

Richard Barrett

eiszeiten

2012-15

horn, trombone, tuba, electronics

performing score

eiszeiten

(2012-14) for horn, trombone, tuba and electronic sounds

commissioned by Zinc & Copper Works

in memory of Konrad Boehmer

duration: approximately 10 minutes

All instruments are to be amplified. The horn is a double horn in Bb and F, the trombone is a tenor-bass instrument with F attachment and the tuba a bass tuba in Bb.

intonation

Eiszeiten is based on the inconsistencies between, on one hand, the (almost) justly-intoned harmonic series of partials produced by the embouchure of brass instruments, and, on the other, the equal chromatic temperament produced by the valve system. Therefore all fingerings and slide-F attachment positions should be tuned to the notated equal-tempered frequencies, and the harmonics on the given fundamentals should be as close as possible to just intonation.

The numbers above the main staff indicate the partial to be used (1=fundamental/pedal-tone). Arrows above or below the accidentals are used for pitches which vary most strongly from equal temperament, although very often two instances of the “same” pitch will vary microtonally from one another because of being produced as different partials of different fundamentals, even when their accidental is the same. The lower staff contains the fingering or slide/F-attachment position, the frequency of the fundamental in Hertz (based on equal temperament at a⁴=440Hz) and the pitch of the fundamental. It is assumed that any necessary adjustments will be made to ensure these fundamentals have the notated frequency values.

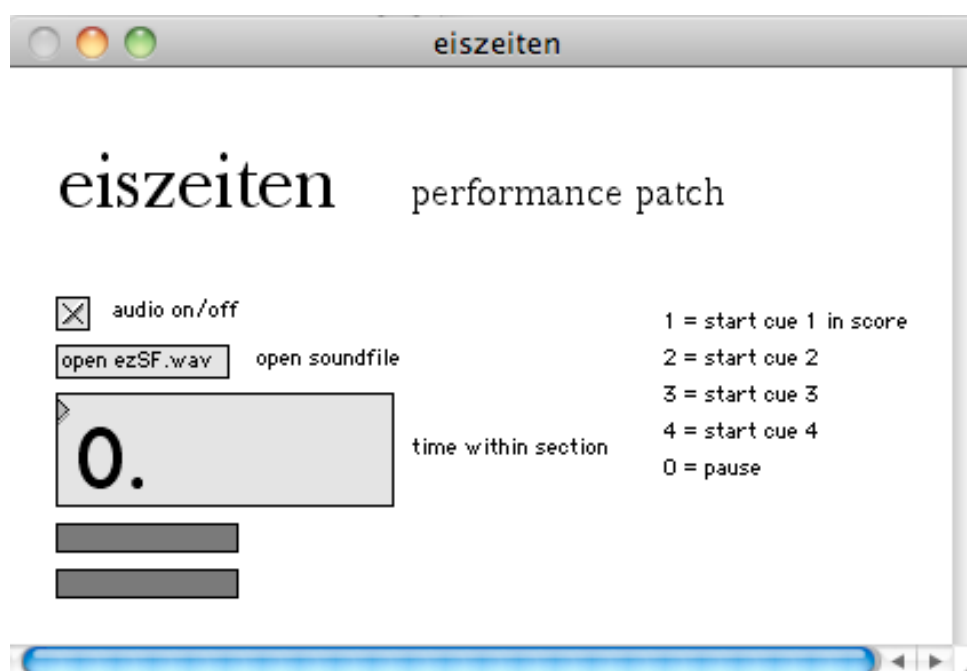
other notations

→ = exhaled, ← = inhaled sounds; ♩ = unpitched air-sounds, ✕ = tongue-ram

The horn is notated a perfect fifth higher than it sounds although its fundamentals on the lower staff (see above) are notated at sounding pitch

electronics

The electronic part consists of a stereo soundfile in four sections which are triggered and stopped at the indicated points in the score, using a Max patch supplied with the soundfile. Each section of the soundfile is at a constant (maximum) volume level – the notated dynamics in the electronic part are intended to be realised at the mixer, to take account of the performing situation and the instrumental dynamics with which they usually crossfade. Each section begins with a fade from silence except cue 4, and each ends with a fade to silence except cue 1. Cue 1 has accordingly been made slightly longer than the 75” given in the score, so that at precisely 75” (according to the timer in the Max patch) the performer of the electronic part cues the instrumentalists and simultaneously stops playback.



