

DARK FORCES SIGNIFY

FOR THREE RETUNED, COMPUTER-DRIVEN PIANOS

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Technical Specifications

The 33-pitch tuning of the three pianos (the same in every octave) is as follows, given first in the number of cents above E-flat, and then as ratios to the nearest E-flat 1/1 below:

Piano	1		2		3	
D	1088	15/8	977	225/128	1044	117/64
Db	969	7/4	938	55/32	906	27/16
C	857	105/64	773	25/16	840	13/8
B	738	49/32	755	99/64	729	195/128
Bb	702	3/2	590	45/32	609	91/64
A	551	11/8	551	11/8	481	169/128
Ab	471	21/16	440	165/128	408	81/64
G	386	5/4	320	77/64	342	39/32
Gb	204	9/8	275	75/64	275	75/64
F	155	35/32	192	143/128	192	143/128
E	92	135/128	53	33/32	27	65/64
Eb	0	1/1	1103	121/64	1173	63/32

Note that no string needs to be raised higher than its natural tuning except for the B-flat on piano 1, which is 2¢ sharp (or if one prefers, 2¢ could be subtracted from all quantities).

For electronic realization of the piece, it can prove helpful to reconfigure the tuning as a reference pitch in cycles per second for each piano, and ratios derived from that standard:

Tuning pitch:	38.891 cps	36.7641 cps	38.2833 cps
D	15/8	225/121	13/7
Db	7/4	20/11	12/7
C	105/64	200/121	104/63
B	49/32	18/11	65/42
Bb	3/2	180/121	13/9
A	11/8	16/11	169/126
Ab	21/16	15/11	9/7
G	5/4	14/11	26/21
F#	9/8	150/121	25/21
F	35/32	13/11	143/126
E	135/128	12/11	65/63
Eb	1/1	1/1	1/1

In the configuration of certain tuning softwares, the following sequences might facilitate getting the required tuning:

Piano 1:

38.891 = Eb0

1/1, 135/128, 35/32, 9/8, 5/4, 21/16, 11/8, 3/2, 49/32, 105/64, 7/4, 15/8

Piano 2:

36.7641485 = Eb0

1/1, 12/11, 13/11, 150/121, 14/11, 15/11, 16/11, 180/121, 18/11, 200/121, 20/11, 225/121

Piano 3:

38.283333 = Eb0

1/1, 65/63, 143/126, 25/21, 26/21, 9/7, 169/126, 13/9, 65/42, 104/63, 12/7, 13/7

For purposes of analysis, the entire scale (which I refer to as my 8x8 scale) is given below, grouping its pitches into eight harmonic series' on the 1st, 3rd, 5th, 7th, 9th, 11th, 13th, and 15th harmonics of E-flat, and naming each pitch in a typographical equivalent of Ben Johnston's just-intonation notation:

Pitch name	Ratio	Cents	1/1	3/2	5/4	7/4	9/8	11/8	13/8	15/8
Db^^-	121/64	1103						11		
D	15/8	1088	15	5	3					1
Db13	117/64	1044					13		9	
C#+	225/128	977								15
Db7	7/4	969	7			1				
C^	55/32	938			11			5		
C+	27/16	906		9			3			
C7+	105/64	857				15				7
Cb13	13/8	840	13						1	
B	25/16	773			5					
Bb^	99/64	755					11	9		
Cb77+	49/32	738				7				
Bb13	195/128	729							15	13
Bb	3/2	702	3	1						
Bbb713	91/64	609				13			7	
A+	45/32	590		15	9		5			3
Ab^	11/8	551	11					1		
Abb1313	169/128	481							13	
Ab7+	21/16	471		7		3				
G^	165/128	440						15		11
G+	81/64	408					9			
G	5/4	386	5		1					
Gb13	39/32	342		13					3	
Gb7^	77/64	320				11		7		
F#+	75/64	275			15					5
F+	9/8	204	9	3			1			
Fb13^	143/128	192						13	11	
F7+	35/32	155			7	5				
E+	135/128	92					15			9
Eb^	33/32	53		11				3		
Eb13	65/64	27			13				5	
Eb	1/1	0	1							
Eb7+	63/32	1173				9	7			

In Johnston's notation, + raises a pitch by 81/80, # raises it by 25/24, b lowers it by 24/25, 7 lowers it by 35/36, ^ raises it by 33/32, 13 raises it by 65/64, and F-A-C, C-E-G, and G-B-D are all perfectly tuned 4:5:6 major triads.

Dark Forces Signify

Kyle Gann
2016

♩ = 64

Piano 1

Piano 2

Pno1

Pno2

Pno1

Pno2

Pno3

10

Pno1

Pno2

Pno3

Ped.



14

Pno1

Pno2

Pno3

Ped.

p

17

Pno1

Pno2

Ped.



20

Pno1

Pno2

Ped.

