

Andrew Nathaniel McIntosh

Four Diffractions

for two trombones with violin obligato

(2009)

PLAINSOUND MUSIC EDITION

for Douglas Wadle and Matt Barbier

based on the *Tractus* from the *Missa pro defunctis* of Johannes Ockeghem
composed c. 1480

cents values are given only for double microtonal accidentals and are shown as
deviations from Pythagorean tuning (in fifths) rather than from equal temperment

duration around 7 minutes

The Extended Helmholtz-Ellis JI Pitch Notation

microtonal accidentals designed by Marc Sabat and Wolfgang von Schweinitz, 2004

3-LIMIT (PYTHAGOREAN) INTERVALS

bb b b# # x

FUNCTION OF THE ACCIDENTALS

notate 35 pitches from the series of untempered perfect fifths
 $(3/2) \approx \pm 702.0$ cents;
perfect fifth (3/2); perfect fourth (4/3); major wholetone (9/8)

5-LIMIT (PTOLEMAIC) INTERVALS

bb b b# # x bb b b# # x

notate an alteration by one syntonic comma $(81/80) \approx \pm 21.5$ cents;
*major third (5/4); minor third (6/5); major sixth (5/3); minor sixth (8/5);
 minor wholetone (10/9)*

bb b b# # x bb b b# # x

notate an alteration by two syntonic commas
 $(81/80) \cdot (81/80) \approx \pm 43.0$ cents;
augmented fifth (25/16); diminished fourth (32/25)

bb b b# # x bb b b# # x

notate an alteration by three syntonic commas
 $(81/80) \cdot (81/80) \cdot (81/80) \approx \pm 64.5$ cents;
minor diesis (128/125)

7-LIMIT (SEPTIMAL) INTERVALS

L l or ll F or ff

notate an alteration by one septimal comma $(64/63) \approx \pm 27.3$ cents;
*natural seventh (7/4); septimal wholetone (8/7);
 septimal diminished fifth (7/5); septimal tritone (10/7);
 septimal minor third (7/6); septimal quartertone (36/35)*

notate an alteration by two septimal commas
 $(64/63) \cdot (64/63) \approx \pm 54.5$ cents;
septimal sixtitone (49/48)

11-LIMIT (UNDECIMAL) INTERVALS

t d

notate an alteration by one undecimal quartertone
 $(33/32) \approx \pm 53.3$ cents;
undecimal augmented fourth (11/8); undecimal diminished fifth (16/11)

13-LIMIT (TRIDECIMAL) INTERVALS

d# #

notate an alteration by one tridecimal thirdditone $(27/26) \approx \pm 65.3$ cents;
tridecimal neutral sixth (13/8); tridecimal neutral third (16/13)

PRIMES IN THE HARMONIC SERIES OCTAVE 16 - 32 (5-limit signs are given here relative to "A")

=b =#

notate an alteration of the 5-limit accidental by one 17-limit schisma
 $(16/17) \cdot (16/15) = (256/255) \approx \pm 6.8$ cents;
*Galileo's "equal-tempered" semitone (18/17);
 17-limit diminished seventh chord 10:12:14:17*

-b -#

notate an alteration by one 19-limit schisma
 $(19/16) \cdot (27/32) = (513/512) \approx \pm 3.4$ cents;
19-limit minor third (19/16); 19-limit minor triad 16:19:24

^# v b

notate an alteration by one 23-limit comma
 $(23/16) \cdot (8/9) \cdot (8/9) \cdot (8/9) \approx \pm 16.5$ cents;
raised leading tone (23/12)

↑
♯

↓
♯

notate an alteration of the 5-limit accidental by one 29-limit comma
 $(29/16) \cdot (5/9) = (145/144) \approx \pm 12.0$ cents

-
♯

+
♯

notate an alteration of the 11-limit accidental by one 31-limit schisma
 $(32/31) \cdot (32/33) = (1024/1023) \approx \pm 1.7$ cents

PRIMES IN THE HARMONIC SERIES OCTAVE 32 - 64 (5-limit signs are given here relative to "A")

{
♯

{
♯

notate an alteration of the 11-limit accidental by one 37-limit schisma
 $(36/37) \cdot (33/32) = (297/296) \approx \pm 5.8$ cents

{
♯

{
♯

notate an alteration of the 5-limit accidental by one 41-limit schisma
 $(32/41) \cdot (81/64) \cdot (81/80) = (6561/6560) \approx \pm 0.3$ cents

{
↑

{
↓

notate an alteration by one 43-limit comma
 $(43/32) \cdot (3/4) = (129/128) \approx \pm 13.5$ cents

{
♯ or {
♯

{
♯ or {
♯

notate an alteration of the 7-limit accidental by one 47-limit schisma
 $(32/47) \cdot (48/49) \cdot (3/2) = (2304/2303) \approx \pm 0.8$ cents

{
♯

{
♯

notate an alteration of the 5-limit accidental by one 53-limit comma
 $(32/53) \cdot (5/3) = (160/159) \approx \pm 10.9$ cents

{
♯

{
♯

notate an alteration of the 13-limit accidental by one 59-limit schisma
 $(32/59) \cdot (24/13) = (768/767) \approx \pm 2.3$ cents

{
♯

{
♯

notate an alteration of the 7-limit accidental by one 61-limit schisma
 $(61/32) \cdot (21/40) = (1281/1280) \approx \pm 1.4$ cents

IRRATIONAL AND TEMPERED INTERVALS

♭

♭

♯

♯

×

notate the respective Equal Tempered Semitone;
may be combined with a cents indication to notate any pitch

NOTE ABOUT CENTS INDICATIONS

optional cents indications may be placed above or below the respective accidentals and are always understood in reference to Equal Tempered semitones, as implied by the Pythagorean accidentals

Four Diffractions

I.

