Eclipses and penumbra

Day McMaster Beyer

*University of Iowa*

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ECLIPSES AND PENUMBRA

by

Day McMaster Beyer

A thesis submitted in partial fulfillment
of the requirements for the
Master of Arts degree in Music for the
Graduate College of
The University of Iowa

May 2019

Thesis Supervisors: Professor David Gompper
Assistant Professor Jean-François Charles
ABSTRACT

“Eclipses” orchestrates the movements of human beings as celestial bodies—as wandering beings that emit waves, cycle in orbit, and create shadows. Subtle microtonal movements, or retunings of the same pitch, tell the story of gradual planetary motion leading to the drama of the eclipse. In the dimmed light of a solar eclipse, even the most familiar surroundings seem unfamiliar and strange.

The harmonic material of “Eclipses” was composed using the Rainbow Harmony Matrix, a MaxMSP-based mouse and keyboard interface designed for real-time interaction with a 2D colorized pitch space defined by Just Intonation ratios. The most difficult coding in this patch was completed thanks to the generous help of Jean-François Charles. The spatialization and color-coding of Just Intonation pitches provided by the Rainbow Harmony Matrix proved invaluable to organizing harmonic and melodic material. Elements of rhythm, timbre, and articulation were largely left to the ear’s intuition.

“Penumbra” magnifies the shadow cast when one celestial body partially obscures the light from another. Moments from “Eclipses” are revisited through a telescopic lens, such that the small whole number relations hiding in the harmonies are magnified, into the field of rhythm. Small gestures orbit each other in wandering motion, building a web of cause and effect.

The harmonic material from “Penumbra” is extracted from two chords occurring in measures 41-43 of “Eclipses.” The small whole number frequency
ratios governing the cross-relations of these two chords are magnified and modified to create polyrhythms that cycle over several minutes.
“Eclipses” orchestrates the movements of human beings as celestial bodies—as wandering beings that emit waves, cycle in orbit, and create shadows. Subtle microtonal movements, or retunings of the same pitch, tell the story of gradual planetary motion leading to the drama of the eclipse. In the dimmed light of a solar eclipse, even the most familiar surroundings seem unfamiliar and strange.

“Penumbra” magnifies the shadow cast when one celestial body partially obscures the light from another. Moments from “Eclipses” are revisited through a telescopic lens, such that the small whole number relations hiding in the harmonies are magnified, into the field of rhythm. Small gestures orbit each other in wandering motion, building a web of cause and effect.

Contact Information: Day Beyer, paleonath@gmail.com
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### PERFORMANCE NOTES

<table>
<thead>
<tr>
<th>3-LIMIT (PYTHAGOREAN) INTERVALS</th>
<th>FUNCTION OF THE ACCIDENTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="3-limit intervals" /></td>
<td>note 35 pitches from the series of untempered perfect fifths (3/2) = ± 702.0 cents; perfect fifth (3/2); perfect fourth (4/3); major whole tone (9/8)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5-LIMIT (PTOLEMAIC) INTERVALS</th>
<th></th>
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</thead>
<tbody>
<tr>
<td><img src="image" alt="5-limit intervals" /></td>
<td>note an alteration by one syntonic comma (81/80) = ± 21.5 cents; major third (5/4); minor third (6/5); major sixth (5/3); minor sixth (8/5); minor whole tone (10/9)</td>
</tr>
<tr>
<td><img src="image" alt="5-limit intervals" /></td>
<td>note an alteration by two syntonic commas (81/80)·(81/80) = ± 43.0 cents; augmented fifth (25/16); diminished fourth (32/25)</td>
</tr>
<tr>
<td><img src="image" alt="5-limit intervals" /></td>
<td>note an alteration by three syntonic commas (81/80)·(81/80)·(81/80) = ± 64.5 cents; minor diesis (128/125)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7-LIMIT (SEPTIMAL) INTERVALS</th>
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</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="7-limit intervals" /></td>
<td>note an alteration by one septimal comma (64/63) = ± 27.3 cents; natural seventh (7/4); septimal whole tone (8/7); septimal diminished fifth (7/5); septimal tritone (10/7); septimal minor third (7/6); septimal quartetone (36/35)</td>
</tr>
<tr>
<td><img src="image" alt="7-limit intervals" /></td>
<td>note an alteration by two septimal commas (64/63)·(64/63) = ± 54.5 cents; septimal sixfhone (49/48)</td>
</tr>
<tr>
<td><img src="image" alt="7-limit intervals" /></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>11-LIMIT (UNDECIMAL) INTERVALS</th>
<th></th>
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<tbody>
<tr>
<td><img src="image" alt="11-limit intervals" /></td>
<td>note an alteration by one undecimal quartetone (33/32) = ± 53.3 cents; undecimal augmented fourth (11/8); undecimal diminished fifth (16/11)</td>
</tr>
<tr>
<td><img src="image" alt="11-limit intervals" /></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>13-LIMIT (TRIDECIMAL) INTERVALS</th>
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</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="13-limit intervals" /></td>
<td>note an alteration by one tridecimal thirteenth (27/26) = ± 65.3 cents; tridecimal neutral sixth (13/8); tridecimal neutral third (16/13)</td>
</tr>
<tr>
<td><img src="image" alt="13-limit intervals" /></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRIMES IN THE HARMONIC SERIES OCTAVE 16 - 32</th>
<th>(5-limit signs are given here relative to &quot;A&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Primes intervals" /></td>
<td>note an alteration of the 5-limit accidental by one 17-limit schisma (16/17)·(16/15) = (256/255) = ± 6.8 cents; Galileo's &quot;equal-tempered&quot; semitone (18/17); 17-limit diminished seventh chord 10:12:14:17</td>
</tr>
</tbody>
</table>

microtonal accidentals designed by Marc Sabat and Wolfgang von Schweinitz, 2004
bow on bridge, parallel to bridge, "white noise"

strike upper half of instrument body with the palm

strike lower half of instrument body with the palm

morph from one technique to another gradually

slow wide vibrato tight fast vibrato
Eclipses

\[ d = 55 \]

sans vib. throughout unless marked

Violin 1

Violin 2

Viola

Violoncello

Vln 1

Vln 2

Vla

Vc.

mf

f

ppp

airy

ppp

pp

ppp
Eclipses
Eclipses

Chris Otto’s guidance and scores provided valuable information on the ordering and kerning of Helmholtz-Ellis accidentals, particularly the rule that accidentals are ordered from left to right by descending prime limit.


This PDF defines the microtonal accidentals used in these scores, and describes the theoretical and pedagogical rationale for their creation. The accidental definitions printed in the performance notes are sourced from pages 13 of this PDF.