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$\text{♩} = 48$

all instruments: unpitched air-sounds with the valve-slide positions as shown so that the fundamental pitch of the tube is as notated, onsets with precise tongued attack, accented cross-headed notes (tongue-rams) with a slight suggestion of pitch

1

air sounds \rightarrow (exhaling) sempre

horn $F\flat$ 43.65Hz

air sounds \rightarrow (exhaling) sempre

trombone VI 43.65Hz

air sounds \rightarrow (exhaling) sempre

tuba \emptyset 43.65Hz

electr.

3

air sounds

horn

air sounds

trombone

air sounds

tuba

15" 60"

5

air sounds $\text{♩} = 48-57$ independently

horn

air sounds $\text{♩} = 48-57$ independently

trombone

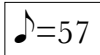
air sounds $\text{♩} = 48-57$ independently

tuba

electr. cue 1 crossfade gradually with instruments

cue 1 stop (abrupt end)

p mp mf



The fundamental frequencies given on the lower staff for each instrument correspond to equal-tempered pitches based on A=440Hz. The sounding pitches on the upper staff are intended to be unaltered natural partials of these fundamentals (the partial numbers are also given), and will thus vary in frequency to a greater or lesser extent even when notated as the same pitch.

6

horn

mf sempre (these fundamentals are notated at concert pitch!)

6 7 5 7 3:2 9 6 7 3:2 9

B \flat 0 58.27Hz B \flat 12 49.00Hz F0 43.65Hz

trombone

mf sempre

6 7 9 5 3:2 6 8 5:4 10 3:2

V 46.25Hz III 51.91Hz FVI 32.70Hz

tuba

mf sempre

11 10 12 16 3:2 9 11 5:4 8 3:2

23 234 14 24

34.65Hz 27.50Hz 29.14Hz 30.87Hz

10

horn

(mf)

7 9 7 9 9:8 10 5:4 5 3:2 8 5:4

F1 38.89Hz B \flat 2 55.00Hz

trombone

(mf)

13 12 11 10 9:8 5 7 3:2 9 8 5:4

FVI 32.70Hz FV 34.65Hz FIV 36.71Hz FII 41.2 F1 43.65Hz IV 49.00Hz FV 34.65Hz

tuba

(mf)

11 9 11 9 9:8 11 14 3:2 8 5:4

24 2 8

30.87Hz 41.20Hz

15

horn

(mf)

5 7 9 8 5:4 10 9:8 3:2 8 10 5:4 5 9:8 6

B \flat 3 49.00Hz F23 34.65Hz F2 41.20Hz B \flat 1 51.91Hz

trombone

(mf)

11 9 5 6 5:4 8 9:8 5 3:2 5 8 5:4 9 11 9:8 6

FV 34.65Hz III 51.91Hz FIV 36.71Hz VII 41.20Hz

tuba

(mf)

10 8 10 13 5:4 9 15 9:8 9 3:2 15 11 5:4 4:5 11 14 9:8 17

2 123 234 1234

41.20Hz 30.87Hz 27.50Hz 24.50Hz

(gradual transition to 1/2 stopped)

18

horn

trombone

tuba

8 7 9 3:2 7:6 4 11 8 6:5 11 8 3:2 3

F1 38.89Hz

FVI 32.70Hz

10 13 10 13 3:2

7 8 6:5 9 7 3:2

23 123 234 12

34.65Hz 30.87Hz 27.50Hz 36.71Hz

20

horn

trombone

tuba

11 3:2 9 7 9 3:2 7 5:4 5:6 9 11 9 11

F1 38.89Hz Bb23 46.25Hz

F23 34.65Hz F12 36.71Hz

VI 43.65Hz FIII 38.89Hz

II 55.00Hz

V 46.25Hz

9 11 8 10 12 10 13 16 3:2 5:4 5:6 9 10 7

12 13 134 1234 14 134 12

36.71Hz 32.70Hz 25.96Hz 24.50Hz 29.14Hz 25.96Hz 36.71Hz

23

horn

trombone

tuba

electr.