Andrew Nathaniel McIntosh

$\text{♩} = 50$

Trombone

f

Trombone

f

5

-38 c

Tbn.

Tbn.

-38 c

9

-38 c

-38 c

Tbn.

Tbn.

-38 c

-38 c

13

Tbn.

Tbn.

17

Tbn.

Tbn.

21

-38 c

Tbn.

Tbn.

25

Tbn.

Tbn.

-38 c

-38 c

29

Tbn.

Tbn.

-38 c

-38 c

-38 c

+81 c

-38 c

+81 c

-38 c

32

Tbn.

Tbn.

-38 c

-38 c

II.

$\text{♩} = 75$

Trombone

mp

mp

39

Tbn.

43

Tbn.

47

Tbn.

51

Tbn.

55

Tbn.

59

Tbn.

Musical score for two tubas (Tbn.) in 3/4 time, measures 59-62. The key signature has one sharp (F#). The top staff (Tbn.) starts with a whole note G4, followed by a quarter rest, then a quarter note A4, and a quarter note B4. The bottom staff (Tbn.) starts with a quarter note G3, followed by a quarter note A3, a quarter note B3, and a quarter note C4. The music continues with various rhythmic patterns and accidentals.

63

Tbn.

Musical score for two tubas (Tbn.) in 3/4 time, measures 63-65. The top staff (Tbn.) starts with a whole note G4, followed by a quarter rest, then a quarter note A4, and a quarter note B4. The bottom staff (Tbn.) starts with a quarter note G3, followed by a quarter note A3, a quarter note B3, and a quarter note C4. The music continues with various rhythmic patterns and accidentals.

66

Tbn.

Musical score for two tubas (Tbn.) in 3/4 time, measures 66-68. The top staff (Tbn.) starts with a quarter note G4, followed by a quarter note A4, a quarter note B4, and a quarter note C5. The bottom staff (Tbn.) starts with a quarter note G3, followed by a quarter note A3, a quarter note B3, and a quarter note C4. The music continues with various rhythmic patterns and accidentals.

III.

$\text{♩} = 65$

Violin *mf* +15 c

Trombone *mf*

Trombone *mf*

Vln. +25 c +75 c +15 c

Tbn.

Tbn.

Vln. +15 c -43 c

Tbn.

Tbn.

Vln. +15 c -43 c +15 c

Tbn.

Tbn.

Vln.

Tbn.

Tbn.

89

Vln. *+75 c* *+15 c*

Tbn. $\text{11}\overline{\text{B}}$

Tbn. $\text{11}\overline{\text{B}}$

93

Vln. *+25 c* *+75 c* *-44 c* *6 c* *-43 c*

Tbn. $\text{11}\overline{\text{B}}$

Tbn. $\text{11}\overline{\text{B}}$

97

Vln. *-7 c* *-49 c*

Tbn. $\text{11}\overline{\text{B}}$

Tbn. $\text{11}\overline{\text{B}}$

100

Vln. *+75 c* *+75 c* *+75 c* *+15 c*

Tbn. $\text{11}\overline{\text{B}}$

Tbn. $\text{11}\overline{\text{B}}$

IV.

Violin $\text{♩} = 55$ $-38 c$ $-31 c$ $-38 c$ $-55 c$
f

Trombone *f*

Trombone *f*

Vln. 107 $+6 c$ $+61 c$ $-38 c$
 $-38 c$

Tbn. $-38 c$

Tbn. $-38 c$

Vln. 111 $+6 c$ $+31 c$ $-38 c$ $+6 c$ $-60 c$ $-38 c$
 $-38 c$ $-38 c$

Tbn. $-38 c$ $-38 c$

Tbn. $-38 c$ $-38 c$

Vln. 114 $-15 c$ $+34 c$

Tbn.

Tbn.

Vln. 117 $-38 c$

Tbn.

Tbn.

121

Vln. *-38 c* *-38 c* *-38 c* *+3 c* *+6 c* *+61 c*

Tbn. *-38 c* *-38 c* *-38 c* *+3 c* *+6 c* *+61 c*

Tbn. *-38 c* *-38 c* *-38 c* *+3 c* *+6 c* *+61 c*

125

Vln. *-38 c* *+38 c* *-38 c* *-38 c*

Tbn. *-38 c* *+38 c* *-38 c* *-38 c*

Tbn. *-38 c* *+38 c* *-38 c* *-38 c*

129

Vln. *+34 c* *+31 c* *+44 c* *+81 c* *+6 c* *-38 c* *-16 c* *-38 c*

Tbn. *-38 c* *-38 c* *-38 c* *-38 c* *-38 c* *-38 c* *-38 c* *-38 c*

Tbn. *-38 c* *-38 c* *-38 c* *-38 c* *-38 c* *-38 c* *-38 c* *-38 c*

133

Vln. *+61 c* *-60 c* *-38 c* *-38 c*

Tbn. *-38 c* *-38 c* *-38 c* *-38 c*

Tbn. *-38 c* *-38 c* *-38 c* *-38 c*

135

Vln. *+6 c* *+61 c*

Tbn. *-38 c*

Tbn. *-38 c*