Radians Phase II (2015)

Radians Phase II premiere performance by Third Sound, November 17, 2015, Havana Contemporary Music Festival, Basilica Menor de San Francisco de Asis, Havana, Cuba

Program Notes

Ever since the 1980's, when I started working as La Monte Young's composition and tuning assistant, I have wanted to compose a work like *Radians Phase* for specialized instrumentalists exploring gradually evolving constellations of tones in extended "just intonation" tunings. However, it was not until 2015 when composer/curator Sam Pluta asked me to write a new work for electronics and Tactus (the contemporary music ensemble at the Manhattan School of Music), that the right opportunity finally presented itself. Subsequently, I composed *Radians Phase II*, which was premiered in the first live concert of contemporary American music in Havana since the Cuban Revolution.

Radians Phase II is scored for flute, clarinet, violin, cello, and sine waves. The work is comprised of an electronic introduction and five interconnected constellations and uses the most complex just intonation tunings and harmonic regions I have explored to date. "Just intonation is the tuning system of the later ancient Greek modes as codified by Ptolemy; it was the aesthetic ideal of the Renaissance theorists; and it is the tuning practice of a great many musical cultures worldwide, both ancient and modern." (Gilmore, Bob, *"Maximum Clarity" and Other Writings On Music*). It is any musical tuning in which the frequencies of notes are related by ratios of whole numbers. The two notes in any just interval are members of the same harmonic series and are called "just" or pure. Historic just intonation uses only notes derived from multiples of the prime numbers 2, 3 and 5, while "extended" just intonation includes higher primes such as 7, 11 and 13, or in the case of *Radians Phase II* every prime up to 677. Just intonation can be contrasted with equal temperament, which dominates most Western instruments, and compromises the purity and harmonic integrity of music for the convenience of having 12 equally spaced notes.

The introduction, using only computer generated sine waves, and Constellation 5, using all of the instruments in conjunction with sine waves, bookend the work by creating a series of "harmonic primes" using only the frequencies that correspond to the first 124 prime numbers of the harmonic series in the key of C, spanning the entire human audible range up to the 677th partial. Prime numbers are significant in that beyond the 5th partial they do not create traditional musical intervals, such as octaves, perfect fifths and fourths, major and minor thirds, etc. Chords derived from harmonic primes are therefore completely outside the realm of traditional harmony. Creating a constellation using every audible harmonic prime is perhaps the most complex harmonically related collection of tones from a single fundamental that can be imagined. The introduction descends through this series of primes, then at the end Constellation 5 ascends through the primes into a stratosphere of barely audible tones.

Constellation 1 is comprised of the first 192 partials of the harmonic series in G. Constellation 2 is based on the first five octaves of the harmonic series and uses the 1st, 2nd, 3rd, 4th, 6th, 7th, 8th,

9th, 10th, 11th, 13th, 15th, 17th, 19th, and 21st partials of the harmonic series in D. Constellation 3 uses the same partials as Constellation 2, but only up to the 19th partial, in reverse order, and transposed back down a fifth to G. Constellation 4 is derived from the tone cluster in "Tone Cloud IV" of *Revelation*, my extended work for piano in just intonation, and uses a tuning based on the harmonic primes 2, 3 and 7, with the 1st, 2nd, 3rd, 4th, 6th, 7th, 8th, 9th, 12th, 14th, 16th, 18th, 21st, 24th, 27th, 28th, 32nd, 36th, 48th, 54th, 56th, 63rd, 64th, 72nd, 96th, 108th, 112th, 126th, 128th, 144th, 189th, 192nd, 216th, 224th, 252nd, and 256th partials of the harmonic series in D, as well as 7:6, 4:3 and their octave duplications. This tuning matrix creates an abundance of septimal commas (the microtonal interval 64:63), which create their own acoustical beats and rhythmic pulsations.

I programmed the matrices of sine waves using algorithms such that the envelopes (fade-in, sustain, and decay times) of most notes are directly related to their corresponding frequencies. This results in an organic relationship between pitch and rhythm that is somewhat akin to concepts of total serialism; however, as a result of the just intonation tunings, the interrelationships are based upon the actual frequencies of the notes themselves, rather than a 12-tone row or serialized construct.

Michael Harrison