

chorale and finely tuned resonators

michael winter (1a, 2013)

instructions:

each part may be played by any sustaining instruments.

all pitches in the piece are derived from harmonics of pitches in a particular bach chorale transposed one octave down. the number below each note indicates the harmonic number of the given pitch from the original pitch in the chorale. a number above a note indicates a cents deviation (1/100th of a tempered semitone) from the written pitch in 12-tone equal temperament. for example, the first note in the piece (in the 4th part) is 31 cents flat of an f# and is equivalent to the 7th harmonic of a g# 2 octaves and a just 7th down.

to facilitate ease of playing, a near just-tuning is used for the score. below is a comparison of the two that gives a cents deviation per harmonic.

just:

1(+0), 2(+0), 3(+2), 4(+0), 5(-14), 6(+2), 7(-31), 8(+0),
9(+4), 10(-14), 11(-49), 12(+2), 13(-59), 14(-31), 15(-12), 16(+0)

near-just:

1(+0), 2(+0), 3(+0), 4(+0), 5(-14), 6(+0), 7(-31), 8(+0),
9(+0), 10(-14), 11(-54), 12(+0), 13(-54), 14(-31), 15(-14), 16(+0)

note that: multiples of the 3rd harmonic are the same as in 12-equal temperament; multiples of the 5th and 7th harmonic are kept just; the difference between the 11th and 13th harmonic is essentially split (the 13th is taken down from the next highest semitone); and the 15th harmonic is brought down 2 cents to match the deviation of multiples of the 3rd harmonic. this results in a tuning where only 4 deviations are needed to achieve the first 16 harmonics of any pitch in 12-tone equal temperament within a just noticeable difference. an ensemble may choose to play a purely just version of the piece by substituting accordingly.

pitches are given in their natural harmonic placement. accidentals apply only to the note they directly precede and octava markings only apply to the note they are directly above. based on the range of the instruments, pitches may be transposed upwards freely by any number of octaves and downwards to the closes available pitch of the same pitch-class.*

in the score, space is proportional to time. measures are given to aid in keeping time but should not be interpreted as indicating any beat structure. a measure should be approximately 4 seconds (or quarter note equals 60 if there were a quarter note).

ideally, the piece should be played by humans, but any number of the parts may be electronically synthesized or prerecorded. note that the parts increase in complexity from the first part to the eighth. included with the score is supercollider code for both the near-just and just versions of the piece. these may be used in performance and/or for practice.

tones should be swelled, entering and exiting as subtly as possible.**

clear; not loud.

*apart from minimizing the number of distinct cents deviations, one of the reasons to use the near-just tuning was to allow string instruments (particularly fretted ones) to retune and play the given pitch on the string with the corresponding cents deviation without microtonal alterations (only transposition by octaves to put the pitch in the range of the string if necessary). the first performance, organized by chaz underinner, was played with 3 of the voices on guitar and the other voices synthesized. chaz worked out a tuning that he found allowed for many of the notes to be played in their written range:

1st guitar: I(-14), II(-54), II(-31)

2nd guitar: II(-14), III(-31), V(-54)

3rd guitar: I(-31), II(-14), III(-54)

4th guitar: I(-14), II(-31), IV(-54)

originally, i had suggested to chaz that each instrument have as distinct a scordatura as possible such that the same strings on different instruments do not have the same cents deviation. i still encourage this as a possibility and it turns out that there are some rather interesting, difficult mathematical problems in finding such solutions given certain constraints (the details of which i will not include here). Of course, performers playing non-fixed pitch string instruments might still find it easier to play without scordatura and simply alter each pitch accordingly as wind instruments would.

**in the first performance, ebows were used with volume pedals until approximately measure 120 where the tone durations become much shorter. at this point, the performers plucked and continued to swell with their volume pedals.

a special thanks to chaz underriner for his help in finalizing this score.

chorale and finely tuned resonators

michael winter (la, 2013)

8ve
-14
15
3

8ve
-14
15

1
1

-31
7

1
1

12
12

8ve
-54
13
4

-31
14

6

8ve
b

9

6

3

-14
5

9

-14
5

11

4

5

8ve
-54

13

6

5

9

-31

7

2

-31

7

2

3

The musical score consists of eight staves, each with four measures. The notation is as follows:

- Staff 1:** Treble clef. Measure 2: Bass clef, note on the 3rd line (F4), with a '3' below it.
- Staff 2:** Treble clef. Measure 3: Note on the 3rd line (F4), with a '3' below it.
- Staff 3:** Treble clef. Measure 3: Note on the 3rd line (F4), with a '-31' above it and a double bar line below it. Measure 4: Note on the 3rd line (F4), with a '7' below it.
- Staff 4:** Treble clef. Empty.
- Staff 5:** Treble clef. Measure 4: Note on the 2nd line (D4), with a '2' below it.
- Staff 6:** Treble clef. Measure 3: Note on the 4th line (A4), with a 'b' above it and a '4' below it.
- Staff 7:** Bass clef. Measure 2: Treble clef, note on the 3rd line (F4), with a '-31' above it, a sharp sign (#) above the note, and a double bar line below it. Measure 4: Note on the 3rd line (F4), with a '7' below it.
- Staff 8:** Bass clef. Measure 4: Treble clef, note on the 4th line (A4), with a '-31' above it, a sharp sign (#) above the note, and a double bar line below it. Measure 5: Note on the 4th line (A4), with a '4' below it.

1

8

3

8ve
-54

11

-14

15

-14

5

-31

7

7

9

-31

7

4

-14

5

8ve

-54

13

2

-14

5

-14

5

The musical score consists of eight staves, each with a five-line staff and a key signature of one sharp (F#). The notation includes various musical symbols and instructions:

- Staff 1:** Treble clef, empty staff.
- Staff 2:** Treble clef, first measure contains a bass clef and a note with a sharp sign and a '1' below it.
- Staff 3:** Treble clef, first measure contains a bass clef and a note with a sharp sign and a '1' below it.
- Staff 4:** Bass clef, first measure contains a treble clef and a note with a sharp sign and a '-14' above it and a '5' below it.
- Staff 5:** Treble clef, empty staff.
- Staff 6:** Bass clef, first measure contains a treble clef and a note with a sharp sign and a '6' below it. The last measure contains a bass clef and a note with a sharp sign and a '1' below it.
- Staff 7:** Treble clef, first measure contains a bass clef and a note with a sharp sign and a '-14' above it and a '5' below it.
- Staff 8:** Treble clef, first measure contains a bass clef and a note with a sharp sign and a '1' below it.

36

6

4

8ve
-31

4

7

8ve
-14

10

3

-14

5

-31

7

-54

13

41

8ve

9

2

2

1

3

3

8

-31
2

7

-31

7

-14

5

46

6

1

2

-31

14

1

6

2

3

8ve

-14

10

-14

10

51

2

-31

14

1

1

9

3

-14

10

8ve

-31

14

3

-54

11

-14

5

The musical score consists of eight staves, each representing a guitar string. The notation is as follows:

- Staff 1 (Treble Clef):** A single note on the first line (F4) with a flat (b) and a fret number of 1.
- Staff 2 (Treble Clef):** A single note on the first space (G4) with a flat (b) and a fret number of 4.
- Staff 3 (Treble Clef):** A single note on the second line (A4) with a flat (b) and a fret number of 5.
- Staff 4 (Bass Clef):** A single note on the first space (G3) with a flat (b) and a fret number of 1.
- Staff 5 (Treble Clef):** A single note on the second line (A4) with a flat (b) and a fret number of 4.
- Staff 6 (Treble Clef):** A single note on the second space (B4) with a flat (b) and a fret number of 5.
- Staff 7 (Treble Clef):** A single note on the third space (C5) with a flat (b) and a fret number of 10.
- Staff 8 (Treble Clef):** A single note on the first space (G4) with a sharp (#) and a fret number of 2.

Additional markings include:

- A double bar line on the first staff.
- A double bar line on the second staff.
- A double bar line on the third staff.
- A double bar line on the fourth staff.
- A double bar line on the fifth staff.
- A double bar line on the sixth staff.
- A double bar line on the seventh staff.
- A double bar line on the eighth staff.

61

2

-14

5

2

3

9

8ve

-54

11

-14

10

-14

5

-31

7

3

11

8ve

-54

11

-14

5

8ve

-14

10

1

66

66

6

3

6

8ve

16

8ve -54

11

9

3

-54

13

1

1

-14

5

71

Staff 1: Treble clef. Measure 3: F#4 (fingering 4).

Staff 2: Treble clef. Measure 2: D3 (fingering 3).

Staff 3: Treble clef. Measure 3: F1 (fingering 1).

Staff 4: Treble clef. Measure 2: F#5 (-14, fingering 5). Measure 4: D7 (-31, fingering 7).

Staff 5: Treble clef. Measure 1: Bb7 (-31, fingering 7). Measure 4: F#4 (fingering 4).

Staff 6: Treble clef. Measure 2: D10 (-14, fingering 10). Measure 4: F#13 (-54, fingering 13).

Staff 7: Bass clef. Measure 1: Bb7 (-31, fingering 7). Measure 4: D8 (fingering 8).

Staff 8: Treble clef. Measure 3: D5 (-14, fingering 5).

76

Staff 1: Treble clef. Measure 1: Bb2. Measure 5: -14, 5.

Staff 2: Treble clef. Measure 1: Bb4. Measure 4: B#1.

Staff 3: Bass clef. Measure 2: 1. Measure 5: 2.

Staff 4: Treble clef. Measure 3: -54, 11. Measure 5: 1.

Staff 5: Treble clef. Measure 4: 1.

Staff 6: Treble clef. Measure 4: -14, 5.

Staff 7: Treble clef. Measure 3: -14, 5.

Staff 8: Treble clef. Measure 1: 6. Measure 5: 3.

81

1

3

2

-31

7

1

-14

5

2

-31

7

8ve

-31

7

-31

1

7

14

14

3

12

4

-54

11

-14

5

86

-31

7

1

2

6

3

1

1

1

5

5

3

1

3

8ve
-31

7

10

-14

-31

7

9

11

8ve
-54

-54

13

13

91

The musical score consists of eight staves, each with four measures. The notation includes various musical symbols and fingerings:

- Staff 1:** Treble clef. Notes: G4 (fingering 2), G3 (fingering 1), G4 (fingering 3), G#4 (fingering 1).
- Staff 2:** Bass clef. Notes: G2 (fingering 1), G#2 (fingering 1), G4 (fingering 2).
- Staff 3:** Bass clef. Notes: G#2 (fingering 2), G#4 (fingering 10, marked -14), G#4 (fingering 5, marked -14).
- Staff 4:** Treble clef. Notes: G#4 (fingering 7, marked -31), G4 (fingering 3).
- Staff 5:** Treble clef. Notes: Gb4 (fingering 9), Gb4 (fingering 6), G#4 (fingering 15, marked -14).
- Staff 6:** Treble clef. Notes: G4 (fingering 5, marked -14), G4 (fingering 5, marked -14), G4 (fingering 5, marked -14).
- Staff 7:** Treble clef. Notes: Gb4 (fingering 14, marked 8ve, -31), G3 (fingering 3), G#4 (fingering 6).
- Staff 8:** Treble clef. Notes: Gb4 (fingering 9, marked 8ve), Gb4 (fingering 3), Gb4 (fingering 7, marked 8ve, -31).

The musical score consists of eight staves, each with a treble clef. The score is divided into four measures by vertical bar lines. The notes and fingerings are as follows:

Staff	Measure 1	Measure 2	Measure 3	Measure 4
1		$\sharp$ 1		1
2	4		2	
3	$\sharp$ 7		6	$\sharp$ 4
4	$\sharp$ 12		-14 5	
5		-14 5	8ve -14 5	
6	-14 5	-14 10		8ve -54 13
7	-54 11		$\flat$ 3	
8		-31 7	-14 5	-14 5

101

The image displays a musical score for guitar, consisting of six staves. The notation includes various fretted notes, fingerings, and accidentals. The score is organized into six measures, each spanning two staves.

