The feedback possible is fascinating - video attributes such as blending arithmetic, saturation, and down-sampling (pixelization) can be modulated by CVs, and these in turn further shape the sounds and colour patterns. My current work, *RGBe Goldberg Machine*, combines both the *Busbytron* and the *Pixel Organ* techniques, combining the flat *Pixel Organ* to the complex 3D spaces of the *Busbytron*.

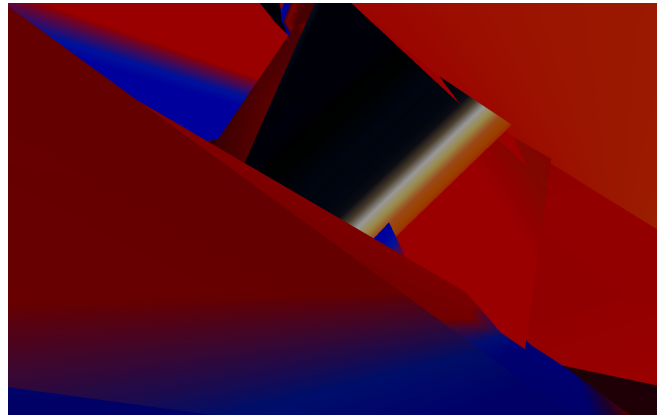


Fig 7. Screen capture of early version of *RGBe Goldberg Machine*.

It is through the integrated multi-media system that I believe that a performance can approach the mechanics of true synaesthesia. Combining the strengths of the hardware modular synth and the flexible software environment of MAX/JITTER allows for just such a complex performance system. The gesture is the heart of the performance system – it is the seed, the before and after of change in both worlds, analogue and digital, sound and light. Creating a semantic link across media introduces the possibility of new meanings, amplifying the performance gesture into a bizarre hybrid form. The performance is like a pass through a mirror maze of facets, a sort of laser cutting a unique form through the system. Each performance gesture cuts a new path, making for a new form in both media, much as synaesthesia spins a new form out of two senses and memory with each pass.

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