Yitgadal

1. ascending viewpoint (for Bill Colvig)
2. descending viewpoint (for Lou Harrison)

for violin, viola, cello, guitar, harp, percussion, and at least six melody instruments (flute, oboe, clarinet, trumpet, piano, pitched percussion)

Larry Polansky
2003-4

written for David Rosenboom and The New Century Players
Yitgadal

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Larry Polansky
Hanover/Aptos
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(Revised, Spring 2004)

Yitgadal is a pair of twin chorales in memory of Lou Harrison and Bill Colvig. Rhythmically, the piece is a free transcription of the Hebrew mourner’s kaddish.

ascending viewpoint goes from harmonic (and rhythmic) simplicity to harmonic (and rhythmic) complexity. descending viewpoint moves in the reverse direction. The pieces may be played in either order.

There are three groups of instruments: harmony, melody, and harp/percussion.

The four harmony instruments (violin, viola, cello, guitar) play natural harmonics on retuned strings. These natural harmonics form different four-part chords (in an extended just intonation) for each beat of the piece. The harmonic progression is determined by a gradual change in a harmonic complexity measure called the Euler GS function, which, in simple terms, measures the relative dissonance of harmonic intervals.

The harmony instruments may be amplified and artificially reverberated slightly to increase their presence in the hall. The guitar may be electric or acoustic.

Notation (harmony instruments)

There are two scores: performance and actual pitch. The performance score uses a standard tablature notation for natural harmonics, indicating nodes on the strings to be played. The actual pitch score shows the sounding pitches resulting from the harmonic fingerings.

Performance Score

In the performance score the string number, harmonic, node, and rhythm are specified, but the actual pitch produced is not notated. String numbers are Roman numerals from low to high (IV– I for the bowed strings, VI – I for the guitar). Harmonics are indicated by Arabic numerals, from the open string, or first harmonic (1) to the 5th harmonic in the bowed strings, 4th in the guitar. The first harmonic is the open string (which might also have been notated as “0”). The 2nd harmonic (2) divides the string in half (and is played at the octave). The 3rd divides the string into three parts, and is usually played at the perfect 5th (but also at the symmetrical point closer to the bridge), and so on.

For example, the notation IV5 for the cello indicates the 5th harmonic on the cello IV string, which is a low C (and is not retuned for the piece). This will result in an E-natural slightly flat (-14¢) of its 12TET namesake, 2 octaves and a M3rd above the open string. As another example, the notation II3 on the viola means that the 3rd harmonic of the viola’s
retuned 2\textsuperscript{nd} (II) string is to be played. That string is retuned to a C\# slightly sharp (+5¢, or the 17\textsuperscript{th} harmonic) of 12TET middle C\#, and the resulting pitch is a similarly sharp G\# (+7¢) an octave and a P5\textsuperscript{th} higher.

The fundamentals of each string are easily obtainable from the natural harmonics on the low string of the cello, and in one case, by tuning a string to a harmonic of a string already tuned to the cello IV string (specifically, viola I, which is a P5\textsuperscript{th}, or 3\textsuperscript{rd} harmonic, of the guitar IV string).

The tuning chart indicates how to tune the instruments (which, with a little practice, can be done quickly and by ear). This tuning chart first shows (top line) the scordatura for the instruments, with the string number above (IV-I) and the harmonic to which the string is tuned (displaced, of course, by octaves) below. For example, the viola I string mentioned above is tuned to the 27\textsuperscript{th} harmonic, which is an A approximately 6¢ sharp of its 12-ET equivalent. The next four systems on the tuning chart show the fingerings, node notation and resultant pitches used in the piece. For example, by sounding the 5\textsuperscript{th} harmonic on the violin I string (I5) (tuned to an E, −14¢), a G\# two octaves and a M3\textsuperscript{rd} above will result (−28¢). Fundamentals (open strings, or 1\textsuperscript{st} harmonics) are notated as regular, black noteheads. Harmonics 2–5 are notated as diamonds.