- Measure 1:**
 - Staff 1: Treble clef, note on the 2nd line (F#4) with a '2' below it.
 - Staff 2: Bass clef, note on the 2nd line (F#3) with a '2' below it.
- Measure 2:**
 - Staff 1: Treble clef, note on the 2nd line (F#4) with a '2' below it.
 - Staff 2: Bass clef, note on the 1st line (F#3) with a '1' below it.
- Measure 3:**
 - Staff 1: Treble clef, note on the 2nd line (F#4) with a '2' below it.
 - Staff 2: Bass clef, note on the 1st line (F#3) with a '1' below it.
- Measure 4:**
 - Staff 1: Treble clef, note on the 2nd line (F#4) with a '2' below it.
 - Staff 2: Bass clef, note on the 1st line (F#3) with a '1' below it.
- Measure 5:**
 - Staff 1: Treble clef, note on the 2nd line (F#4) with a '2' below it.
 - Staff 2: Bass clef, note on the 1st line (F#3) with a '1' below it.
- Measure 6:**
 - Staff 1: Treble clef, note on the 2nd line (F#4) with a '2' below it.
 - Staff 2: Bass clef, note on the 1st line (F#3) with a '1' below it.

106

1

14

5

3

6

5

3

6

1

5

7

5

10

11

7

11

8ve
-31

14

4

4

13

1

111

111

16

6

6

7

3

13

3

8ve

9

1

9

9

4

5

6

5

3

1

23

116

3 1 9

#1 4 13

3 4

3 10

2 7 5

-14 5 5 3

-31 7 14

4 9

126

The musical score is composed of eight staves, each representing a different string of a 12-string guitar. The notation includes various fret numbers (e.g., 2, 6, 10, 13) and accidentals (sharps, flats) placed above or below the notes. Some notes are marked with '8ve' (octave) or '-54' (fret). The score is organized into measures by vertical bar lines.

Staff 1 (Top): Bass clef. Notes include 2, 6, 10, 3, 8, 1, 13, 1. Accidents: 6 (flat), 10 (sharp), 13 (sharp).

Staff 2: Bass clef. Notes include 3, 8, 11, 2, 9, 1, 8, 2, 5, 1. Accidents: 3 (sharp), 9 (flat), 1 (flat), 8 (sharp), 5 (flat).

Staff 3: Treble clef. Notes include 7, 12, 4, 1, 4, 1, 5, 13, 7, 1. Accidents: 7 (flat), 12 (sharp), 1 (flat), 4 (sharp), 5 (sharp), 13 (flat).

Staff 4: Treble clef. Notes include 5, 5, 2, 7, 11, 7, 3, 5, 1, 5. Accidents: 5 (flat), 2 (flat), 7 (flat), 11 (sharp), 3 (flat), 5 (flat).

Staff 5: Treble clef. Notes include 10, 7, 6, 5, 13, 5, 9, 6, 4, 1. Accidents: 7 (flat), 13 (flat), 5 (flat), 4 (sharp).

Staff 6: Treble clef. Notes include 7, 13, 13, 3, 7, 2, 13, 2, 3, 11, 16, 4, 7. Accidents: 7 (sharp), 13 (sharp), 3 (flat), 7 (flat), 2 (sharp), 11 (flat), 16 (flat), 7 (sharp).

Staff 7: Treble clef. Notes include 6, 11, 7, 11, 10, 10, 3, 4, 7. Accidents: 6 (flat), 11 (sharp), 7 (flat), 10 (flat), 3 (sharp), 4 (sharp).

Staff 8 (Bottom): Bass clef. Notes include 1, 13, 10, 13, 3, 4, 5, 7, 9, 11. Accidents: 1 (sharp), 13 (sharp), 10 (flat), 3 (sharp), 4 (flat), 5 (flat), 7 (flat), 9 (flat), 11 (flat).

8ve
-54
-14

2 11 15 3 5 3 1 1

4 #1 11 9 3 9 2 4 5 1

-54 8ve
-31 -14

11 1 3 6 14 3 5 1 9

2 3 #2 3 1 5 14 7 7 11

1 8 -14 8 8ve
-14 -14 8ve 8ve -31 8ve

1 5 8 9 5 10 12 8 7

-14 -14 # 2 1 1 6 9 6 4

3 5 5 8

8ve -31 -31 -14 -14 8ve
-31

9 14 4 9 7 7 5 5 7

-14 -14 8ve 8ve -14 -31 8ve
-54

10 5 16 10 5 7 7 2 11 3

136

The musical score consists of 8 staves, each containing a series of notes and fret numbers. The notation includes various accidentals (sharps, flats, naturals) and dynamic markings (8ve, -14, -31, -54). The score is divided into measures by vertical bar lines.

Staff 1: 12, 1, 4, 9, 15, 3, 3, 9, 5, 3, 5

Staff 2: 8, 1, 10, 2, 4, 4, 2, 2, 1, 2, 2

Staff 3: 1, 7, 13, 5, 7, 10, 5, 5, 5, 5, 7

Staff 4: 5, 4, 7, 4, 11, 8, 5, 3, 6, 8

Staff 5: 5, 4, 1, 5, 9, 4, 1, 8, 2, 11

Staff 6: 11, 13, 5, 7, 7, 7, 3, 1, 6, 7

Staff 7: 3, 11, 9, 3, 5, 7, 2, 11, 7, 7, 5

Staff 8: 10, 10, 9, 6, 5, 7, 1, 7, 15, 13

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part 1

8ve
-14

15

3

6

11

4

16

3

21

1

26

-31

7

31

36

b
6

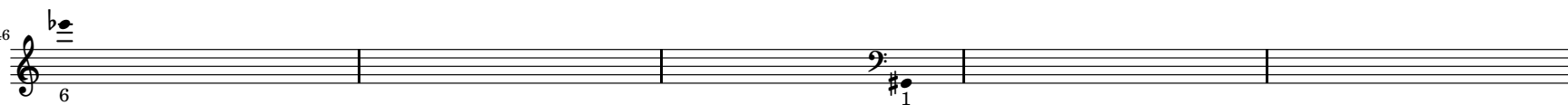
part 1

41



8ve
9

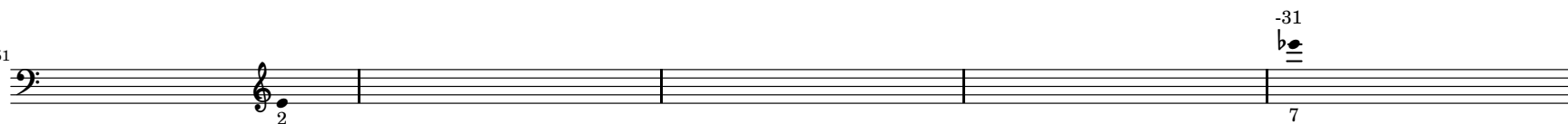
46



b
6

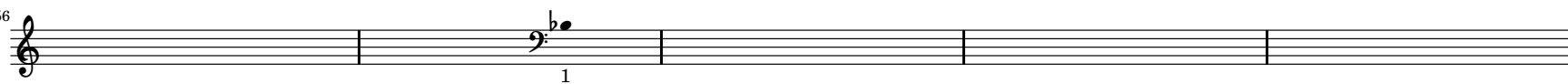
1

51



2
-31
7

56



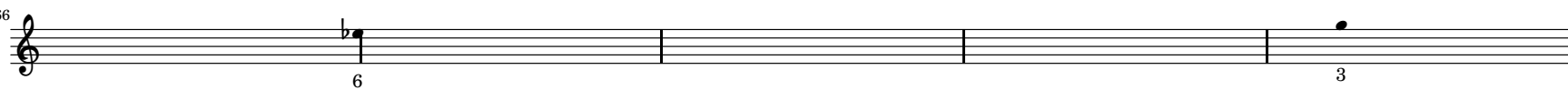
b
1

61



2
2

66



b
6
3

71



4

76



b
2
-14
5
2

part 1

81

1

#1

The first system of the musical score is written on a single staff. It begins with a treble clef, a key signature of one sharp (F#), and a common time signature (C). The first measure contains a quarter note on G4, with the number '7' written below it. The second measure is empty. The third measure contains a quarter note on B3, with the number '1' written below it. The fourth measure is empty. The fifth measure contains a quarter note on D4, with the number '2' written below it. The sixth measure is empty. The system ends with a double bar line. Above the first measure, the number '86' is written. Above the third measure, the number '-31' is written.

91

2

1

3

1

96

101

2 1

The first system of the musical score for 'The Rose Tree' consists of two staves. The top staff is in treble clef and contains a single note, G4, marked with a '1' below it. The bottom staff is in bass clef and contains a single note, G3, marked with a '3' below it. The system is numbered '106' at the beginning.

111

The musical notation for Example 111 consists of two staves. The left staff is a bass clef, and the right staff is a treble clef with a sharp sign. The notation is a single horizontal line with a vertical bar at the end, indicating a measure.

