

Design Strategies for a Hybrid Video Synthesizer

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AUDIOVISUAL PERFORMANCE AND VIDEO SYNTHESIS

Live audiovisual performance can be defined as an event of sound and image manipulation (Carvalho and Lund, 2015). Through rapid advances in technology, various strategies exist today towards composing and performing such material. These range from hardware analogue instruments, digital tools, commercially available solutions to artist-built custom solutions incorporating various media.

While any intermedia work can be termed as ‘audiovisual’ (Carvalho and Lund, 2015), Chion (1994) makes the argument towards combining audiovisual elements to create a third “audiovisual element”, which creates “added value”. Grierson (2005) defines audiovisual practise as the “process of composing ... which exploit added value”. According to Grierson (2005) the main strategies for composing audiovisual material are synchronization of audio and visual elements, audiovisual congruence, and binary opposition. These relationships between audio and visual material in an audiovisual composition come together to create added value and is a valuable framework for analysis.

The electronic analogue video synthesizer and computer-based approaches towards image generation have historically contributed towards building visual tools for audiovisual performance. Collopy (2014) argues that “designers modelled video synthesizers on audio synthesizers...”, and this can be seen in the instruments built in by Eric Siegel, Bill Etra and Steve Rutt, Dan Sandin, Stephen Beck, and others. Siegel defined his work as the “video equivalent of a music synthesizer” (as quoted in Dunn, 1992) and Beck’s synthesizer would incorporate “principles of control voltage and artificial signal production from audio synthesizers” (Collopy, 2014). The result of this influence meant that these video synthesizers could be controlled the same way as audio synthesizers - in a modular fashion with control voltages (CV) which were often compatible with each other.

Parallel to the analogue world of video synthesis, digital advancements were also underway. On the one hand, there was the addition of digital circuitry in analogue synthesizers for added control (Collopy, 2014) and on the other, there was development of computer-based systems for graphics generation. The role of computers in the arts would only increase over time as they would become smaller, portable and more powerful and play an important role in the artistic audiovisual performance world of today (Salter, 2010).

Digital platforms and computers would also fundamentally change the landscape of electronic music. Modular synthesizers would lose favour for smaller digital synthesizers and eventually, computers (Trocco and Pinch, 2009). However, from the mid-nineties onwards, a resurgence of modular instruments have taken place with the invention and popularity of the Eurorack format (Fantinatto, 2013). While still relying on the concepts of discrete modules with control voltage compatibility, the Eurorack format has also incorporated modern digital microcontrollers and offers a truly modern modular environment for sound synthesis (Connor, no date). This is of course, in conjunction with the continued use of the computer and the digital audio workstations (DAWs).

When it comes to video synthesis however, this hybrid nature has not caught up. While some companies are designing and releasing video synthesizers in both standalone and modular formats, they follow an all-analogue circuitry. While digital platforms have been incorporated in some physical instruments, one of the drawbacks of these instruments is limited control over parameters for integration in an audiovisual setting. The lack of a modular yet modern physical video synthesis platform is important to note here considering the influence the pioneering modular audio synthesizers has had on video synthesizers in their infancy.

CONTEMPORARY PRACTISES

Even with overarching characteristics of what constitutes an instrument suited towards live performance as discussed by Franco et al. (2004) and Levin (2000), an exhaustive list and comparison of each would be fairly demanding. In practice, two distinct classes of instruments and platforms can be identified: 1. Using existing and commercial solutions towards building a performance, and 2. Artist-developed tools and systems for performance.

When analyzing tools with classifications by Franco et al. (2004) and Levin (2000), artist-developed tools are seen to provide the highest flexibility, as the artist has fundamental control over every audio and visual event and their interactions. However, this comes at the added expense of the initial investment of development time. Existing solutions, including visual jockey (VJ) software and standalone software or hardware platforms, on the other hand, are more immediate in their output, being easier to use at the cost of flexibility.

Magnusson's (2010) analysis of instrument design through the concept of affordances and constraints can be extended towards audiovisual platforms as well as purely visual tools. On the topic of commercial solutions versus artist developed tools, he writes,

Problems with the former lie in the conceptual and compositional constraints imposed upon users by software tools that clearly define the scope of available musical expressions. It is for this reason that many musicians, determined to fight the fossilization of music into stylistic boxes, often choose to work with programming environments that allow for more extensive experimentation. However, problems here include the practically infinite expressive scope of the environment, sometimes resulting in a creative paralysis or in the frequent symptom of a musician-turned-engineer.

The same phenomenon is also seen in purely visual performance systems, both in hardware and software. Striking the right balance between an extensive development framework and the constraints put into it often lead to more immediate output. To such an end, Magnusson (2010) introduces the idea of mapping as design constraints. This is proposed through a model where the artist interacts with a controller using a mapping engine connected to the sound engine for performance and composition. Through this interaction and sonic and haptic feedback (and additionally, visual feedback), the musician can continue their process of composition and performance.

PROPOSED DESIGN FOR A HYBRID VIDEO SYNTHESIZER

For developing a modern hybrid video synthesizer which would be physical, tactile and work in a modular fashion, based on the earlier discussions, the authors would like to propose the following strategies.

Firstly, it would have to be compatible with the Eurorack format. As discussed earlier, modular video synthesis platforms of the past have had a rich history of inheriting from the modular sound synthesis platforms of their time. Following a similar strategy would have a few advantages. With compatible voltage sources, it would be possible to drive both audio and video together towards fulfilling the characteristics identified by Franco et al. (2004) and Levin (2000) and correspond to the strategies as identified by Grierson (2005) towards exploiting added value. Working with established standards and having various control voltage sources would be added advantages.

Secondly, it should be both easy to use as well as extensively customizable towards generating complexity. Following the idea of mapping as design constraints (Magnusson, 2010), this instrument would be able to map both physical inputs as well as control voltage inputs to visual parameters while retaining the advantages of artist developed tools by being customizable enough to go under the hood and fundamentally alter the programming paradigms.

Finally, it would need to be compatible with contemporary display technologies to easily integrate with modern studios and performance venues.

CONCLUSIONS

A prototype instrument with the strategies discussed above has already been developed, implemented and used in live performances by the first author¹. This current version of the instrument, built around a Raspberry Pi

¹ https://github.com/sourya-sen/rPi_synth

using custom hardware and software, allows both direct plug and play capability for visuals, as well as CV control over parameters using Eurorack standards. While it has immediate output and follows a comprehensive mapping engine with the panel controls, CV inputs and parameters, it is also extensible for more complex operations on the software side. Also supporting a HDMI output, this instrument fulfills the requirements as discussed in this paper. It is already available open source for those interested in implementing their own versions and going forwards, future iterations are planned.

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