The 9\textsuperscript{th} and 15\textsuperscript{th} harmonics (guitar IV, viola I and IV respectively) can be alternately tuned as perfect P5\textsuperscript{ths} from violins IV/cello III, and P5\textsuperscript{ths} from violin I/guitar I, respectively. The 27\textsuperscript{th} harmonic (viola I) can then be tuned as a P5\textsuperscript{th} from the 9\textsuperscript{th} harmonic (or more simply, as 3 P5\textsuperscript{ths} from C).

Actual Pitch Score
In the actual pitch score, all pitches are notated as they sound given the fingerings below the note and the scordatura. The first time a pitch is sounded, its cents deviation is given. Note that there are a number of enharmonic cognates as a result of the harmonics, for example, the C\#, which is produced as violin III4 (or violin III1, III2; viola I1, I2, and I4) is a different pitch than the C\# which results from cello I3. The former is 5¢ sharp, a 17\textsuperscript{th} harmonic. The latter is 47¢ flat, the 3\textsuperscript{rd} harmonic of the 11\textsuperscript{th} harmonic (or 33\textsuperscript{rd} harmonic).

Standard tuning for C-natural is the fundamental of the entire piece.

Rhythm
In ascending viewpoint, the harmony instruments players should begin in rhythmic unison, and allow themselves more and more freedom towards the end, playing individually “around” the notation as they like (as long as each four part “chord” is more or less played around the same time). In other words, all instruments should proceed through the score at more or less the same rate, but may treat the exact rhythms as a kind of guide, starting in strict unison, ending in freedom.

In descending viewpoint, the harmony instruments should do the opposite, starting out in individual rhythmic freedom, and gradually constraining themselves to the notated rhythms by the end of the piece.
Melody instruments
The melody instruments play only one pitch, in rhythmic unison. Melody instruments should fade in and fade out smoothly over the course of their melodic segments (delineated by periods of rest). They may play in different octaves if they like, though they should stay in one octave for an entire “fade in/fade out” section. Occasionally they might also play a perfect fifth of the melody, or chordal instruments (like the piano and pitched percussion) might play some open 5th or octave.

Any instruments might be used to play these parts, as long as the six parts in the score are played. Other instruments might double an existing part as well. Transitions from one instrument to another to be as smooth as possible, the unison timbres should be perceived as one single melody, rather than several instruments playing the same note in unison.

Harp/Percussion
The harp and percussion function as punctuating instruments. The harp is retuned for the pitches it uses (see below). The harp tuning can be easily obtained from the cello harmonics, or by ear from its own harmonics on the low C strings.

The harp uses the following pitches, within a small number of octaves: C, C#, E, F#, G, Ab, Bb. These are tuned to the 1st, 17th, 5th, 11th, 3rd, 13th, and 7th harmonics (respectively) of the low cello C. For ease of tuning, the C and G are almost exactly in equal-temperament, the E is slightly flat (14¢), the Bb flatter (31¢), and the F# and Ab almost exactly a quarter-tone between F/F# and Ab/A.

The percussion may play a variety of quiet, non-pitched instruments (small cymbals, wood blocks, any found percussion sounds, etc.). The percussionist should orchestrate the piece according to his own ideas. One or two sounds may be used for the six “cadences,” or a wide variety of sounds might be used.

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LP
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Technical note
The **Euler GS** (Gradus Suavitatis, 1739) function of a number is the sum of its prime factors multiplied by their exponents, minus one less than the number of distinct factors. It measures a certain form of numerical complexity, and, by extension, may function as a harmonicity or consonance/dissonance measure.

By definition, the minimum value of the GS function is 1:

\[
\text{Gs}(1) = 1 - (1-1) = 1
\]

The smaller the prime factors, and the smaller their exponents, the smaller the GS function. For example:

\[
\begin{align*}
gs(2) &= 2 - (1-1) = 2 \\
gs(3) &= 3 - (1-1) = 3 \\
gs(5) &= 5 - (1-1) = 5 \\
gs(6) &= 2 + 3 - (2-1) = 4 \\
gs(7) &= 7 - (1-1) = 1 \\
gs(8) &= (2 * 3) - (1-1) = 6 \\
gs(11) &= 11 - (1-1) = 11 \\
gs(15) &= 3 + 5 - (2-1) = 7 \\
gs(35) &= 5 + 7 - (2-1) = 11 \\
gs(144) &= 2 + 7 + 11 - (3-1) = 18 \\
gs(210) &= 2 + 3 + 5 + 7 - (4-1) = 14 \\
gs(3072) &= (2 * 10) + 3 - (2-1) = 22
\end{align*}
\]