15" irregular wavering in pitch, sometimes but not often as rapid as vibrato, up to one semitone above and below principal pitch (mf)

15" (tacet)

7.5" sim. (f)

cue 2

cue 2 stop

♩=68

24

horn

trombone

tuba

13 8 16 7 10 11 13 11 5

f *mf* *f*

F3 36.71Hz F2 41.20Hz F123 30.87Hz F3 36.71Hz F0 F2 F23 43.65 41.20 34.65Hz Bb23 46.25Hz F2 41.20Hz

7 10 10 11 6 7 9 6 5

f *mf* *f*

IV 49.00Hz V 46.25Hz FV 34.65Hz FVI 32.70Hz FIV FVI 36.71Hz 32.70Hz FIII 38.89Hz I 58.27Hz

12 7 9 6 4:5 6 6

f *mf* *f*

134 25.96Hz 13 32.70Hz 234 27.50Hz 123 30.87Hz 234 3 234 27.50 36.71 27.50Hz ∅ 43.65Hz 1234 24.50Hz

31

horn

trombone

tuba

13 3 2 13

mf

F0 43.65Hz F123 30.87Hz Bb23 46.25Hz etc. sim.

11 9 8 7 10:7 4:3

mf

FV 34.65Hz VII 41.20 V 46.25 III 51.91 etc. sim.

7 11:8 9:10

mf

I 38.89Hz 3 36.71Hz 123 30.87Hz 134 25.96 etc. sim.

33

horn

trombone

tuba

13 (as before) 10:7 5:4 6:7 3:2 2 3

mp *f*

Bb2 55.00Hz Bb23 46.25Hz F2 41.20Hz

10:7 5:4 6:7 3:2 4

mp *f*

FIV 36.71Hz V 46.25Hz FV 34.65Hz

10:7 5:4 6:7 3:2 3

mp *f*

134 25.96Hz 1234 24.50Hz 14 29.14Hz

35

horn

trombone

tuba

mf

13

5:4 14 6:7 11:9 12 11

Bb3 49.00Hz

F3 36.71 F1 38.89 F2 41.20 F0 43.65 Bb2 55.00 Bb3 49.00 Bb23 46.25 Bb1 51.91

FIV 36.71Hz

V 46.25 FV 34.65Hz etc. sim.

11

7 10 11 3:2 7:5 8 11 10

234 27.50Hz

2 41.20Hz 234 27.50Hz 134 25.96Hz 1 38.89Hz 23 34.65Hz 1234 24.50 234 27.50

37

horn

trombone

tuba

mp

10:9 14 13

F0 43.65Hz F3 36.71Hz

10:9 14 11 14

VII 41.20Hz

I 58.27Hz FI 43.65Hz

10:9 13 10

13 14 12 36.71Hz

23 32.70Hz 134 29.14Hz 2 34.65Hz 134 25.96Hz 2 41.20 234 27.50Hz

16 3:2 5:4 15 14 5:6

F1 38.89Hz F13 32.70Hz

8 10 11 14 5:6

I FI FIII III

58.27Hz 43.65Hz 38.89Hz 51.91

11 14 9 13 5:6

134 2 234 1234

32.70Hz 29.14Hz 36.71Hz 34.65Hz 25.96Hz 41.20 27.50Hz 24.50Hz

40

horn

trombone

tuba

mp

5 8

F23 34.65Hz Bb2 55.00Hz

4 7 8

F2 41.20Hz F23 34.65Hz

10 16 14 15

I FIV FII FIII

58.27Hz 36.71Hz 41.20Hz 38.89

FI I

43.65Hz 58.27Hz

11 14

III FIV FII

51.91Hz 36.71Hz 41.20Hz

mf

mf

mp

(1234)

* here (as elsewhere!) differentiate as clearly as possible between the various durations by concentrating on their ends as much as their beginnings!

