

Horn

for horn and live electronics, or horn and tape

**Larry Polansky
1989; rev. 1992**

for Chris Bobrowski

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Horn may be performed by a live french horn player accompanying herself on tape, or by a live performer with computer-generated tape or real-time electronics.

The score is in *written*, not *sounding* pitch, so the piece is actually in concert, or sounding Bb.

Structure

The piece is in five sections of 17 "measures." In the first section (mm. 1-17) a harmonic series on low F (written) is built gradually, from simplest to most complex prime harmonic. That low F is the fundamental for the entire work. In the second section (mm. 18-34), the harmonic series on F (I) is replaced with one on A (V, the fifth harmonic). In the third section (mm. 35-51) a series on C (III, the third harmonic) replaces the one on A. In the fourth section (mm. 52-68) the series on C is replaced with the original series on F. In the fifth section (69-85), the series on F gradually drops out. The order of entry of harmonics for each section (except the last, which is the reverse) is as given on the bottom of page 2 of the score: 17, 13, 11, 14, 7, 15, 10, 5, 9, 12, 6, 3, 16, 8, 4, 2, 1 (from "highest to lowest prime").

Horn belongs to a set of works which are orchestrations of a single idea. All of these pieces have the same harmonic structure as my earlier work, *Psaltery* (1978-9). Other pieces in the set are *Cello*, *Canon for Flute*, *Glass*, *Choir*, and *Flutes* (all written between 1979-80).

Intonations

Intonations in *Horn* are drawn from the first 51 harmonics of the note F (written). These pitches are derived from three harmonic series: one beginning on F, one on a just perfect fifth of F (3/2, or an octave below the third harmonic), and one on a just major third of F (5/4, or two octaves below the fifth harmonic). Only one set of 17 intervals needs to be learned, the first 17 harmonics (half of which are octaves of some other pitch in the series).

Intonations are indicated in the score as cents (¢) deviations from the nearest tempered note. For example, the C-natural in measure 6 is notated as 2¢ higher than equal-tempered C (in this particular case, an almost insignificant difference). In measure 13, the entrance of the 7th harmonic (Eb), the ¢ deviation is of course much larger — 31¢ flat of an equal-tempered Eb. Each pitch is identified upon entering or leaving by a roman numeral with an arabic numeral subscript. The roman numeral shows the *harmonic series* to which the pitch belongs (I for F, V for A, and III for C). The subscripted arabic numeral identifies the *harmonic number*. A "+" means that the pitch is introduced in that measure, a "-" means it is dropped. A slash between two numbers (e.g. III₁₁/V₁₃) means that the pitch above the slash replaces the pitch below (these pitches are often close together).

For example, in measure 19, V₁₃/I₁₆ means that the 13th harmonic of V(A) gradually replaces the 16th harmonic of I(F) over the course of the measure. Both of these particular pitches are notated as

F on the top line of treble clef. As the notation indicates, V_{13} is 27¢ sharp of I_{16} , which is the same as its tempered neighbor. What is heard is a gradual retuning of that pitch over the measure.

One pitch, I_{15} , is “retained” throughout the whole piece, although it is renamed as V_6 , V_{12} , and III_{10} . Other pitches are common to various pairs of the three harmonic series. Several pitches, for reasons of range, are adjusted down one octave from where they would naturally occur in the harmonic series, but their intonations are not affected.

The tuning chart shows the intonations for all pitches used in the piece.

Notation

Each measure contains an “arpeggio” of available pitches that may be played in any order, in any way. These pitches are available for the length of the measure.

There are usually 17 notes in a given arpeggio, with the exception of mm. 42-49, which have only 16, and the first and last section. The transition between arpeggios should be smooth — the new pitch should always “crossfade” with the pitch it is replacing. In effect, the performer can think of each arpeggio as having 18 pitches (with the exception of mm. 42-49).

Four types of noteheads are used:

- *a non-beamed black notehead* is a pitch from the current harmonic series
- *a non-beamed white notehead* indicates a pitch that is entering in the current measure. It should be accented slightly. It always has an associated ¢ deviation from its nearest tempered neighbor.
- *beamed black or white notehead* indicates the member of the new harmonic series replacing the a member of the previous series. For example, in measure 19, the A-sharp and F-natural (white notehead) are both members of the series on $V(A)$. As a new series replaces an old one, more and more of the pitches in the resultant arpeggio (which is a mixture of two different harmonic series) will be beamed

Duration

Each measure of the score is of indeterminate length; the entire piece should be about 17 minutes long. The measures do not have to be of equal length, in fact, the second through fourth sections (mm. 18 – 68) should progress faster than the beginning and end of the piece (mm. 1 – 17 and mm. 69-85). Measures in which there is a “complete” harmonic series (mm. 17, 34, 51, 68), can be treated as cadences, or places of temporary rest, and may last a bit longer.

Tape or electronics part

The tape or live electronics part is another realization of the score. To perform with tape, make between 4 and 8 realizations of the score on multi-track tape, and use the tape to accompany the live performer. Durations of individual measures do not have to be synchronized. However, each track or realization of the piece should progress more or less at the same rate, and should be the same length.

An electronically generated tape part, realized in Csound by the composer and Tom Erbe, is available from the composer.

Live computer electronics may also be used. There are some simple hardware and software requirements. The required software is a program written by the composer in *HMSL (Hierarchical Music Specification Language)*, a computer music language written by Phil Burk, the composer, and David Rosenboom. The computer program is a "live realization" of the compositional procedure for the piece. That is, the computer composes the piece while it is performing it, according to the same ideas which structured the score itself. The software runs on a Commodore Amiga or Macintosh computer, and is available from the composer. The software is self-contained, and can be run by the performer without any extensive knowledge of computers. Because the software uses special system exclusive software to achieve the real-time intonation control, two Yamaha FBO1's are required as well, in addition to the computer and MIDI interface.