The GS function of a prime is that prime. GS functions are not, as is clear from the above, unique. The GS function of a ratio is, by definition, the GS of the ratio’s LCM (least common multiple). For example:

\[
\begin{align*}
gs(3/2) &= gs(6) = 4 \\
gs(7/4) &= gs(28) = 10
\end{align*}
\]

In this way, it yields a clear measure of harmonic complexity for a just ratio.
יתגдол

1. ascending viewpoint (for bill colvig)
   (performance score)
Violin & Viola
Cello
Guitar
Flute
Oboe
Clarinet
Trumpet
Piano
Pitched Perc.
Melody
Harmony
Harp
Perc.

Quietly

ldgty

Larry Polansky

(Yitgadal)
ascending viewpoint
(for bill colvig)

for bill colvig

Larry Polansky
harp always legato, firm, but quiet

verse 2

slight crescendo
Verse 3

p. Perc.
Perc.
Cello
Trpt.
Vln.
Vla.
Gtr.
Ob.
Cl.
Fl.

Page 4 (Ascending)
Verse 4

Ⅲ3 ⅩⅤ ⅩⅤ ⅩⅤ ⅩⅤ ⅩⅤ ⅩⅤ ⅩⅤ
ⅠⅢ Ⅺ ⅩⅤ ⅩⅤ Ⅹ14 ⅩⅤ ⅩⅤ ⅩⅤ
ⅣⅤ ⅩⅤ ⅩⅤ ⅩⅤ ⅩⅤ ⅩⅤ ⅩⅤ ⅩⅤ
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page 7 (Ascending)
2. descending viewpoint (for lou harrison) (performance score)
page 5 (Descending)
Verse 4

Page 7 (Descending)
Verse 5
1. ascending viewpoint (for bill colvig)
   (actual pitch score)
Violin

Viola

Harmony

Cello

Guitar

Flute

Oboe

Clarinet

Melody

Trumpet

Piano

Pitched Perc.

Harp

Perc.
page 2 (Ascending)
2. descending viewpoint (for lou harrison)
   (actual pitch score)
Quietly

\( \text{descending viewpoint} \)
(for lou harrison)

Larry Polansky

\[ \begin{array}{c}
\text{Violin} \\
\text{Viola} \\
\text{Harmony} \\
\text{Cello} \\
\text{Guitar} \\
\text{Flute} \\
\text{Oboe} \\
\text{Clarinet} \\
\text{Melody} \\
\text{Trumpet} \\
\text{Piano} \\
\text{Pitched Percussion} \\
\text{Harp} \\
\text{Percussion}
\end{array} \]
Verse 2
Verse 5

(page 8 (Descending))
Vln.  
\[ I_1 \ IV_4 \ I_1 \ IV_4 \ I_1 \ IV_4 \ IV_1 \ IV_2 \ IV_4 \ IV_1 \ IV_1 \ IV_4 \ IV_2 \]

Vla.  
\[ IV_1 \ IV_4 \ IV_2 \ III_4 \ IV_4 \ IV_2 \ IV_1 \ IV_2 \ IV_2 \ IV_4 \ IV_2 \ IV_1 \]

Cello  
\[ IV_1 \ III_4 \ IV_1 \ IV_2 \ III_1 \ IV_3 \ III_1 \ III_2 \ IV_4 \ IV_4 \ IV_5 \ IV_2 \ IV_1 \]

Gtr.  
\[ VI_3 \ VI_3 \ VI_2 \ VI_4 \ VI_1 \ VI_3 \ VI_2 \ VI_1 \ VI_4 \ VI_1 \ VI_4 \ VI_2 \ VI_1 \]

Fl.  
-  

Ob.  
-  

Cl.  
-  

Trpt.  
-  

Pno.  
-  

P. Perc  
-  

Harp  
-  

Perc.  
-  

page 9 (Descending)