43

horn

f *mf* *mp*

2/8 4/8 4/8 6/8

F13 32.70Hz Bb2 55.00Hz etc. sim. F123 BbO

trombone

f *mf* *mp*

V 46.25Hz FII 41.20 FVI 41.20 VII etc. sim. FIV V I

tuba

f *mf* *mp*

O 43.65Hz 2 O 1 etc. sim. 14 3

7:6 9:10 3:2 5:6 5:4 11:10 7:6 5:6 5:4

46

horn

mp *mf*

6/8 3/8 7/16

F3 F123 BbO FO 43.65Hz BbO 58.27 Bb1 51.91 Bb23 46.25Hz Bb2 55.00

trombone

mp *mf*

(I) V FIV V I FV 34.65Hz FI 43.65Hz

tuba

mp *mf*

123 14 3 234

8:9 8:9 9 8:9

49

horn

mp *mf*

7/16 11/16 15/16 12/16 14/16 13/16 10/8

BbO 58.27Hz FO 43.65Hz Bb2 55.00Hz Bb23 46.25Hz Bb1 51.91Hz

trombone

mf *mf* *mf*

III 51.91Hz V 46.25Hz FII 38.89Hz

tuba

mp

(234)

52

horn

f sempre

F123
30.87Hz

10 11

12 13 14 15 $7:9$

5 6

11 12 13

trombone

f sempre

VI
43.65Hz

8

9 10 11 $5:6$

5:6

tuba

f sempre

1234
24.50Hz

14 13 12 11 10 $16:11$

13 12 11 10 9 $8:9$

234
27.50Hz

54

horn

Bb0
58.27Hz

14

10 11 12 13 $7:6$

2 3

9 16

11 12 13 14 $6:4$

trombone

FIII
38.89Hz

9 10 11 12 13

7 8 9 $6:5$

8

tuba

11 10 9 8 7 $8:7$

123
30.87Hz

10 9 8 7 $6:5$

23
34.65Hz

58

horn

f

Bb523
46.25Hz

7 10

rapid and irregular harmonic glissandi between these two partials

25"

(tacet)

hold pitch as stable as possible (with circular breathing)

ff

F23
34.65Hz

trombone

f

FIV
36.71Hz

9 13

rapid and irregular harmonic glissandi between these two partials

25"

(tacet)

hold pitch as stable as possible (with circular breathing)

ff

II
55.00Hz

tuba

f

12 17

rapid and irregular harmonic glissandi between these two partials

25"

(tacet)

hold pitch as stable as possible (with circular breathing)

ff

123
30.87Hz

electr.