116

3

1

9

part 1

121

9 7 12 9 8 1

2 6 1 3 6 10 3 8 1 13 1

2 11 15 3 5 3 1 1

12 1 4 9 15 3 3 9 5 3 5

-31

-14

8ve -54

-14

8ve -54

-14

8ve

-14

-14

8ve

-14

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part 2

8ve

-14

15

8ve

b

9

-14

5

3

8

9

1

4

part 2

41

2

46

2

51

-31

14

56

4

61

-14

5

66

6

71

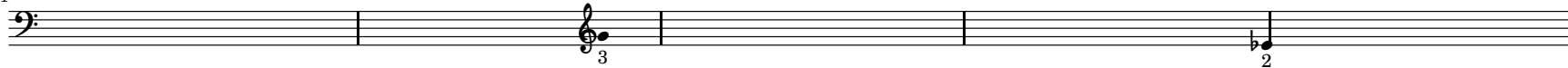
3

76

4

part 2

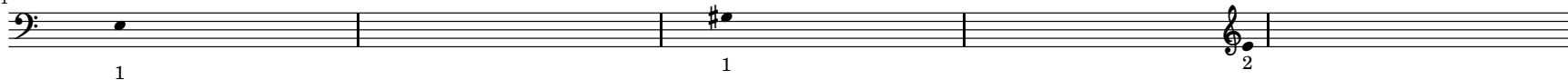
81



86



91



96



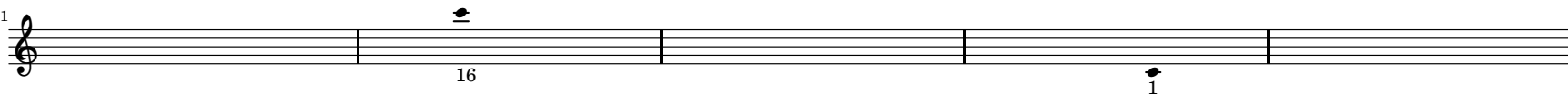
101



106



111



116



part 2

121

8ve
-31

14

1

2

2

1

3

126

3

8

11

2

9

1

1

8

2

5

1

131

4

1

11

9

3

9

2

4

5

1

136

8

1

10

2

4

4

2

2

2

1

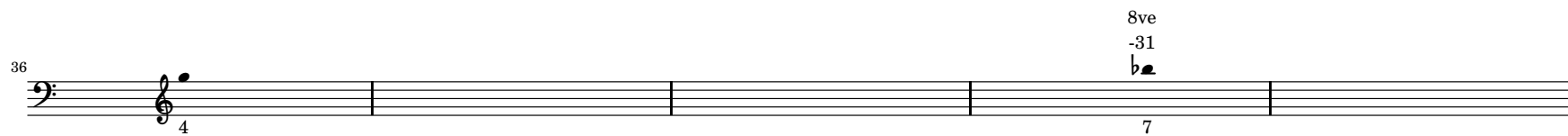
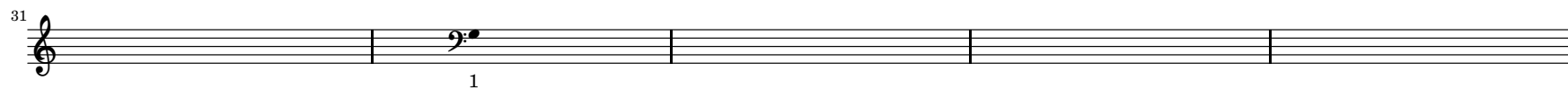
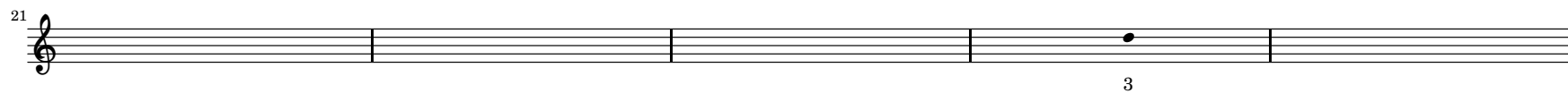
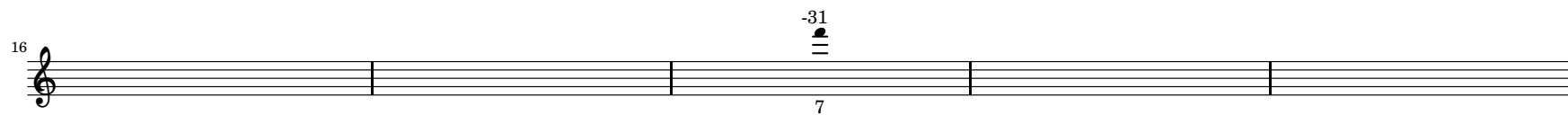
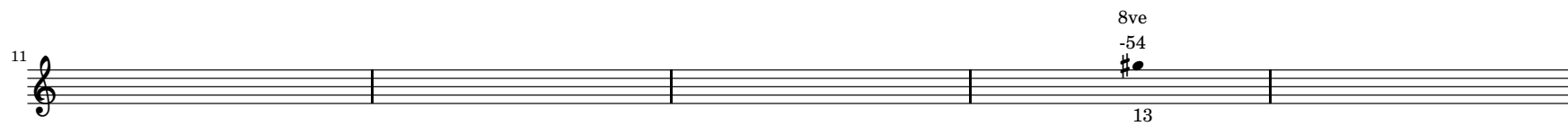
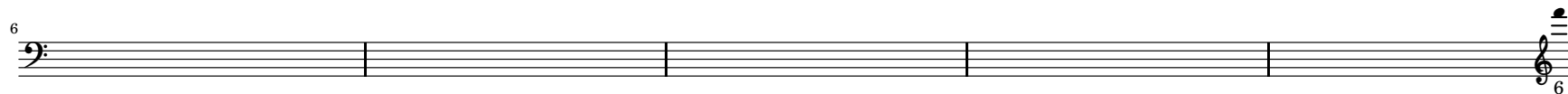
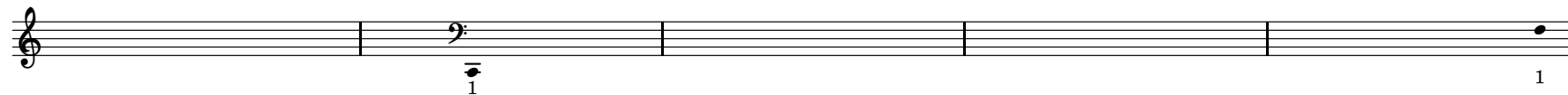
2

2

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part 3



part 3

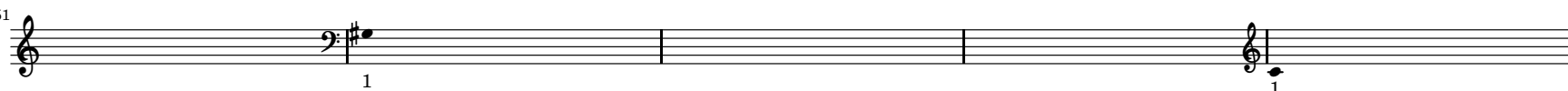
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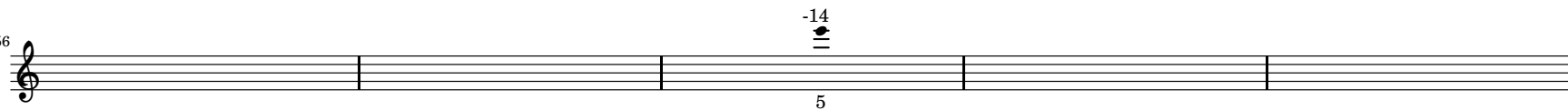
46



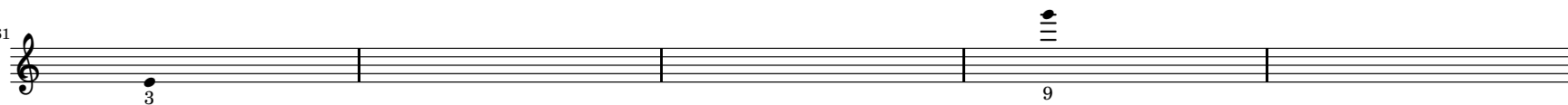
51



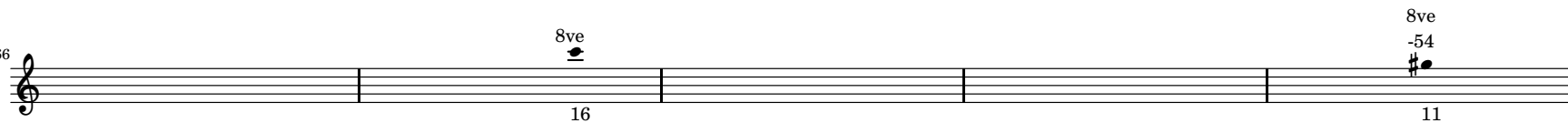
56



61



66



71



76



part 3

81

86

91

96

101

106

111

116

part 3

121

2 1 14 1 10 1 5 1 3

8ve -31 -14 -14

126

7 12 4 1 4 1 5 13 7 1

-31 8ve -54 -31 -14

131

11 1 3 6 14 3 5 1 9

-54 8ve -31 -14

136

1 7 13 5 7 10 5 5 5 7

-31 -54 -14 8ve -14 -14 -14 -31

chorale and finely tuned resonators

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part 4

4

6

11

16

21

26

31

36

7

3

6

5

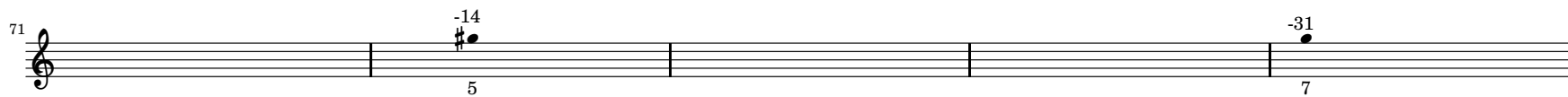
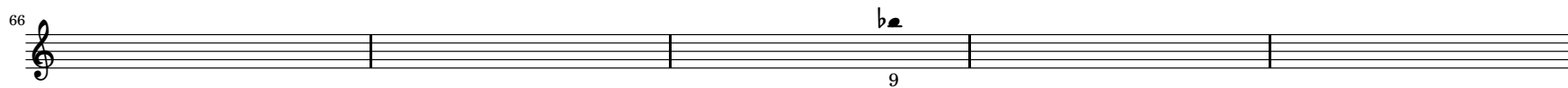
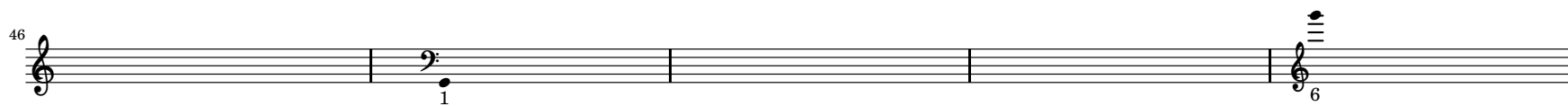
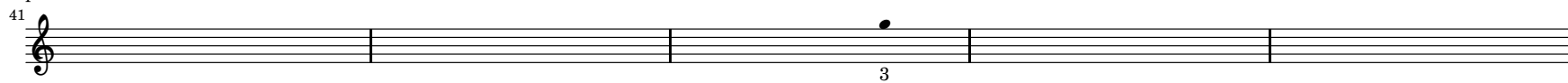
11

4

5

10

part 4



part 4

81

-14

5

2

86

-14

5

-14

5

91

-31

7

3

96

12

-14

5

101

-14

15

12

10

9

106

-14

5

-31

7

111

8ve

-54

3

13

3

116

-14

10

3

3

part 4

The image displays four staves of musical notation, each representing a different part of a piece. The notation includes fret numbers and accidentals for various notes. The staves are labeled with measure numbers 121, 126, 131, and 136.

Staff 1 (Measure 121): Notes are on a treble clef staff. Fret numbers are 5, 4, 13, 2, 15, 13, 3, and 9. Accidentals include a sharp on the 2nd fret and a flat on the 9th fret. Labels above the staff include -14, -54, 8ve -14, and 8ve -54.

Staff 2 (Measure 126): Notes are on a treble clef staff. Fret numbers are 5, 5, 2, 7, 11, 7, 3, 5, 1, and 5. Accidentals include a flat on the 7th fret, a sharp on the 11th fret, and a flat on the 5th fret. Labels above the staff include -14, -14, -31, -54, 8ve -31, -14, and -14.

Staff 3 (Measure 131): Notes are on a treble clef staff. Fret numbers are 2, 3, 2, 3, 1, 5, 14, 7, 7, and 11. Accidentals include a sharp on the 2nd fret, a flat on the 3rd fret, and a flat on the 11th fret. Labels above the staff include -14, -31, 8ve -31, 8ve -31, and -54.

Staff 4 (Measure 136): Notes are on a treble clef staff. Fret numbers are 5, 4, 7, 4, 11, 8, 5, 3, 6, and 8. Accidentals include a flat on the 7th fret, a sharp on the 4th fret, and a flat on the 5th fret. Labels above the staff include -14, -31, -54, -14, and 8ve.

chorale and finely tuned resonators

michael winter (la, 2013)

part 5

Musical staff 1 (Measures 1-4): Treble clef. Measure 2 contains a bass clef and a sharp sign. Measure 3 contains a note with a subscript 1.

Musical staff 2 (Measures 5-8): Bass clef. Measure 8 contains a treble clef, a note with a subscript 5, and a sharp sign with a -14 above it.

Musical staff 3 (Measures 9-12): Treble clef. Measure 12 contains a sharp sign and a 9 below the staff.

Musical staff 4 (Measures 13-16): Treble clef. Measure 16 contains a note with a 2 below the staff.

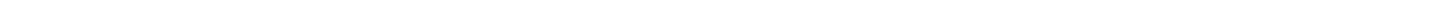
Musical staff 5 (Measures 17-20): Treble clef. No notes or markings.

Musical staff 6 (Measures 21-24): Treble clef. Measure 22 contains a sharp sign with a -14 above it and a 5 below the staff. Measure 24 contains a sharp sign with an 8ve above it, a -54 above it, and a 13 below the staff.

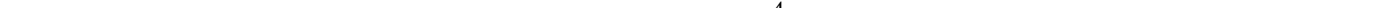
Musical staff 7 (Measures 25-28): Treble clef. No notes or markings.

Musical staff 8 (Measures 29-32): Treble clef. Measure 29 contains a note with a flat sign and a 3 below the staff.