23

Pno1

Pno2

Pno3

Ped.

5

26

The musical score consists of three systems, each for a different piano part (Pno1, Pno2, Pno3). Each system has a grand staff with a treble and bass clef. Pno1 starts at measure 26 with a treble clef and a key signature of one flat. Pno2 and Pno3 have treble clefs and a key signature of two sharps. Pedal markings 'Ped.' are present in measures 27 and 28 for Pno2, and in measures 27 and 28 for Pno3. A dynamic marking 'p' is present in measure 28 for Pno3.

30

Pno1

Pno2

Ped.



33

Pno1

Pno2

Pno3

Ped.

37

Pno1

Pno2

Pno3

Ped. _____

Ped. _____

Ped. _____



40

Pno1

Pno3

Ped. _____

Ped. _____

44

Pno1

Pno2

p

p

Ped.

Ped.

Ped.

Detailed description: This system contains measures 44, 45, and 46. Pno1 (Piano 1) has a treble clef and a 4/4 time signature. Measure 44 starts with a piano (*p*) dynamic and a half note chord of G#4 and B4. A slur covers the notes G#4, B4, and D5 in measures 44, 45, and 46. Pno2 (Piano 2) has a treble and bass clef. Measure 44 has a piano (*p*) dynamic and a half note chord of G#4 and B4. Measures 45 and 46 feature a continuous eighth-note accompaniment in the bass clef, with a 'Ped.' marking under the first measure of each. Measure 46 has a 'Ped.' marking under the first measure of the eighth-note accompaniment.



47

Pno1

Pno2

Ped.

Ped.

Detailed description: This system contains measures 47, 48, and 49. Pno1 (Piano 1) has a treble clef and a 4/4 time signature. Measure 47 has a half note chord of G#4 and B4. Measure 48 has a half note chord of G#4 and B4. Measure 49 has a half note chord of G#4 and B4. Pno2 (Piano 2) has a treble and bass clef. Measure 47 has a half note chord of G#4 and B4. Measures 48 and 49 feature a continuous eighth-note accompaniment in the bass clef, with a 'Ped.' marking under the first measure of each.

49

Pno1

5

Ped.

Ped.



52

Pno1

Ped.

Ped.

Ped.

Pno2

Pno3

Ped.

55

Pno1

Pno2

Pno3

The musical score consists of three systems, each for a different piano part. The first system, Pno1, has a treble and bass staff. The second system, Pno2, also has a treble and bass staff. The third system, Pno3, has a treble and two bass staves. The score begins with a treble clef and a 4/4 time signature. At the start of the second measure, the time signature changes to 3/4 for Pno1 and Pno2. The key signature is one flat (B-flat). Pedal markings ('Ped.') are placed under the bass lines of Pno1, Pno2, and Pno3, indicating sustained notes. The notation includes various chords, arpeggios, and melodic lines.

59

Pno1

Pno2

Pno3

The musical score consists of three systems, each for a piano (Pno1, Pno2, Pno3). Each system has a treble and bass staff. Pno1 starts at measure 59 with a treble staff containing notes and a bass staff with a continuous eighth-note pattern. A 'p' dynamic marking is placed below the first measure of the Pno1 bass staff. Pno2 and Pno3 have treble staves with notes and rests, and bass staves with notes and rests. Pedal markings ('Ped.') are located under the bass staves of Pno1, Pno2, and Pno3. The page number '11' is in the top right corner.

63

Pno1

Ped.

Pno2

Ped.

66

Pno1

Pno2

Pno3

The musical score is for three pianos, labeled Pno1, Pno2, and Pno3. It begins at measure 66. Pno1 is in the treble clef with a sharp sign and a bass clef with a 3/4 time signature. Pno2 is in the treble clef with a sharp sign and a bass clef with a 3/4 time signature. Pno3 is in the treble clef with a sharp sign and a bass clef with a 3/4 time signature. The score includes various chords, melodic lines, and pedal markings (Ped.) with brackets indicating duration. Dynamics like 'p' are also present.

70

Pno1

Pno2

Pno3

p

5

Ped.

Ped.

Ped.

Detailed description: The score is for three pianos. Pno1 (top) starts at measure 70 with a treble clef staff containing a melodic line with a fermata and a bass clef staff with a rhythmic accompaniment. A dynamic marking of *p* is present. Pno2 (middle) has two staves with chords and a rhythmic accompaniment. Pno3 (bottom) has two staves with a single chord and a rhythmic accompaniment. Pedal markings (Ped.) are present under the bass clef staves of Pno1, Pno2, and Pno3. A fingering '5' is indicated for Pno1.

73

Pno1

Ped. _____

Pno2



77

Pno1

Ped. _____

Pno2

Pno3

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80

Pno1

Pno2

5

5

Ped.

Ped.



83

Pno1

Pno2

Pno3

p

p

Ped.

Ped.