cue 3

cue 3 stop

f *ff*

$\text{♩} = 81$ use circular breathing as necessary for longer sustained sounds

59

9
16

4

15
16

7
8

horn

ff sempre

Bb2
55.00Hz

trombone

legato possibile

8:7

9 6 10 13 7 8 6 9 13 15 11 14 5 2 13

ff sempre

III IV FVI

51.91Hz 49.00Hz 32.70Hz

tuba

legato possibile

10:9

10 11 13 15 4 7 12 9 5 3 8 15 14 11 13 9 3

ff sempre

234 14 123

27.50Hz 29.14Hz 30.87Hz

61

7
8

14 15 13 6 9 8 11 9 11 7 5 3 9 4

9
16

horn

ff

Bb13 Bb2 Bb0

43.65Hz 55.00Hz 58.27Hz

trombone

ff

II

55.00Hz

tuba

legato possibile

4:3

11 6 7 13 10 11 3:2 9 12 5 13 14

ff

2 12 123

41.20Hz 36.71Hz 30.87Hz

63

horn

ff

Bb23 46.25Hz

Bb13 43.65Hz

Bb123 41.20Hz

trombone

ff

FVI 32.70Hz

FV 34.65Hz

FIII 38.89Hz

tuba

ff

234 27.50Hz

Detailed description: This block contains the musical notation for measures 63, 64, and 65 for the horn, trombone, and tuba sections. The horn part (measures 63-65) features a melodic line with notes 13, 11, 13, 9, 14, 12, 15, 13, 9, 5, 3, 15, 7, 16, 13, 15, 8. It includes dynamic markings *ff* and *f*, and frequency labels Bb23 (46.25Hz), Bb13 (43.65Hz), and Bb123 (41.20Hz). The trombone part (measures 63-65) features a melodic line with notes 11, 7, 15, 10, 4, 12, 9, 14, 9, 15, 13. It includes dynamic markings *ff* and *f*, and frequency labels FVI (32.70Hz), FV (34.65Hz), and FIII (38.89Hz). The tuba part (measures 63-65) features a melodic line with notes 4, 15, 13, 15. It includes dynamic markings *ff* and *f*, and frequency labels 234 (27.50Hz). Fingerings and slurs are indicated throughout the parts.

65

horn

ff

Bb2 55.00Hz

trombone

ff

II 55.00Hz

V 46.25Hz

VI 43.65Hz

tuba

ff

134 25.96Hz

1234 24.50Hz

23 34.65Hz

Detailed description: This block contains the musical notation for measures 65, 66, and 67 for the horn, trombone, and tuba sections. The horn part (measures 65-67) features a melodic line with notes 8, 9, 16, 13. It includes dynamic markings *ff*, *f*, and *ff*, and frequency labels Bb2 (55.00Hz). The trombone part (measures 65-67) features a melodic line with notes 5, 4, 3, 6, 8, 11, 15, 7, 13, 9, 5, 12. It includes dynamic markings *ff*, *f*, and *ff*, and frequency labels II (55.00Hz), V (46.25Hz), and VI (43.65Hz). The tuba part (measures 65-67) features a melodic line with notes 15, 16, 8, 13, 6, 11, 10, 15, 7, 13, 11, 15, 9, 5, 4, 3, 2. It includes dynamic markings *ff*, *f*, and *ff*, and frequency labels 134 (25.96Hz), 1234 (24.50Hz), and 23 (34.65Hz). Fingerings and slurs are indicated throughout the parts.

67

horn

13 15 9:10 9 7 16 12 5 13 8:7 14 13 16

ff *f* *ff* *f*

F12 36.71Hz Bb1 51.91Hz Bb12 49.00Hz

trombone

14 11 8 13 15 10 7 2 3 13:10 15 11 10 7 6 10:7 7 4 5 11

f *ff* *f* *ff* *f* *ff*

FII 41.20Hz FIII 38.89Hz I 58.27Hz

tuba

8

f *ff* *f* *ff*

234 27.50Hz

69

horn

4 11 12 15 11 9 6 13 14 10 2 12 11 7 3:2 5 9 8 3:2

ff *f* *ff* *f* *ff*

Bb23 46.25Hz F13 32.70Hz F1 38.89Hz

trombone

2

ff *f* *ff* *f*

II 55.00Hz

tuba

15 11 10 12 9 7 6 7 4 7:6 13 11

ff *f* *ff* *f*

24 30.87Hz 23 34.65Hz 3 36.71Hz

71

horn

6:5 5:6 5:6

13 7 8 10 3 13 9 15 11 17 16

ff *mf*

Bb1 51.91Hz (b) F123 30.87 (b) F0 43.65Hz (b)

trombone

11 12 13 9 7 11 10 8 5 9 11

ff *mf* *ff* *mf*

11:12 I FVI 58.27 32.70Hz (b) (b)

tuba

16

mf *ff* *mf* *ff*

234 27.50Hz (b)

73

horn

17 16 15 11:12 5 7 11 6 9

ff *mf* *ff*

F23 34.65Hz (b) Bb2 55.00Hz (b) Bb12 49.00 (b)

trombone

4

ff *mf* *ff* *mf*

11 55.00Hz (b)

tuba

9 10 3:2 3 9 8 11 5:6 7 6 10 14

mf *ff*

2 41.20Hz (b) 1 38.89Hz (b) 14 29.14 (b)