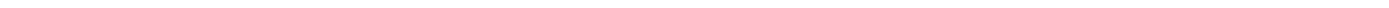
part 5

41 

46 

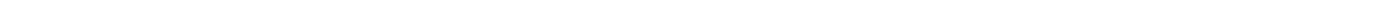
56 

66



3

76



1
2

part 5

81

-31
#

7

8ve
-31
b

7

86

3

1

3

91

b

9

6

15

-14

96

-14

5

8ve
-14

5

101

3

-14

5

106

-14

5

-14

5

-14

10

111

8ve

9

1

116

-31

2

7

3

-14

5

part 5

121

126

131

136

chorale and finely tuned resonators

michael winter (la, 2013)

part 6

Musical staff 1 (treble clef): Measure 12 contains a note with a flat and a sharp symbol.

Musical staff 2 (treble clef): Measure 9 contains a note with a sharp symbol.

Musical staff 3 (treble clef): Measure 7 contains a note with a sharp symbol and a -31 symbol.

Musical staff 4 (treble clef): Measure 4 contains a note with a flat and a sharp symbol.

Musical staff 5 (treble clef): Measure 15 contains a note with a sharp symbol and a -14 symbol.

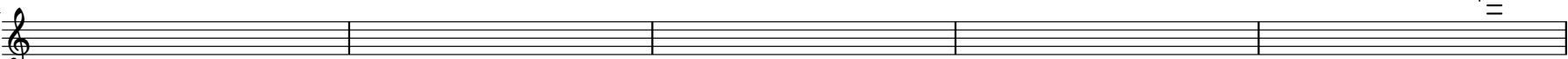
Musical staff 6 (treble clef): Measure 2 contains a note with a flat and a sharp symbol.

Musical staff 7 (bass clef): Measure 6 contains a note with a sharp symbol. Measure 1 contains a note with a sharp symbol.

Musical staff 8 (bass clef): Measure 5 contains a note with a sharp symbol and a -14 symbol.

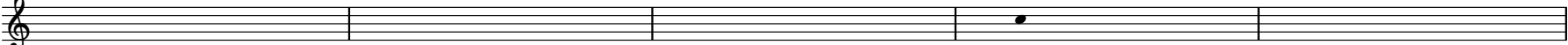
part 6

41



7

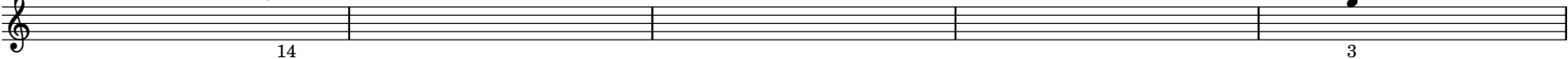
46



3

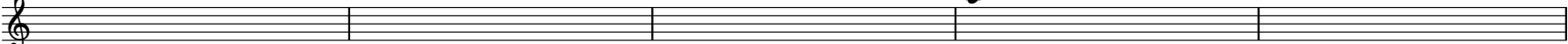
51

8ve
-31
b



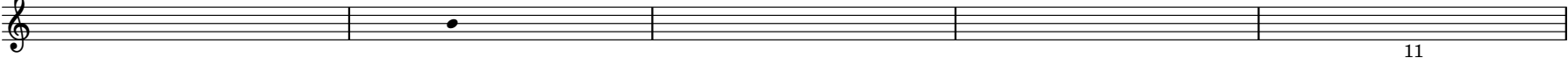
143

56



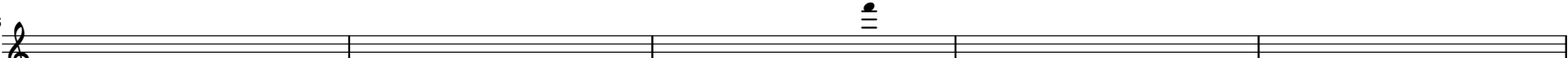
-14
5

61



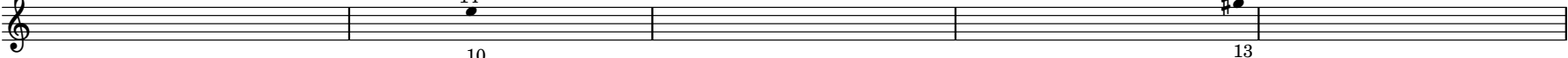
311

66



-54
13

71



-1413

76



-14
52

part 6

81

1

-31

7

-31

14

86

7

10

91

-14

5

-14

5

-14

5

96

-14

5

-14

10

8ve

-54

13

101

8ve

-14

10

-14

5

-14

5

106

-54

11

8ve

-31

7

-54

11

111

9

9

116

-14

5

-14

5

3

3

part 6

121

7 15 10 11 5 7 7 14

126

7 13 13 3 7 2 13 2 3 11 16 4 7

131

3 5 5 8 2 1 1 6 9 6 4

136

11 13 5 7 7 7 3 1 6 7

chorale and finely tuned resonators

michael winter (la, 2013)

part 7

8ve

-54

13

4

6

11

2

-31

16

7

21

-14

5

26

-14

5

31

-14

5

36

-14

5

-31

7

part 7

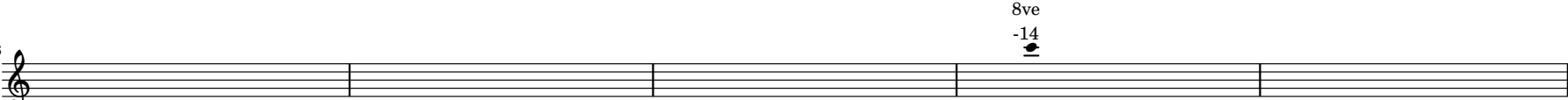
41



-31

7

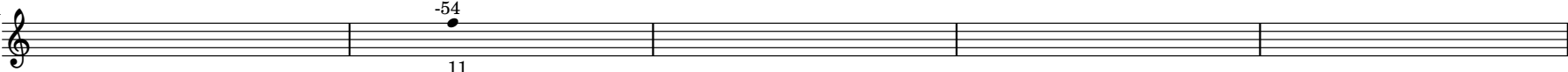
46



8ve
-14

10

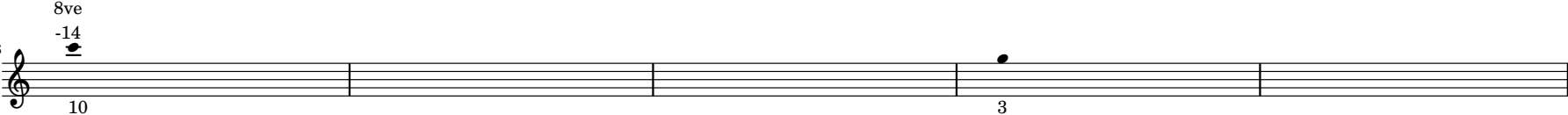
51



-54

11

56

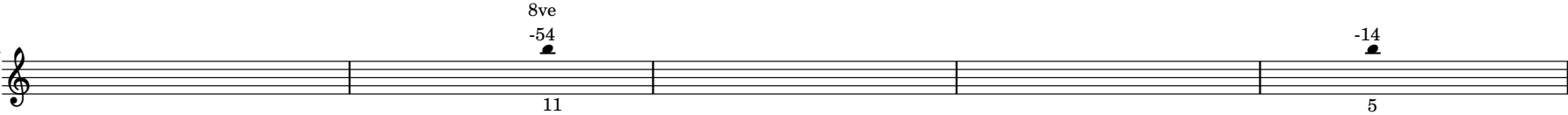


8ve
-14

10

3

61

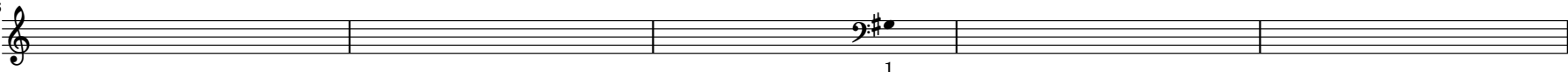


8ve
-54

11

5

66



1

71

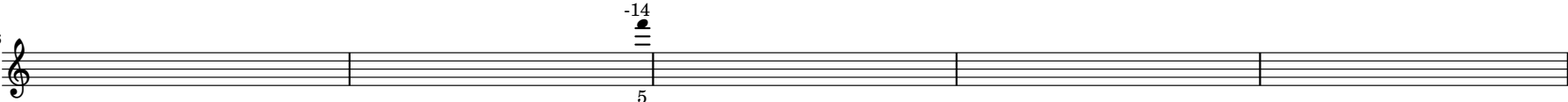


-31

7

8

76



-14

5

2

part 7

81

3 12 4

86

-31 7 9 8ve -54 11

91

8ve -31 14 3 6

96

-54 11 3

101

-31 7 9 8ve

106

8ve -31 14 4 4

111

4 5 -14 6

116

-31 7 3 -31 14

part 7

121

126

131

136

1 8 8 11 3 2 6 5 9

6 11 7 11 10 10 3 4 7

9 14 4 9 7 7 5 5 7

3 11 9 3 5 7 2 11 7 7 5

-54 8ve -31 -14 8ve

-54 8ve -31 -14 8ve

-31 -14 8ve -31 -14 8ve

-54 8ve -31 -14 8ve

chorale and finely tuned resonators

michael winter (la, 2013)

part 8

Staff 1 (Treble clef): Measure 1-4. Measure 3 contains a note with a flat and a sharp, labeled -31, with a 14 below it.

Staff 2 (Treble clef): Measure 1-4. Measure 3 contains a note with a flat, labeled -14, with a 5 below it.

Staff 3 (Treble clef): Measure 1-4. Measure 1 contains a note with a sharp, labeled -31, with a 7 below it. Measure 4 contains a note with a flat, labeled 2.

Staff 4 (Bass clef): Measure 1-4. Measure 4 contains a note with a flat, labeled 4.

Staff 5 (Treble clef): Measure 1-4. Measure 3 contains a note with a flat and a sharp, labeled -31, with a 7 below it.

Staff 6 (Treble clef): Measure 1-4. Measure 3 contains a note with a flat, labeled -14, with a 5 below it.

Staff 7 (Treble clef): Measure 1-4. Measure 1 contains a note with a flat, labeled 1.

Staff 8 (Bass clef): Measure 1-4. Measure 3 contains a note with a flat and a sharp, labeled -54, with a 13 below it.

