Colour Etude I

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Extended Abstract

Colour Etude I is the first in a series of pieces exploring the strict application of certain spectral techniques influenced by the research of William Sethares, while keeping all parameters except for harmony very simple. These pieces function as a means to test harmonic concepts, and to create more accessible examples of microtonal and spectral music by leaving most other aspects of the piece uncomplicated.

"The more I experimented with alternative tunings, the more it appeared that certain kinds of scales sound good with some timbres and not with others. Certain kinds of timbres sound good in some scales and not in others."[1] This quote from William A. Sethares stems from the beginnings of his research in Psychoacoustics and sensory consonance. His research would go on to suggest that there is a correlation between the pitches which occur as partials in a sound's spectrum, and the pitches which create the scale affording the most perceived consonance when writing music using that sound.

This had implications about harmony that interested me greatly, and I've applied aspects of this theory to several pieces of mine in many different ways. Some of the intended results of doing this have included: creating unusual microtonal modes which are spectrally derived; developing a kind of structurally functional harmony using these modes; attempting control perceived consonance and dissonance; effectively blending electronic and acoustic sounds together within a single texture; and deriving multiple elements of a work, such as harmony and form, from a single source, usually an individual sound.

The ultimate purpose of all of the listed aims was to create a sound-world which was cohesive, yet unique and distinctive to each piece, while still allowing for music with contrast and an engaging dramatic shape. Nonetheless, the questions still remained: to what extent is the use of Sethares's theories actually contributing to this final goal, and can his assertions actually be applied in a meaningful way within the context of a composition?

The difficulty in answering these questions lies in part in a lack of controlled examples clearly demonstrating the application Sethares's research. For example, the vast majority of music is made using sounds with varying spectra, not just a single spectrum which transposes in exact ratios as the fundamental changes; even a piece for solo instrument will demonstrate spectral variety in different registers. Sethares himself has written many examples that do effectively demonstrate his point, but the problem is that, from a musical point of view, they simply don't sound very good; this due largely to the demonstrative function of these examples, rather than their being true performance-designed compositions, and also because the sound design in question is very old-fashioned and uninspiring.

I wanted to put the effectiveness of Sethares's results to the test by writing a piece which puts them in the absolute foreground. Using additive synthesis, I could design a spectrum which could then be transposed exactly to reduce the kind of spectral variance previously discussed, and test whether I could compose an effective work using just one set of frequency ratios. To add to the emphasis on harmony, I wanted the piece to be very basic in all other regards; the form ended up as essentially a simple theme and variation, for example, and there is little in the way of rhythmic development.

To begin with, an 11-partial waveform was generated in SuperCollider using random numbers for the partial frequencies and amplitudes, which I derived using SuperCollider's ExpRand method. The amplitudes were then tweaked to taste, but the frequencies were left as generated. The resulting ratios of the partials were as follows, where f is the fundamental frequency, to the nearest two decimal places: f, 1.87f, 1.97f, 2.10f, 3.20f, 3.40f, 5.24f, 7.00f, 8.61f, 8.92f, 9.97f.

The entire piece uses instances of waveforms with these same ratios between the frequencies of their 11 partials - i.e. exact transpositions of the same waveform. Rather than deriving modes from these frequencies, the exact pitches are used only, while a section is centered on a particular fundamental; to put it into terms relating to tonal music, in a particular 'key', only notes whose fundamental frequencies occur in the spectrum of the 'tonic' can be used. This leads to a series of 11-pitch sets which modulate between each other via common pitches, and the modulations are the structural signposts of the piece.

References

[1] Sethares, William A. *Tuning, Timbre, Spectrum, Scale*. London: Springer-Verlag, 1998.