74

horn

mf *ff* *mf* *ff*

Bb2
55.00Hz

trombone

15 10:13 14 13 12 8 15 3 7

mf *ff* *mf*

V 46.25Hz VII 41.20Hz

tuba

9 12 7 9 10 4 14:13 6 8 5 9 7

mf *ff* *mf*

4 32.70Hz 43.65Hz

56" 56"

75

horn (tacet)

ff

trombone (tacet)

ff

tuba (tacet)

ff

electr. *ff* *fff*

cue 4 cue 4 stop

=81-96 independently
 each sound different in timbre and/or microtonal inflection
 (up to 1/4 tone either side of C#) - freely alternating between
 open, half-stopped and stopped sound

=81-96 independently
 each sound different in timbre and/or microtonal inflection
 (up to 1/4 tone either side of C#)

=81-96 independently
 each sound different in timbre and/or microtonal inflection
 (up to 1/4 tone either side of C#)

76 ♩=96

horn *p* *mp* *p* *mf* (lip trill 13/14)

F1 38.89 Bb23 46.25 Bb123 41.20 Bb2 55.00 Bb12 49.00 Bb0 58.27 Bb1 51.91 F0 43.65Hz

(b) (b) (b) (b) (b) (b) (b)

trombone (very slow constant glissando with intermittent sound!) *p* *mp* *p* *mp* *mf* *mp* *p* *mp*

II 1/2 I 1/2 (5) 6 5

tuba (valve 2) *mp* *mf* (1234)

1234 (1234)

78 (rapid random activity on all three valves while holding pitch as close as possible to A4)

horn *f* *ff* *f* *ff* *f* *mf* *f* *mf*

(Bb division) 14 15 11 12 13 11 10 15 13 14 11 11 10

Bb123 F1 Bb2 Bb12 Bb23 Bb1 Bb0 F1 Bb23 Bb123 Bb1 Bb2 Bb0

41.20 38.89 55.00 49.00 46.25 51.91 58.27 38.89 46.25 41.20 51.91 55.00 58.27

(b) (b) (b) (b) (b) (b) (b) (b) (b) (b) (b) (b) (b)

trombone *f* *mf* *mp* *f* *mf* *mp* *mf* *ff* (rapid slide vibrato ± 1/4 tone)

FV 1/2 FIV 1/2 IV 1/2 - V 1/2

tuba *f* *mf* *mp* *f* *mf* *mp* *mf* *ff* (valves 1, 2 & 3, independently)

(1234) (1234)

80

horn *ff* *f* *fff* *f* *fff* *ff* *f* *ff* *fff* *ff* *f*

Bb12 49.00 Bb23 46.25 Bb2 55.00 Bb1 51.91 F1 38.89 Bb0 58.27 Bb12 49.00 Bb123 41.20 Bb2 55.00 F1 38.89 Bb1 51.91 Bb12 49.00 Bb0 58.27

(b) (b) (b) (b) (b) (b) (b) (b) (b) (b) (b) (b) (b)

trombone (lip trill 8/7) *fff* (rapid slide vibrato)

FV - FIII

tuba *ff* *f* *fff* *f* *fff* *ff* *f* *ff* *fff* *ff* *f*

(1234)

horn
fff sempre
12 11 7 6 5 3 9:10 8 9 10 11 12 13 14 15 3 7:8
F2 F1 F12 F23 F13 F123 F13 Bb2
41.20 38.89 36.71 34.65 32.70 30.87Hz 32.70 55.00
(b) (b) (b) (#) (b) (b) (b) (b)

trombone
fff sempre
7 16 (upward gliss. of harmonics, downward gliss. of slide) 6:5 6 4 3 2 14 13 12 11 10 9
I VII III V VI VII VII I
58.27Hz 41.20Hz 51.91 46.25 43.65 41.20Hz 41.20Hz 58.27
(b) (b) (b) (#) (b) (b) (b) (b)

tuba
fff sempre
(all 4 valves, independently) 3:2 14 6 5 4 3 2 9:8 9 10 11 12 13 14 15 16 4:5
1234 1 0 24 134 1234 234
24.50Hz 38.89 43.65 30.87 25.96 24.50Hz 27.50Hz
(b) (b) (b) (b) (b) (b) (b)