part 8

41

-14

5

46

-14

10

51

-14

5

56

-31

2

7

61

8ve

-14

10

1

66

-14

1

5

71

-14

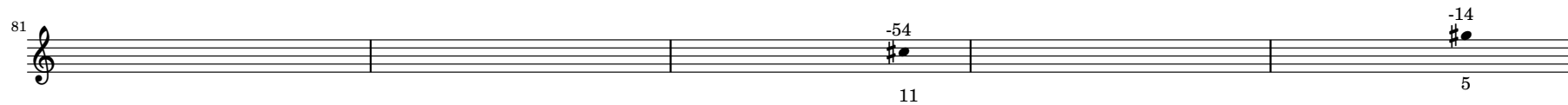
5

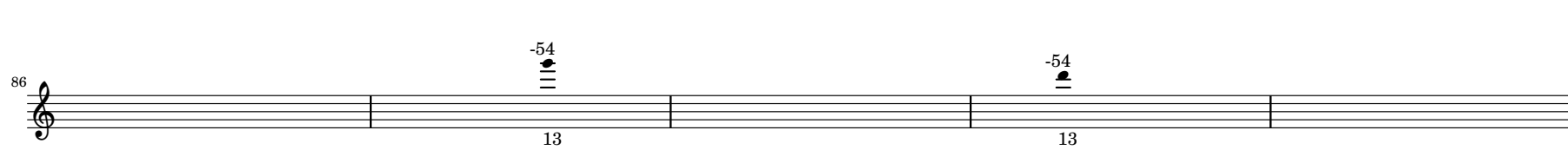
76

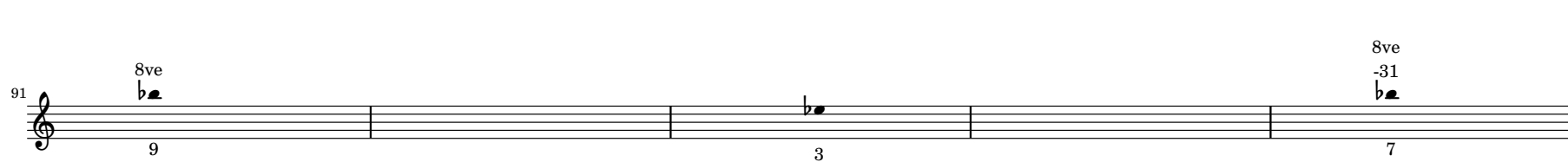
6

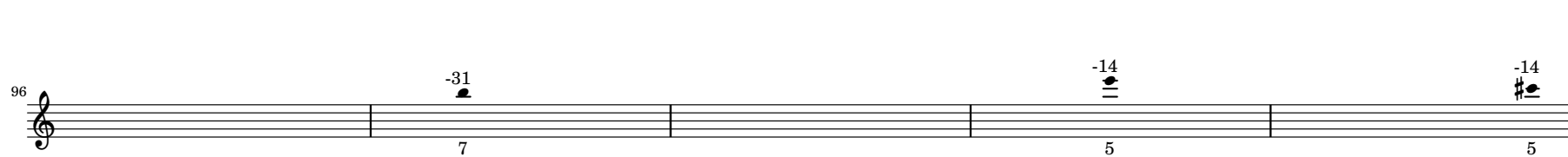
3

part 8

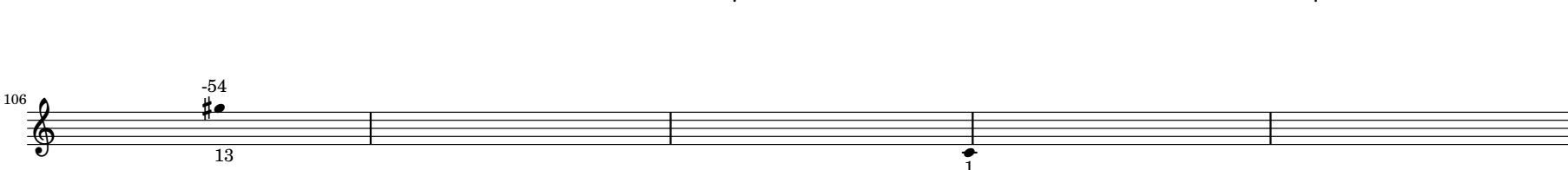
81 
11 5

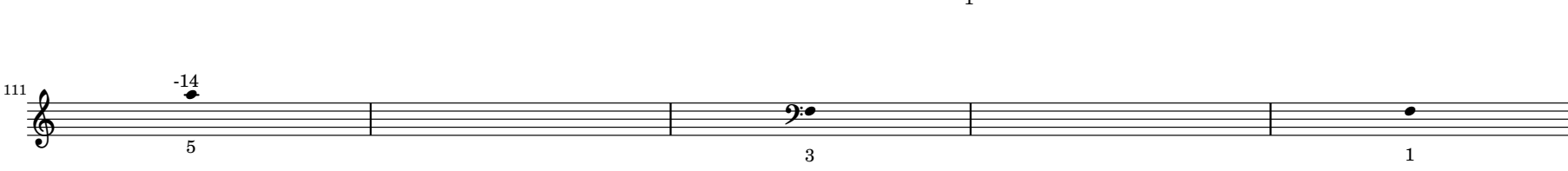
86 
13 13

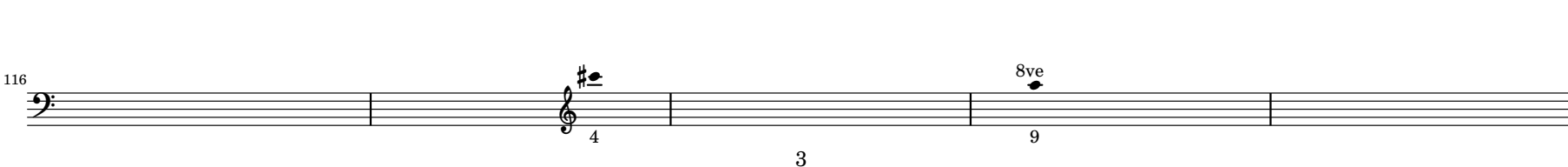
91 
9 3 7

96 
7 5 5

101 
7 7

106 
13 1

111 
5 3 1

116 
4 3 9

part 8

121

126

131

136

8ve -14

8ve -31

8ve -54

-31

8ve -14

8ve -14

-54

8ve -54

-14

-31

8ve -31

-54

8ve -31

-14

-54

10 5 16 10 5 7 7 2 11 3

10 10 9 6 5 7 1 7 15 13

```
//chorale and finely tuned resonators (near-just version) by michael winter. first realization. Supercollider 3.6.3. gpl.
```

```
(var buff, pat, seq, tick = 0, win, play, reset, measurefield, beatfield, clock, transport, beatdur, beatdurfield, vol, volfield;
```

```
buff = Buffer.alloc(s, 512, 1);  
buff.sine1(1.0, true, true, true);
```

```
SynthDef(\sine, { |freq = 440, dur = 1, transpose = 0, amp = 0.1|  
    var out, bufnum = 0, outbus = 0;  
    out = EnvGen.ar(Env.sine(dur, 1), 1, doneAction: 2) * amp * Osc.ar(bufnum, freq * pow(2,transpose/12), 0, 1, 0);  
    Out.ar(outbus, out ! 2);  
}).add;
```

```
pat = {arg transpose, amp, tempo; var v1, v2, v3, v4, v5, v6, v7, v8;
```

```
v1 = Pbind(  
    \instrument, \sine, \transpose, transpose,\amp, amp,  
    \freq, Pseq([0, 1959.62, 523.25, 830.61, 174.61, 207.65, 1631.74, 1244.51, 1760.0, 1244.51, 103.83, 329.63, 1222.42, 233.08, 349.23, 261.63,  
622.25, 783.99, 830.61, 311.13, 1307.89, 174.61, 51.91, 407.93, 116.54, 415.3, 392.0, 65.41, 880.0, 277.18, 277.18, 261.63, 220.0, 261.63, 138.59,  
174.61, 692.83, 174.61, 1038.07, 326.97, 466.16, 233.08, 1174.66, 587.33, 1453.71, 783.99, 698.46, 415.3, 196.0, 116.54, 261.63, 43.65, 329.63,  
1046.5, 1555.35, 311.13, 1108.73, 233.08, 1807.39, 138.59, 466.16, 1914.86, 1555.35, 622.25, 653.95, 783.99, 65.41, 261.63, 1864.66, 51.91, 830.61,  
587.33, 872.91, 261.63, 587.33, 1864.66, 489.91, 392.0, 1099.8]),  
    \dur, tempo * Pseq([8.125, 11.5, 22.125, 24.5, 23.75, 28.125, 24.375, 27.25, 10.125, 11.125, 11.75, 13.375, 10.375, 14.875, 12.375, 10.0,  
13.0, 12.75, 11.875, 12.625, 11.875, 5.75, 8.5, 6.625, 5.5, 8.0, 5.25, 7.0, 5.875, 9.0, 6.375, 8.125, 7.375, 8.0, 7.75, 8.25, 5.875, 9.875, 6.875,  
7.75, 6.125, 7.875, 8.125, 2.5, 2.0, 2.75, 2.375, 2.375, 2.5, 2.5, 1.0, 1.0, 2.0, 2.125, 1.875, 2.375, 2.0, 2.875, 1.75, 2.75, 2.25, 2.25, 2.75,  
2.375, 3.0, 2.625, 1.625, 1.625, 2.625, 1.25, 1.625, 1.125, 1.25, 1.375, 1.875, 2.25, 2.75, 2.5, 1.375]));
```

```
v2 = Pbind(  
    \instrument, \sine, \transpose, transpose,\amp, amp,  
    \freq, Pseq([0, 1745.82, 1864.66, 582.6, 587.33, 1046.5, 1567.98, 138.59, 698.46, 349.23, 130.81, 233.08, 1631.74, 311.13, 311.13, 1244.51,  
872.91, 349.23, 1396.91, 587.33, 932.33, 207.65, 392.0, 311.13, 261.63, 698.46, 233.08, 164.81, 207.65, 329.63, 523.25, 164.81, 174.61, 207.65,  
622.25, 622.25, 519.04, 783.99, 1046.5, 261.63, 51.91, 1046.5, 1138.59, 1831.56, 261.63, 466.16, 261.63, 138.59, 207.65, 415.3, 1318.51, 478.72,  
349.23, 1244.51, 233.08, 261.63, 1661.22, 349.23, 924.82, 58.27, 523.25, 103.83, 639.01, 1567.98, 587.33, 698.46, 261.63, 1046.5, 1307.89, 116.54,  
1396.91, 155.56, 2076.15, 116.54, 349.23, 311.13, 523.25, 261.63, 329.63, 261.63, 174.61]),  
    \dur, tempo * Pseq([9.625, 22.375, 26.5, 10.625, 18.0, 19.625, 17.625, 28.125, 11.375, 14.25, 10.5, 11.375, 10.25, 10.0, 11.375, 14.0, 14.0,  
14.875, 10.875, 14.75, 12.75, 14.125, 8.75, 6.75, 5.375, 6.625, 6.125, 8.0, 6.875, 7.5, 9.5, 7.75, 7.875, 7.125, 6.75, 8.25, 6.875, 8.0, 9.125, 8.875,  
6.875, 9.25, 9.25, 2.5, 1.875, 2.125, 2.625, 1.25, 1.625, 1.375, 1.125, 1.875, 2.5, 1.5, 2.25, 1.875, 1.375, 2.125, 2.5, 1.125, 1.75, 2.25, 2.75,  
2.875, 1.125, 1.625, 2.0, 1.625, 2.5, 2.125, 1.5, 2.625, 2.5, 1.5, 2.375, 2.875, 1.875, 1.125, 1.125, 1.125, 1.0]));
```

```
v3 = Pbind(  
    \instrument, \sine, \transpose, transpose,\amp, amp,  
    \freq, Pseq([0, 65.41, 174.61, 1396.91, 1705.95, 1372.12, 587.33, 1089.05, 196.0, 783.99, 1831.56, 69.3, 1453.71, 207.65, 261.63, 1307.89,  
329.63, 1567.98, 2093.0, 1705.95, 130.81, 130.81, 659.26, 1222.42, 196.0, 277.18, 174.61, 415.3, 1038.07, 549.9, 1453.71, 392.0, 415.3, 233.08,  
218.23, 415.3, 1046.5, 277.18, 1244.51, 783.99, 1831.56, 196.0, 783.99, 155.56, 174.61, 1831.56, 207.65, 653.95, 155.56, 259.52, 174.61, 293.66,  
457.89, 1567.98, 1046.5, 116.54, 698.46, 98.0, 519.04, 1807.39, 1222.42, 174.61, 1278.02, 98.0, 261.63, 987.77, 1831.56, 392.0, 1468.06, 110.0,  
587.33, 207.65, 1453.71, 852.98, 1165.2, 457.89, 1959.62, 1307.89, 436.46, 653.95, 611.21]),  
    \dur, tempo * Pseq([5.25, 14.125, 20.25, 14.375, 15.75, 24.125, 15.625, 15.625, 16.125, 12.875, 25.0, 10.875, 13.875, 12.0, 14.0, 11.125,  
11.875, 13.75, 11.25, 11.5, 13.25, 13.625, 12.875, 8.5, 9.25, 8.25, 6.625, 6.125, 8.125, 6.25, 8.0, 5.125, 6.625, 5.875, 9.875, 8.625, 7.625, 9.25,  
5.125, 9.375, 8.875, 6.0, 9.0, 2.5, 3.0, 1.0, 1.75, 1.5, 2.75, 2.375, 2.375, 2.5, 1.625, 1.75, 1.375, 1.5, 1.25, 2.375, 2.5, 1.875, 2.5, 1.875, 2.75,  
1.0, 1.125, 2.25, 2.875, 3.0, 2.875, 1.75, 2.5, 2.625, 2.75, 1.75, 2.5, 1.75, 1.875, 1.5, 1.5, 2.75, 2.25]));
```

```
v4 = Pbind(  
    \instrument, \sine, \transpose, transpose,\amp, amp,  
    \freq, Pseq([0, 726.86, 293.66, 1244.51, 872.91, 1914.86, 174.61, 653.95, 1959.62, 783.99, 98.0, 1567.98, 466.16, 174.61, 293.66, 653.95,  
1914.86, 932.33, 823.92, 770.08, 717.26, 220.0, 259.52, 349.23, 872.91, 872.91, 726.86, 783.99, 1661.22, 489.91, 1307.89, 1567.98, 1959.62, 1567.98,  
777.68, 485.12, 415.3, 1705.95, 622.25, 174.61, 872.91, 872.91, 698.46, 677.01, 415.3, 1959.62, 1807.39, 493.88, 622.25, 326.97, 653.95, 220.0,
```

```

1222.42, 852.98, 1831.56, 523.25, 1385.66, 261.63, 872.91, 392.0, 293.66, 277.18, 311.13, 43.65, 1555.35, 1222.42, 1831.56, 1831.56, 639.01, 872.91,