87

Pno1

Pno2

Pno3

The musical score consists of three parts: Pno1, Pno2, and Pno3. Pno1 is the most active part, featuring a complex chordal texture in the treble clef and a continuous eighth-note bass line in the bass clef. The bass line is marked with 'Ped.' (pedal) and has a 'p' (piano) dynamic marking at the end. Pno2 and Pno3 provide sparse chordal accompaniment, with Pno2 having a treble clef and Pno3 having both treble and bass clefs. The score is marked with measure numbers 87, 88, 89, and 90.

91

Pno1

Ped.

Pno2

p

Pno3

p

The musical score consists of three systems, each for a different piano (Pno1, Pno2, Pno3). The first system (Pno1) features a continuous eighth-note accompaniment in the bass clef, with a 'Ped.' marking below the staff. The second system (Pno2) has a few notes in the first measure and rests in the subsequent measures. The third system (Pno3) has a melodic line in the first measure and sustained chords in the second and third measures. Dynamics include piano (*p*) and a 'Ped.' marking.

94

Pno1

Pno2

Pno3

p

Ped.

Ped.

Detailed description: The score is for three pianos. Pno1 (left) starts at measure 94 with a complex texture. The right hand has a series of chords, and the left hand has a steady eighth-note bass line. Pedal markings are present under the bass line. Pno2 (middle) has a few chords in the final measures. Pno3 (right) has a few notes in the final measures. The dynamic *p* is marked for Pno1 in the final measure.

98

Pno1

Ped. Ped. Ped. Ped.

Pno2

Pno3



101

Pno1

Ped. Ped. Ped.

f

Pno3

105

Pno1

Ped.

Pno2

f

mf

Ped.

Pno3

f

mf

Ped.

109

Pno1

Pno3

The musical score consists of two systems, one for Pno1 and one for Pno3. Each system has a treble and a bass staff. Measure 109 is in 5/4 time. In the Pno1 system, the treble staff has a whole rest, and the bass staff has a whole rest. In the Pno3 system, the treble staff has a melodic line starting with a grace note and a finger number '5', and the bass staff has a rhythmic accompaniment. Measure 110 is in 3/4 time. In the Pno1 system, both staves have complex chords with many notes. In the Pno3 system, the treble staff has a melodic line with a grace note, and the bass staff has a rhythmic accompaniment. Measure 111 is in 3/4 time. In the Pno1 system, both staves have complex chords. In the Pno3 system, the treble staff has a melodic line with a grace note, and the bass staff has a rhythmic accompaniment. Dynamics include *mf* and *Ped.* (pedal). A section change is indicated by a brace under the time signature change from 5/4 to 3/4.

112

Pno1

ff

mf

Ped.

Pno2

ff

Ped.

Pno3

ff

Ped.

116

Pno1

Pno2

Pno3

mf *Ped.*

mf *Ped.*

ff *mf*

Ped. *Ped.*

Ped.

mf *Ped.*

mf *Ped.*

120

Pno1

Pno2

Pno3

mf
Ped.

The musical score is arranged in three systems, each for a different piano (Pno1, Pno2, Pno3). The tempo is marked as 120. The key signature has one flat (B-flat). Pno1 and Pno2 play a rhythmic pattern of eighth notes in the bass clef, with a dynamic marking of *mf* and a pedal marking. Pno2 also has a melodic line in the treble clef. Pno3 has a melodic line in the treble clef and a rhythmic pattern in the bass clef. The score consists of four measures across three systems.

124

Pno1

Pno2

Pno3

mf

mf

mf

Ped.

Ped.

Ped.

127

Pno1

Pno2

Pno3

The musical score is for three pianos (Pno1, Pno2, Pno3) in 3/4 time. Pno1 starts at measure 127 with a complex texture of chords and a bass line. Pno2 and Pno3 are mostly silent, with some final notes and a pedal mark at the end of the piece.

Ped.

Ped.

Ped.

131

Pno1

Ped.

Pno2

Ped.

Pno3

Ped.

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135

Pno1

Pno2

Pno3

The musical score consists of three systems, each for a different piano (Pno1, Pno2, Pno3). The first system (Pno1) starts at measure 135 and features a complex texture with chords and a rhythmic accompaniment. The second system (Pno2) has sparse accompaniment with some chords and rests. The third system (Pno3) also has sparse accompaniment with some chords and rests. Pedal markings are present under the first system.

Ped. Ped. Ped. Ped.

Ped.

139

Pno1

Pno2

Pno3

142

Pno1

Ped.

Ped.

Pno3



146

Pno1

Ped.

Ped.

Pno3

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150

Pno1

p

Ped.

Pno3

p

Ped.



154

Pno1

p p

Ped.

Pno2

p

Ped.

Pno3

p

Ped.

158

Pno1

Pno2

Pno3

Ped.



161

Pno1

Pno3

Ped.

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