Horn was first performed by Chris Bobrowski (horn) and the composer, using two Yamaha FBO1's and an Amiga 1000, at the Mills College Center for Contemporary Music, March, 1990.

Larry Polansky
Oakland, CA, 1990/Lebanon, NH, 1992

Series on F (1/1)

cents from tempered: +2 4 5 6 7 8 9 10 11 12 13 14 15 16 17

partial#: 1 2 3

Detailed description: This musical notation shows the first 17 partials of a series on F. The top staff is a treble clef with notes and accidentals. The bottom staff is a bass clef with notes. Cent values are written above the notes. The values are: -14, +2, -31, +4, -14, -49, +2, +41, -31, -12, +5. The first three partials are labeled with 'partial#' 1, 2, and 3.

Series on C (3/2)

cents from tempered: +2 +2 +4 +2

Detailed description: This musical notation shows the first 17 partials of a series on C. The top staff is a treble clef with notes and accidentals. The bottom staff is a bass clef with notes. Cent values are written above the notes. The values are: -12, +4, -29, +2, +6, -12, -47, +4, +43, -29, -10, +2, +7. The first four partials are labeled with 'cents from tempered' values: +2, +2, +4, +2.

Series on A (5/4)

cents from tempered: -12 -14 -28 -12 -45 -14 -10 -28 -63 -12 +27 -45 -26 -14 -9

Detailed description: This musical notation shows the first 17 partials of a series on A. The top staff is a treble clef with notes and accidentals. The bottom staff is a bass clef with notes. Cent values are written above the notes. The values are: -12, -14, -28, -12, -45, -14, -10, -28, -63, -12, +27, -45, -26, -14, -9. The first two partials are labeled with 'cents from tempered' values: -14, -14.

26

-10 (-14) -12

V_9/I_{11} V_{12}/I_{15}

28

-12 -12

V_3/I_7 V_6/I_8

30

(-14) (-14)

V_{16}/I_{10} V_8/I_{12}

32

(-14) (-14)

V_4/I_5 V_2/I_4

34 Full Series on V (A)

(5) (6) (7) (8) (17) (9) (10) (16) (11) (13) (14) (15) (12)

V_1/I_1

35 Until 52, all new stemmed pitches from III (C)

+7 +43

III_{17}/V_5 III_{13}/V_{15}

37

III₁₁/V₁₃ III₁₄/V₁₇

39

III₇/V₄ III₁₅/V₉

41

* only 16 pitches, III₅ = V₃ until 50.

(-12) (-12)

(this "new" note is same as old one)

III₁₀/V₁₂ III₅/V₆

43 (16 pitches only)

III₉/V₁₁ III₁₂/V₁₄

45 (16 pitches only)

III₆/V₇ III₃/V₂

47 (16 pitches only)

III₁₆/V₁₆ III₈/V₁₀

49 (16 pitches only) (17 pitches)

III₄/V₈ III₂/V₃

51 Full series on III (C)

III₁/V₁

52 Until end, all new stemmed pitches from I (F)

I₁₇/III₁₁ I₁₃/III₉

54

I₁₁/III₁₅ I₁₄/III₁₄

56

I₇/III₅ I₁₅/III₁₀

58

I₁₀/III₁₃ I₅/III₃

60 +4 (+2) (same as before)

I_9 / III_6 I_{12} / III_8

62

I_6 / III_{17} I_3 / III_4

64

I_{16} / III_{12} I_8 / III_{16}

66

I_4 / III_7 I_2 / III_2

68 Full series on I (F) (parenthetical pitches drop out)

I_1 / I_1 - I_{17}

70

- I_{13} - I_{11}

72

Musical notation for measures 72 and 73. Measure 72 features a treble clef with a melodic line and a bass clef with a bass line. Measure 73 continues the melody and bass line. Chord markings below the bass line are -I₁₄ and -I₁₇. Accents (>) are placed under the bass notes in both measures.

74

Musical notation for measures 74 and 75. Measure 74 features a treble clef with a melodic line and a bass clef with a bass line. Measure 75 continues the melody and bass line. Chord markings below the bass line are -I₁₅ and -I₁₀. Accents (>) are placed under the bass notes in both measures.

76

Musical notation for measures 76 and 77. Measure 76 features a treble clef with a melodic line and a bass clef with a bass line. Measure 77 continues the melody and bass line. Chord markings below the bass line are -I₅ and -I₉. Accents (>) are placed under the bass notes in both measures.

78

Musical notation for measures 78 and 79. Measure 78 features a treble clef with a melodic line and a bass clef with a bass line. Measure 79 continues the melody and bass line. Chord markings below the bass line are -I₁₂ and -I₆. Accents (>) are placed under the bass notes in both measures.

80

Musical notation for measures 80, 81, and 82. Measure 80 features a treble clef with a melodic line and a bass clef with a bass line. Measure 81 continues the melody and bass line. Measure 82 continues the melody and bass line. Chord markings below the bass line are -I₃, -I₁₆, and -I₄. Accents (>) are placed under the bass notes in measures 80, 81, and 82.

83

Musical notation for measures 83, 84, and 85. Measure 83 features a treble clef with a melodic line and a bass clef with a bass line. Measure 84 continues the melody and bass line. Measure 85 continues the melody and bass line. Chord markings below the bass line are -I₄ and -I₂. Accents (>) are placed under the bass notes in measures 83 and 84.