523.25, 1222.42, 1108.73, 957.43, 1567.98, 1555.35, 783.99, 1174.66, 1760.0]],
    \dur, tempo * Pseq([0.75, 23.75, 23.625, 10.0, 28.0, 16.375, 22.5, 16.5, 29.125, 14.125, 11.625, 12.5, 11.875, 13.125, 11.375, 14.25, 11.25,
14.375, 11.125, 10.5, 12.375, 12.5, 8.0, 8.0, 9.625, 8.75, 8.625, 9.375, 9.75, 6.375, 8.375, 5.25, 5.75, 9.5, 6.375, 9.375, 5.25, 9.125, 8.5, 8.125,
9.875, 2.375, 2.875, 2.5, 1.5, 1.25, 1.75, 1.625, 1.375, 1.75, 2.5, 2.625, 1.5, 1.875, 2.5, 1.375, 2.375, 1.25, 1.75, 2.125, 2.0, 1.75, 2.0, 1.75,
1.5, 2.875, 1.875, 2.25, 2.125, 1.875, 1.875, 2.125, 1.875, 1.125, 1.625, 2.625, 3.0, 2.125, 1.875]));

v5 = Pbind(
    \instrument, \sine, \transpose, transpose, \amp, amp,
    \freq, Pseq([0, 103.83, 1307.89, 1567.98, 392.0, 872.91, 1807.39, 466.16, 415.3, 1396.91, 311.13, 698.46, 1099.8, 1046.5, 979.81, 1222.42,
587.33, 915.78, 277.18, 196.0, 1631.74, 1831.56, 415.3, 196.0, 523.25, 1244.51, 466.16, 979.81, 1385.66, 1745.82, 587.33, 777.68, 872.91, 1307.89,
1385.66, 1760.0, 164.81, 523.25, 1372.12, 979.81, 196.0, 478.72, 207.65, 872.91, 777.68, 872.91, 1038.07, 1959.62, 305.61, 1567.98, 872.91, 1519.83,
1307.89, 1864.66, 1244.51, 277.18, 220.0, 164.81, 1396.91, 979.81, 1046.5, 1760.0, 1555.35, 1234.48, 1975.53, 1396.91, 1831.56, 1165.2, 554.37,
174.61, 1385.66, 1760.0, 1046.5, 174.61, 1864.66, 698.46, 957.43]),
    \dur, tempo * Pseq([7.875, 29.0, 19.625, 20.125, 28.75, 13.375, 22.25, 23.125, 15.0, 12.625, 11.0, 13.0, 14.5, 13.75, 12.0, 13.75, 13.375,
14.25, 12.0, 13.125, 9.125, 8.375, 7.875, 6.625, 10.0, 6.5, 7.875, 8.125, 7.875, 10.0, 10.0, 6.875, 8.25, 9.125, 5.375, 9.75, 5.625, 8.375, 7.75, 8.5,
2.875, 2.5, 2.25, 2.75, 1.875, 2.375, 2.0, 2.75, 1.125, 1.25, 1.875, 1.875, 2.5, 1.25, 1.5, 2.0, 3.0, 1.75, 2.5, 3.0, 2.625, 1.375, 1.875, 1.125,
2.375, 2.125, 1.125, 1.5, 2.875, 2.875, 1.75, 2.25, 1.875, 1.875, 2.875, 1.0, 2.875]));

v6 = Pbind(
    \instrument, \sine, \transpose, transpose, \amp, amp,
    \freq, Pseq([0, 1244.51, 1567.98, 970.24, 932.33, 1555.35, 155.56, 587.33, 65.41, 1555.35, 1631.74, 523.25, 1831.56, 783.99, 872.91, 493.88,
1519.83, 1354.01, 653.95, 852.98, 979.81, 116.54, 363.43, 970.24, 1940.47, 1385.66, 582.6, 872.91, 1307.89, 653.95, 777.68, 1705.95, 1959.62, 1307.89,
259.52, 1138.59, 1831.56, 1519.83, 1174.66, 1174.66, 388.84, 326.97, 987.77, 1372.12, 653.95, 1745.82, 717.26, 1038.07, 1453.71, 970.24, 1372.12,
1453.71, 852.98, 1354.01, 293.66, 1222.42, 554.37, 1138.59, 523.25, 783.99, 639.01, 1244.51, 622.25, 1631.74, 587.33, 872.91, 692.83, 830.61, 415.3,
130.81, 130.81, 587.33, 1108.73, 1567.98, 1108.73, 852.98, 1705.95, 346.42, 1222.42, 1372.12, 1222.42, 293.66, 349.23, 1975.53, 915.78]),
    \dur, tempo * Pseq([7.625, 25.875, 11.25, 22.875, 19.0, 23.25, 12.75, 16.25, 11.875, 28.125, 13.75, 10.25, 14.125, 15.0, 13.125, 12.625,
12.875, 14.75, 10.125, 14.375, 12.625, 8.375, 8.125, 8.75, 5.0, 7.5, 7.375, 7.0, 9.125, 5.5, 9.25, 6.125, 5.25, 5.5, 7.0, 9.5, 6.625, 7.5, 8.625,
6.75, 8.75, 5.75, 8.125, 2.75, 1.625, 2.0, 1.125, 2.125, 2.5, 1.75, 2.0, 1.875, 1.75, 1.25, 1.375, 1.5, 1.0, 1.75, 1.125, 2.625, 2.0, 1.25, 1.75,
1.25, 1.875, 2.5, 2.25, 2.0, 1.125, 1.0, 1.25, 1.375, 2.125, 2.75, 2.125, 2.375, 1.125, 2.875, 2.75, 2.25, 1.625, 1.5, 2.375, 1.25, 1.625]));

v7 = Pbind(
    \instrument, \sine, \transpose, transpose, \amp, amp,
    \freq, Pseq([0, 1705.95, 554.37, 130.81, 1453.71, 326.97, 519.04, 218.23, 692.83, 611.21, 485.12, 2076.15, 717.26, 2076.15, 783.99, 1914.86,
979.81, 207.65, 611.21, 1396.91, 1385.66, 261.63, 523.25, 932.33, 457.89, 1244.51, 1914.86, 1831.56, 146.83, 415.3, 569.29, 932.33, 1222.42, 69.3,
1864.66, 1940.47, 830.61, 932.33, 554.37, 979.81, 1567.98, 1453.71, 1153.81, 174.61, 932.33, 1046.5, 1434.53, 587.33, 138.59, 783.99, 346.42, 1760.0,
1046.5, 1434.53, 1831.56, 1914.86, 1959.62, 1385.66, 830.61, 739.99, 1222.42, 1760.0, 1372.12, 783.99, 587.33, 1453.71, 915.78, 1307.89, 823.92,
1940.47, 587.33, 569.29, 1864.66, 523.25, 326.97, 544.53, 622.25, 1914.86, 1631.74, 1372.12, 1745.82]),
    \dur, tempo * Pseq([3.25, 12.75, 29.5, 20.0, 19.75, 16.875, 24.625, 17.875, 15.125, 20.0, 13.0, 12.375, 15.0, 12.25, 14.0, 10.875, 13.625,
12.0, 13.125, 11.625, 13.125, 6.625, 5.875, 8.0, 5.875, 6.5, 6.5, 8.75, 8.25, 5.875, 8.375, 9.75, 8.5, 5.625, 5.5, 8.0, 7.625, 8.25, 6.25, 7.0, 6.875,
8.0, 8.5, 1.125, 2.75, 2.375, 2.125, 2.875, 2.875, 1.375, 1.125, 2.125, 2.125, 2.875, 2.75, 2.0, 2.625, 2.5, 1.25, 2.125, 2.375, 1.625, 2.375, 1.25,
2.875, 2.5, 2.875, 1.5, 2.875, 2.875, 1.5, 1.125, 1.625, 1.0, 2.75, 1.5, 1.125, 2.875, 1.625, 2.5, 2.625]));

v8 = Pbind(
    \instrument, \sine, \transpose, transpose, \amp, amp,
    \freq, Pseq([0, 1222.42, 489.91, 726.86, 220.0, 1318.51, 1222.42, 489.91, 164.81, 903.7, 326.97, 1385.66, 653.95, 415.3, 1372.12, 1745.82,
138.59, 138.59, 692.83, 1555.35, 1174.66, 587.33, 569.29, 823.92, 1519.83, 1138.59, 1864.66, 622.25, 1831.56, 970.24, 1307.89, 1099.8, 1453.71,
1453.71, 852.98, 261.63, 872.91, 174.61, 174.61, 1108.73, 1760.0, 69.3, 1959.62, 523.25, 852.98, 1831.56, 1705.95, 1222.42, 1959.62, 138.59, 569.29,
1745.82, 1138.59, 830.61, 1046.5, 388.84, 485.12, 783.99, 1914.86, 979.81, 653.95, 1864.66, 1745.82, 218.23, 513.97, 2055.86, 523.25, 717.26, 622.25,
519.04, 777.68, 1567.98, 932.33, 1307.89, 1831.56, 103.83, 915.78, 979.81, 1138.59]),
    \dur, tempo * Pseq([8.5, 20.5, 12.75, 15.875, 18.5, 13.0, 19.875, 13.75, 27.75, 28.0, 13.875, 14.625, 14.875, 10.875, 12.625, 11.375, 10.0,
13.0, 10.75, 11.0, 14.875, 14.5, 7.5, 7.75, 6.875, 7.875, 8.875, 7.625, 7.625, 8.625, 5.625, 9.375, 7.75, 5.375, 10.0, 9.625, 8.25, 8.0, 9.125, 5.875,
9.75, 2.875, 2.25, 2.875, 1.375, 2.75, 1.5, 1.0, 2.875, 2.0, 1.125, 2.625, 1.75, 3.0, 2.5, 2.125, 2.625, 1.875, 2.875, 1.25, 1.875, 1.375, 1.5, 2.125,
2.75, 1.625, 2.625, 2.25, 2.375, 2.375, 2.625, 2.125, 1.125, 2.0, 1.875, 2.25, 1.375, 1.0, 1.75]));

Ppar([v1, v2, v3, v4, v5, v6, v7, v8]); //edit which voices are played here

