Rhythmic Rendering

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Abstract

Rhythmic Rendering is a compositional approach to organizing sound through the integration of rhythmic matrices and selected audio signal processing routines. In this scheme, signal processing becomes integral to the structure of a musical composition, rather than "sweetening" added globally at the terminal point of an audio chain, as in commercial synthesizers.

1 Introduction

Rhythmic Rendering is a term I have invented to describe an approach to computer music integrating rhythm and digital signal processing. The basic idea is simple, and is related to the concept of rendering in the computer graphics domain. In particular, I adopt the concept of a wireframe: a stripped down model of a geometric shape which is submitted to a set of algorithmic programs such as texture mappers, artificial light sources, and the like to create a final complex image.

In Rhythmic Rendering, the wireframe is a polyphonic set of attack patterns, one pattern for each sound to be rendered. In its simplest form, the data is specified as a series of ones and zeros, corresponding to notes and rests. This is most easily conceptualized as a virtual drum machine grid. A direct audio realization is then prepared using either an acoustic compiler such as Cmix[1] or a general purpose realtime DSP system such as Kyma[2].

The central idea of Rhythmic Rendering then is to intercept the wireframe rhythmic data and route each individual instantiation of a sound to a specific signal processing routine. This approach is quite open-ended since any audio signal processing scheme may be employed, any set of sounds may be used, and many schemes for selecting and organizing the signal processing are easily imagined.

For my own work, I have designed a set of Cmix functions which apply processes such as compression, time-varying filtering, time-companding, complex feedback loops, comb filters, custom reverberators, and so forth. In addition, each function may play the input sound at arbitrary increment, arbitrary pan location, backwards, and/or gated (with smoothing fadeout). These Cmix functions receive input from scores generated by my virtual drum machine, BashFest[3]. The input data to BashFest is where the actual Rhythmic Rendering is specified, and this may be done either by hand or with a set of algorithmic filters written in Perl. I have also made a realtime realization of this scheme using Max to control the Kyma realtime DSP system.

2 Precedents

The ideas behind Rhythmic Rendering have some important precedents. The atomistic approach to polyphony, where each sound receives individual treatment, is explicitly expressed in Schoenberg's idea of klangfarbenmelodie, where each note of a melody is orchestrated differently. This idea is taken to further extremes in the post-WWII serial music of Boulez and Stockhausen where melody effectively disappears as a local phenomenon.

3 Intelligent Dance Music

Since the early 1990s, Rhythmic Rendering techniques have be used in experimental forms of electronic dance music, often labelled under the rubric Intelligent Dance Music, one of a startling number of sub-genres in the field of Techno music. This is especially true of Drum and Bass, an extremely complex, polyphonic style with large numbers of practitioners in Berlin and other centers of Techno music innovation. Typical features of Drum and Bass are time-varying filters, feedback loops tuned to the tempo, retrograde samples, gating, and more exotic signal processing, all applied to individual

samples or tracks, and often for just a few beats at a time.

Although Techno is often associated with analog synthesizers and processors, having fueled a renewed interest in vintage analog synthesizers, many Techno practitioners have already integrated software synthesis into their studios. One of the most accomplished Techno artists, Richard D. James, noted for his design and use of idiosyncratic analog circuitry, recently discussed his collaborations with programmers over the Internet to design custom digital signal processors and sequencers [4].

4 Future Work

There are three main areas in which Rhythmic Rendering can benefit from further research. First, a good graphical interface remains to be built. I have built rudimentary interfaces with both NeXTSTEP Interface Builder and CGI scripting[5]. While these interfaces can ameliorate the burden of data entry, they also structure access to the data in ways which can be constricting. A more flexible interface would provide access to multiple views of the data, with the possibility of new points of view defined or programmed by the user. Such an interface might best be designed in a VR environment in order to more fully represent the multi-dimensional nature of Rhythmic Rendering data.

Second, additional performance models need to be developed for realtime rendering. The most familiar existing model consists of the typical mixdown situation for Techno artists manipulating multiple processor controllers in the course of mixing a track. One might also pursue realtime interaction with algorithmic systems where the musician influences probabilities for statistical decisions about processing distribution among the sounds. Then there remains the large issue of designing strategies for multiple performer interaction with the materials and each other.

Third, much more research can be done on mappings of external data to the processing and creation of Rhythmic Rendering data. Many well-understood algorithmic procedures such as cellular automata, genetic algorithms and neural nets could be applied more or less directly. It would also be interesting to find ways of mapping unrelated structured sources of data. For example, there could be an ongoing broadcast of rendered sound, influenced in character by atmospheric disturbances or fluctuations in foreign currency exchange rates.

5 Conclusions

Rhythm is a primal force in much music across many cultures. In the western tradition, the integration of rhythm with the structured use of frequency ratios led to the expressive syntax, forms and styles of tonal music. Compositional exploration of the structured integration of rhythm with sound and digital signal processing has already revealed a new terrain of possibilities and promises to produce new and unexpected musical riches in the future.

References

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