```



```

};

seq = { arg startTime = 0, transpose = 0, amp = 0.1, tempo = 1;
  Prout({ |inval|
    var pstrm = pat.value(transpose, amp, tempo).asStream, time = 0, event;
    while { time < startTime } {
      event = pstrm.next(inval.copy);
      if(event.isNil) { nil.yield };
      time = time + event.delta;
    };
    inval = Event.silent(time - startTime).yield;
    pstrm.embedInStream(inval)}});

};

AppClock.clear;

win = Window.new("chorale and finely tuned resonators", Rect(128, 64, 800, 400));

StaticText(win, Rect(20, 60, 70, 20)).string_("measure");
measurefield = TextField(win, Rect(20, 80, 560, 300)).string_("1").align_(\right).font_(Font("Courier-Bold", 280));

StaticText(win, Rect(600, 60, 70, 20)).string_("beat");
beatfield = TextField(win, Rect(600, 80, 180, 300)).string_("1").align_(\right).font_(Font("Courier-Bold", 280));

play = Button(win, Rect(20, 20, 50, 30));
play.states = ([["Start",Color.black, Color(0.6, 0.35, 0.35)],["Pause", Color.black, Color(0.35, 0.35, 0.6)]]);
play.action = ({
  case {play.value == 1} {
    tick = ((measurefield.string.asInteger - 1) * 4) + beatfield.string.asInteger;
    AppClock.sched(0.0, {arg time;
      measurefield.string = ((tick / 4).asInteger + 1).asSymbol;
      beatfield.string = ((tick % 4).asInteger + 1).asSymbol;
      0.1});
    clock = TempoClock(1, 0);
    beatdur = beatdurfield.string.asFloat;
    vol = volfield.string.asFloat;
    clock.schedAbs(beatdur, { tick = tick + 1; beatdur});
    transport = seq.value(tick * beatdur, 0, 0.1 * vol, beatdur).play(clock);
  };
  case {play.value == 0} {AppClock.clear; clock.stop;});
});

reset = Button.new(win, Rect(90, 20, 50, 30));
reset.states = ([["Reset", Color.black, Color(0.35,0.6,0.35)]]);
reset.action = ({tick = 0; play.value = 0; clock.stop; AppClock.clear; measurefield.string = 1; beatfield.string = 1});

StaticText(win, Rect(200, 20, 50, 30)).string_("vol");
volfield = TextField(win, Rect(230, 20, 40, 30)).string_("1.0").align_(\right).font_(Font("Courier-Bold", 14));

StaticText(win, Rect(300, 20, 100, 30)).string_("beat dur");
beatdurfield = TextField(win, Rect(365, 20, 40, 30)).string_("1.0").align_(\right).font_(Font("Courier-Bold", 14));

win.front;

MasterEQ(2) //graphic equalizer from quark; remove if necessary
)

```

```
//chorale and finely tuned resonators (just version) by michael winter. first realization. Supercollider 3.6.3. gpl.
```

```
(var buff, pat, seq, tick = 0, win, play, reset, measurefield, beatfield, clock, transport, beatdur, beatdurfield, vol, volfield;
```

```
buff = Buffer.alloc(s, 512, 1);  
buff.sine1(1.0, true, true, true);
```

```
SynthDef(\sine, { |freq = 440, dur = 1, transpose = 0, amp = 0.1|  
  var out, bufnum = 0, outbus = 0;  
  out = EnvGen.ar(Env.sine(dur, 1), 1, doneAction: 2) * amp * Osc.ar(bufnum, freq * pow(2,transpose/12), 0, 1, 0);  
  Out.ar(outbus, out ! 2);  
}).add;
```

```
pat = {arg transpose, amp, tempo; var v1, v2, v3, v4, v5, v6, v7, v8;
```

```
v1 = Pbind(  
  \instrument, \sine, \transpose, transpose,\amp, amp,  
  \freq, Pseq([0, 1961.89, 523.86, 830.61, 174.82, 207.65, 1631.74, 1245.95, 1764.07, 1245.95, 103.83, 329.63, 1222.42, 233.08, 349.23, 261.63,  
622.97, 784.9, 830.61, 311.13, 1307.89, 174.61, 51.91, 407.93, 116.54, 415.3, 392.0, 65.41, 881.02, 277.18, 277.18, 261.63, 220.0, 261.63, 138.59,  
174.61, 692.83, 174.82, 1038.07, 326.97, 466.7, 233.08, 1177.38, 588.69, 1453.71, 784.9, 700.07, 415.3, 196.0, 116.54, 261.93, 43.65, 330.01, 1047.71,  
1555.35, 311.49, 1108.73, 233.08, 1802.18, 138.59, 466.16, 1920.4, 1557.15, 622.97, 653.95, 784.9, 65.41, 261.63, 1866.81, 51.91, 830.61, 588.69,  
873.92, 261.93, 588.01, 1868.97, 489.91, 392.45, 1099.8]),  
  \dur, tempo * Pseq([8.125, 11.5, 22.125, 24.5, 23.75, 28.125, 24.375, 27.25, 10.125, 11.125, 11.75, 13.375, 10.375, 14.875, 12.375, 10.0,  
13.0, 12.75, 11.875, 12.625, 11.875, 5.75, 8.5, 6.625, 5.5, 8.0, 5.25, 7.0, 5.875, 9.0, 6.375, 8.125, 7.375, 8.0, 7.75, 8.25, 5.875, 9.875, 6.875,  
7.75, 6.125, 7.875, 8.125, 2.5, 2.0, 2.75, 2.375, 2.375, 2.5, 2.5, 1.0, 1.0, 2.0, 2.125, 1.875, 2.375, 2.0, 2.875, 1.75, 2.75, 2.25, 2.25, 2.75,  
2.375, 3.0, 2.625, 1.625, 1.625, 2.625, 1.25, 1.625, 1.125, 1.25, 1.375, 1.875, 2.25, 2.75, 2.5, 1.375]));
```

```
v2 = Pbind(  
  \instrument, \sine, \transpose, transpose,\amp, amp,  
  \freq, Pseq([0, 1747.84, 1868.97, 582.6, 588.01, 1046.5, 1571.61, 138.59, 698.46, 349.23, 130.81, 233.08, 1631.74, 311.13, 311.13, 1244.51,  
872.91, 349.23, 1398.53, 588.01, 932.33, 207.65, 392.45, 311.13, 261.93, 699.26, 233.08, 164.81, 207.65, 329.63, 523.25, 164.81, 174.61, 207.65,  
622.97, 622.97, 519.04, 784.9, 1046.5, 261.63, 51.91, 1046.5, 1135.3, 1831.56, 261.63, 466.16, 261.63, 138.59, 207.89, 415.78, 1318.51, 480.1, 349.23,  
1247.39, 233.08, 261.63, 1661.22, 349.23, 924.82, 58.27, 523.25, 103.83, 640.86, 1571.61, 588.01, 700.07, 261.63, 1046.5, 1307.89, 116.54, 1396.91,  
155.56, 2076.15, 116.54, 349.23, 311.13, 523.25, 261.63, 329.63, 261.63, 174.61]),  
  \dur, tempo * Pseq([9.625, 22.375, 26.5, 10.625, 18.0, 19.625, 17.625, 28.125, 11.375, 14.25, 10.5, 11.375, 10.25, 10.0, 11.375, 14.0, 14.0,  
14.875, 10.875, 14.75, 12.75, 14.125, 8.75, 6.75, 5.375, 6.625, 6.125, 8.0, 6.875, 7.5, 9.5, 7.75, 7.875, 7.125, 6.75, 8.25, 6.875, 8.0, 9.125, 8.875,  
6.875, 9.25, 9.25, 2.5, 1.875, 2.125, 2.625, 1.25, 1.625, 1.375, 1.125, 1.875, 2.5, 1.5, 2.25, 1.875, 1.375, 2.125, 2.5, 1.125, 1.75, 2.25, 2.75,  
2.875, 1.125, 1.625, 2.0, 1.625, 2.5, 2.125, 1.5, 2.625, 2.5, 1.5, 2.375, 2.875, 1.875, 1.125, 1.125, 1.125, 1.0]));
```

```
v3 = Pbind(  
  \instrument, \sine, \transpose, transpose,\amp, amp,  
  \freq, Pseq([0, 65.41, 174.61, 1398.53, 1701.03, 1372.12, 588.01, 1089.05, 196.0, 783.99, 1831.56, 69.3, 1453.71, 207.65, 261.63, 1307.89,  
330.01, 1571.61, 2093.0, 1710.88, 130.81, 130.81, 659.26, 1222.42, 196.0, 277.18, 174.61, 415.3, 1038.07, 549.9, 1453.71, 392.45, 415.3, 233.08,  
218.23, 415.78, 1047.71, 277.18, 1245.95, 784.9, 1831.56, 196.22, 783.99, 155.56, 174.61, 1831.56, 207.65, 653.95, 155.56, 259.52, 174.61, 294.0,  
457.89, 1569.79, 1046.5, 116.54, 698.46, 98.0, 519.04, 1802.18, 1222.42, 174.61, 1281.71, 98.0, 261.93, 988.91, 1831.56, 392.45, 1468.06, 110.0,  
588.69, 207.65, 1453.71, 850.52, 1165.2, 457.89, 1959.62, 1307.89, 436.46, 653.95, 611.21]),  
  \dur, tempo * Pseq([5.25, 14.125, 20.25, 14.375, 15.75, 24.125, 15.625, 15.625, 16.125, 12.875, 25.0, 10.875, 13.875, 12.0, 14.0, 11.125,  
11.875, 13.75, 11.25, 11.5, 13.25, 13.625, 12.875, 8.5, 9.25, 8.25, 6.625, 6.125, 8.125, 6.25, 8.0, 5.125, 6.625, 5.875, 9.875, 8.625, 7.625, 9.25,  
5.125, 9.375, 8.875, 6.0, 9.0, 2.5, 3.0, 1.0, 1.75, 1.5, 2.75, 2.375, 2.5, 1.625, 1.75, 1.375, 1.5, 1.25, 2.375, 2.5, 1.875, 2.5, 1.875, 2.75,  
1.0, 1.125, 2.25, 2.875, 3.0, 2.875, 1.75, 2.5, 2.625, 2.75, 1.75, 2.5, 1.75, 1.875, 1.5, 1.5, 2.75, 2.25]));
```

```
v4 = Pbind(  
  \instrument, \sine, \transpose, transpose,\amp, amp,  
  \freq, Pseq([0, 726.86, 294.0, 1245.95, 872.91, 1920.4, 174.61, 653.95, 1959.62, 784.9, 98.0, 1569.79, 467.24, 174.61, 294.0, 653.95, 1920.4,  
934.48, 823.92, 770.08, 719.34, 220.0, 259.52, 349.23, 872.91, 872.91, 726.86, 784.9, 1663.14, 489.91, 1309.4, 1569.79, 1959.62, 1571.61, 777.68,  
485.12, 415.78, 1701.03, 622.97, 174.82, 872.91, 872.91, 698.46, 675.05, 415.3, 1961.89, 1802.18, 494.45, 623.69, 326.97, 653.95, 220.0, 1222.42,
```

```

855.44, 1831.56, 523.86, 1385.66, 261.63, 872.91, 392.0, 294.0, 277.18, 311.49, 43.65, 1555.35, 1222.42, 1831.56, 1831.56, 640.86, 872.91, 523.25,
1222.42, 1108.73, 960.2, 1567.98, 1555.35, 784.9, 1176.02, 1760.0]],
    \dur, tempo * Pseq([0.75, 23.75, 23.625, 10.0, 28.0, 16.375, 22.5, 16.5, 29.125, 14.125, 11.625, 12.5, 11.875, 13.125, 11.375, 14.25, 11.25,
14.375, 11.125, 10.5, 12.375, 12.5, 8.0, 8.0, 9.625, 8.75, 8.625, 9.375, 9.75, 6.375, 8.375, 5.25, 5.75, 9.5, 6.375, 9.375, 5.25, 9.125, 8.5, 8.125,
9.875, 2.375, 2.875, 2.5, 1.5, 1.25, 1.75, 1.625, 1.375, 1.75, 2.5, 2.625, 1.5, 1.875, 2.5, 1.375, 2.375, 1.25, 1.75, 2.125, 2.0, 1.75, 2.0, 1.75,
1.5, 2.875, 1.875, 2.25, 2.125, 1.875, 1.875, 2.125, 1.875, 1.125, 1.625, 2.625, 3.0, 2.125, 1.875]));

v5 = Pbind(
    \instrument, \sine, \transpose, transpose, \amp, amp,
    \freq, Pseq([0, 103.83, 1307.89, 1571.61, 392.0, 872.91, 1802.18, 466.7, 415.78, 1396.91, 311.13, 699.26, 1099.8, 1046.5, 979.81, 1222.42,
588.01, 915.78, 277.18, 196.0, 1631.74, 1831.56, 415.78, 196.0, 523.86, 1247.39, 466.7, 980.94, 1385.66, 1745.82, 588.01, 777.68, 872.91, 1307.89,
1385.66, 1764.07, 164.81, 523.25, 1372.12, 979.81, 196.0, 480.1, 207.65, 872.91, 777.68, 872.91, 1038.07, 1959.62, 305.61, 1569.79, 872.91, 1515.45,
1307.89, 1868.97, 1245.95, 277.18, 220.0, 164.81, 1396.91, 979.81, 1046.5, 1764.07, 1555.35, 1234.48, 1977.82, 1396.91, 1831.56, 1165.2, 554.37,
174.61, 1385.66, 1764.07, 1046.5, 174.61, 1864.66, 698.46, 960.2]),
    \dur, tempo * Pseq([7.875, 29.0, 19.625, 20.125, 28.75, 13.375, 22.25, 23.125, 15.0, 12.625, 11.0, 13.0, 14.5, 13.75, 12.0, 13.75, 13.375,
14.25, 12.0, 13.125, 9.125, 8.375, 7.875, 6.625, 10.0, 6.5, 7.875, 8.125, 7.875, 10.0, 10.0, 6.875, 8.25, 9.125, 5.375, 9.75, 5.625, 8.375, 7.75, 8.5,
2.875, 2.5, 2.25, 2.75, 1.875, 2.375, 2.0, 2.75, 1.125, 1.25, 1.875, 1.875, 2.5, 1.25, 1.5, 2.0, 3.0, 1.75, 2.5, 3.0, 2.625, 1.375, 1.875, 1.125,
2.375, 2.125, 1.125, 1.5, 2.875, 2.875, 1.75, 2.25, 1.875, 1.875, 2.875, 1.0, 2.875]));

v6 = Pbind(
    \instrument, \sine, \transpose, transpose, \amp, amp,
    \freq, Pseq([0, 1245.95, 1571.61, 970.24, 932.33, 1557.15, 155.56, 588.01, 65.41, 1555.35, 1631.74, 523.86, 1831.56, 784.9, 872.91, 494.45,
1524.22, 1350.11, 653.95, 850.52, 979.81, 116.54, 363.43, 970.24, 1940.47, 1385.66, 582.6, 872.91, 1307.89, 653.95, 777.68, 1701.03, 1959.62, 1307.89,
259.52, 1141.88, 1831.56, 1524.22, 1177.38, 1177.38, 388.84, 326.97, 988.91, 1372.12, 1177.38, 654.7, 1745.82, 719.34, 1038.07, 1453.71, 970.24, 1372.12,
1453.71, 850.52, 1350.11, 294.0, 1222.42, 554.37, 1135.3, 523.25, 784.9, 640.86, 1244.51, 622.25, 1631.74, 588.01, 872.91, 692.83, 830.61, 415.3,
130.81, 130.81, 588.01, 1111.3, 1569.79, 1108.73, 855.44, 1701.03, 346.42, 1222.42, 1372.12, 1222.42, 294.0, 349.23, 1977.82, 915.78]),
    \dur, tempo * Pseq([7.625, 25.875, 11.25, 22.875, 19.0, 23.25, 12.75, 16.25, 11.875, 28.125, 13.75, 10.25, 14.125, 15.0, 13.125, 12.625,
12.875, 14.75, 10.125, 14.375, 12.625, 8.375, 8.125, 8.75, 5.0, 7.5, 7.375, 7.0, 9.125, 5.5, 9.25, 6.125, 5.25, 5.5, 7.0, 9.5, 6.625, 7.5, 8.625,
6.75, 8.75, 5.75, 8.125, 2.75, 1.625, 2.0, 1.125, 2.125, 2.5, 1.75, 2.0, 1.875, 1.75, 1.25, 1.375, 1.5, 1.0, 1.75, 1.125, 2.625, 2.0, 1.25, 1.75,
1.25, 1.875, 2.5, 2.25, 2.0, 1.125, 1.0, 1.25, 1.375, 2.125, 2.75, 2.125, 2.375, 1.125, 2.875, 2.75, 2.25, 1.625, 1.5, 2.375, 1.25, 1.625]));

v7 = Pbind(
    \instrument, \sine, \transpose, transpose, \amp, amp,
    \freq, Pseq([0, 1701.03, 554.37, 130.81, 1453.71, 326.97, 519.04, 218.23, 692.83, 611.21, 485.12, 2076.15, 719.34, 2076.15, 784.9, 1920.4,
979.81, 207.65, 611.21, 1396.91, 1385.66, 261.93, 523.86, 932.33, 457.89, 1247.39, 1920.4, 1831.56, 147.0, 415.78, 570.94, 933.41, 1222.42, 69.3,
1868.97, 1940.47, 830.61, 932.33, 554.37, 979.81, 1569.79, 1453.71, 1153.81, 174.61, 932.33, 1046.5, 1438.68, 588.01, 138.59, 784.9, 346.42, 1764.07,
1047.71, 1438.68, 1831.56, 1920.4, 1959.62, 1385.66, 831.57, 739.99, 1222.42, 1764.07, 1372.12, 783.99, 588.69, 1453.71, 915.78, 1307.89, 823.92,
1940.47, 588.01, 570.94, 1868.97, 523.86, 326.97, 544.53, 622.25, 1920.4, 1631.74, 1372.12, 1745.82]),
    \dur, tempo * Pseq([3.25, 12.75, 29.5, 20.0, 19.75, 16.875, 24.625, 17.875, 15.125, 20.0, 13.0, 12.375, 15.0, 12.25, 14.0, 10.875, 13.625,
12.0, 13.125, 11.625, 13.125, 6.625, 5.875, 8.0, 5.875, 6.5, 6.5, 8.75, 8.25, 5.875, 8.375, 9.75, 8.5, 5.625, 5.5, 8.0, 7.625, 8.25, 6.25, 7.0, 6.875,
8.0, 8.5, 1.125, 2.75, 2.375, 2.125, 2.875, 2.875, 1.375, 1.125, 2.125, 2.125, 2.875, 2.75, 2.0, 2.625, 2.5, 1.25, 2.125, 2.375, 1.625, 2.375, 1.25,
2.875, 2.5, 2.875, 1.5, 2.875, 2.875, 1.5, 1.125, 1.625, 1.0, 2.75, 1.5, 1.125, 2.875, 1.625, 2.5, 2.625]));

v8 = Pbind(
    \instrument, \sine, \transpose, transpose, \amp, amp,
    \freq, Pseq([0, 1222.42, 489.91, 726.86, 220.0, 1318.51, 1222.42, 489.91, 164.81, 901.09, 326.97, 1385.66, 653.95, 415.3, 1372.12, 1745.82,
138.59, 138.59, 692.83, 1555.35, 1176.02, 588.01, 570.94, 823.92, 1515.45, 1135.3, 1868.97, 622.97, 1831.56, 970.24, 1307.89, 1099.8, 1453.71,
1453.71, 850.52, 261.63, 872.91, 174.82, 174.61, 1108.73, 1764.07, 69.3, 1961.89, 523.86, 850.52, 1831.56, 1701.03, 1222.42, 1959.62, 138.59, 567.65,
1745.82, 1135.3, 831.57, 1046.5, 388.84, 485.12, 785.8, 1920.4, 979.81, 653.95, 1864.66, 1745.82, 218.23, 513.97, 2055.86, 523.25, 719.34, 622.97,
519.04, 777.68, 1571.61, 933.41, 1307.89, 1831.56, 103.83, 915.78, 980.94, 1135.3]),
    \dur, tempo * Pseq([8.5, 20.5, 12.75, 15.875, 18.5, 13.0, 19.875, 13.75, 27.75, 28.0, 13.875, 14.625, 14.875, 10.875, 12.625, 11.375, 10.0,
13.0, 10.75, 11.0, 14.875, 14.5, 7.5, 7.75, 6.875, 7.875, 8.875, 7.625, 7.625, 8.625, 5.625, 9.375, 7.75, 5.375, 10.0, 9.625, 8.25, 8.0, 9.125, 5.875,
9.75, 2.875, 2.25, 2.875, 1.375, 2.75, 1.5, 1.0, 2.875, 2.0, 1.125, 2.625, 1.75, 3.0, 2.5, 2.125, 2.625, 1.875, 2.875, 1.25, 1.875, 1.375, 1.5, 2.125,
2.75, 1.625, 2.625, 2.25, 2.375, 2.375, 2.625, 2.125, 1.125, 2.0, 1.875, 2.25, 1.375, 1.0, 1.75]));

Ppar([v1, v2, v3, v4, v5, v6, v7, v8]); //edit which voices are played here

```

```

};

seq = { arg startTime = 0, transpose = 0, amp = 0.1, tempo = 1;
  Prout({ |inval|
    var pstrm = pat.value(transpose, amp, tempo).asStream, time = 0, event;
    while { time < startTime } {
      event = pstrm.next(inval.copy);
      if(event.isNil) { nil.yield };
      time = time + event.delta;
    };
    inval = Event.silent(time - startTime).yield;
    pstrm.embedInStream(inval)}});

};

AppClock.clear;

win = Window.new("chorale and finely tuned resonators", Rect(128, 64, 800, 400));

StaticText(win, Rect(20, 60, 70, 20)).string_("measure");
measurefield = TextField(win, Rect(20, 80, 560, 300)).string_("1").align_(\right).font_(Font("Courier-Bold", 280));

StaticText(win, Rect(600, 60, 70, 20)).string_("beat");
beatfield = TextField(win, Rect(600, 80, 180, 300)).string_("1").align_(\right).font_(Font("Courier-Bold", 280));

play = Button(win, Rect(20, 20, 50, 30));
play.states = ([["Start",Color.black, Color(0.6, 0.35, 0.35)],["Pause", Color.black, Color(0.35, 0.35, 0.6)]]);
play.action = ({
  case {play.value == 1} {
    tick = ((measurefield.string.asInteger - 1) * 4) + beatfield.string.asInteger;
    AppClock.sched(0.0, {arg time;
      measurefield.string = ((tick / 4).asInteger + 1).asSymbol;
      beatfield.string = ((tick % 4).asInteger + 1).asSymbol;
      0.1});
    clock = TempoClock(1, 0);
    beatdur = beatdurfield.string.asFloat;
    vol = volfield.string.asFloat;
    clock.schedAbs(beatdur, { tick = tick + 1; beatdur});
    transport = seq.value(tick * beatdur, 0, 0.1 * vol, beatdur).play(clock);
  };
  case {play.value == 0} {AppClock.clear; clock.stop;});
});

reset = Button.new(win, Rect(90, 20, 50, 30));
reset.states = ([["Reset", Color.black, Color(0.35,0.6,0.35)]]);
reset.action = ({tick = 0; play.value = 0; clock.stop; AppClock.clear; measurefield.string = 1; beatfield.string = 1});

StaticText(win, Rect(200, 20, 50, 30)).string_("vol");
volfield = TextField(win, Rect(230, 20, 40, 30)).string_("1.0").align_(\right).font_(Font("Courier-Bold", 14));

StaticText(win, Rect(300, 20, 100, 30)).string_("beat dur");
beatdurfield = TextField(win, Rect(365, 20, 40, 30)).string_("1.0").align_(\right).font_(Font("Courier-Bold", 14));

win.front;

MasterEQ(2) //graphic equalizer from quark; remove if necessary
)

```