

XIII. Harmonia

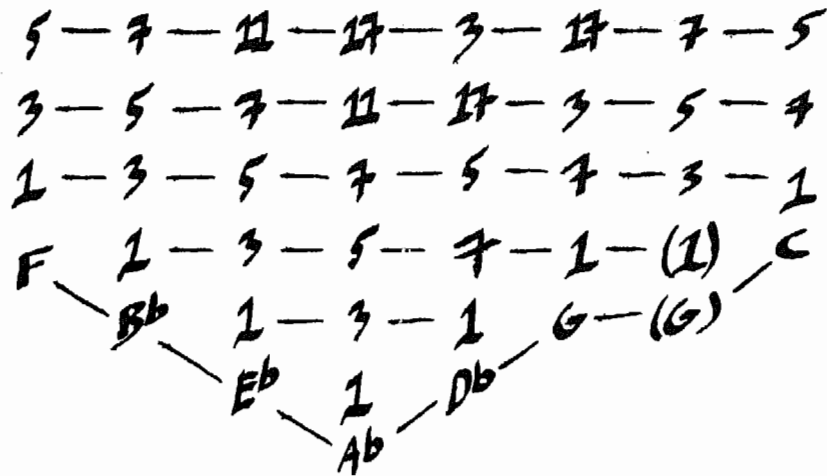
The four Harmonia, along with some related pieces (Saxony, Band and Chromatic Canon) represent in a way the current stage of Tenney's thinking (although there are several later pieces: Septet, Listen, Glissade, Voices, deus ex machina..., see Appendix II); all of which I am omitting from this article because I have simply not had enough time to "live" with them). The Three Indigenous Songs was actually written prior to many of the Harmonia, but was copied and premiered later.

Although in many ways, the Harmonia are clearly related to the Chorales, Clang and other earlier works, there is a kind of unity to the set that distinguishes them. For one thing, they are even more economical than most of Tenney's previous works, and their avoidance of musical drama, and strict adherence to canonical and harmonic formulations is taken almost to a compositional limit. They are each different solutions to a certain harmonic/canonic/formal puzzle, and the ways in which each solves this puzzle is unique and fascinating. There is some confusion about their numberings, since there have been several revisions. Acting on Tenney's wishes about the set, I have omitted #1 (later revised to be what is now #2), and retained the current numerical ordering even though it does not necessarily correspond to the chronological.

#2 is, as Tenney calls it, the "ur" version, in that it clearly states the harmonic idea without any artifice of orchestration, melody, rhythm, etc.. It is for any sustaining instruments, and is simply a chorale of available pitches. The piece is dedicated to the great American composer, theorist, teacher, instrument builder, etc., Lou Harrison, whose long interest in intonation has been an influence on Tenney.

In discussing its form, we can provide a basis for the other Harmonia as well. It consists of a steadily growing and then decaying chord, based on the primes of the harmonic series, which modulates roughly in the circle of fifths. The voice leading can be seen in the diagram of Example XIII.1, in terms of the number of the partial in relation to the new root. The basic principle is that of closest voice movement, with each successive chord in the first half containing one higher harmonic, and each in the second half one less. Tenney's idea seems to be one of an extended dominant, since in the Harmonia he tends to omit the 13th and 19th partials, basing the pieces on a chord that might be called an aug11 b9. (In the key of C: C-E-G-Bb-F#-Db). The first half of the piece is highly ordered, with a kind of canon by partial in each voice (1,3,5,7...; see Example XIII.1). The second half upsets this symmetry to some

Example XIII.1



VOICE LEADING SYSTEM FOR HARMONIA (from #2)

extent, mainly to facilitate the desired C dominant ending (so that the piece might be "cyclic"). Another interesting aspect of the piece is that in the first half (up to the Ab "tonality") the series is built up over a phantom root, suggesting the "tonic" before it actually enters. In the second half, the tonic enters under the old "tonality", and the higher pitches return to the new bass note. A look at the score shows the extremely smooth and clear voice leading, with no voice (except the bass moving in fifths) having a range of more than a major third. Example XIII.2 is the entire score for this piece.

#3 is a remarkable hoquet for three harps dedicated to Susan Allen, and is the one in the set that I have not heard in its completed version (though I am familiar with it in an earlier sketch). Each of the three harps is at a different pitch, harp I being 14 cents sharp of harp II, and harp III 14 cents flat. In this way, many of the intervals of the harmonic series primes can be approximated quite closely. For example, the just third (fifth harmonic) is exact between harps I and II, and between III and II, and the wider deviations from tempered tuning (like the 31 cents flat seventh and 49 cents flat 11th) are approximated by the pitch distance of the outer harps (28 cents). The most common usage of this, from "sections" IV through X (Bb through A in the modulatory scheme) shows the way in which the full

Example XIII.2

HARMONIUM #2

JAMES TENNEY
9/76

for LOU HARRISON

The score of HARMONIUM #2 consists of seven sections (indicated by double "bar-lines"), each of which is divided into two to five segments (single "bar-lines"). The notation shows available pitches for each segment, with numbers above notes indicating deviations from the tempered pitch in cents.

Each performer chooses one after another of the available pitches in the current segment, and plays it as follows: $ppp \leftarrow X \rightarrow ppp$, where "X" is the dynamic level notated for that pitch. Each tone may be from four to twelve seconds long, but its duration should be equally divided between the crescendo and decrescendo portions of the tone. After a pause at least as long as the previous tone, this process is repeated with the same or any other available pitch in that segment. Non-sustaining instruments with fixed intonation (e.g., keyboard and mallet instruments) may play only the lowest pitch in any segment, letting the tone fade away completely before sounding it again.

The transition from one segment to another may be initiated by any player, simply by introducing the newly available pitch for the next segment (a "white" note). These transitions should be timed so that the total duration of each section is somewhere between one and three minutes in length.

The musical score consists of three systems, each with four staves. The notation includes various dynamic markings and pitch deviation numbers in cents above notes. The first system starts with a treble clef staff and a bass clef staff, both marked <mp>. The second system continues with similar dynamics, including <mf> and <f>. The third system concludes with <pp> markings. Pitch deviations are indicated by numbers such as -14, -31, +2, +5, -49, and -14 above notes. The score is divided into sections by double bar lines and segments by single bar lines.

"ur" chord is intoned (Example XIII.3).

Example XIII.3



The Eb tonality (1,3,5,7,11) is distributed among the three harps in such a way that the intonations of the partials are as follows:

<u>Pitch</u>	<u>Harmonic #</u>	<u>Harmonic Series Intonation (cents)</u>	<u>Harp Tuning (cents)</u>	<u>Deviation from "Natural Intonations"</u>
Eb	1	0	0	0
Bb	3	702	700	-2
G	5	386	386	0
Db	7	969	972	+3
A	11	551	586	+35
E	17	105	86	-19

Note that while these pitches perhaps derive from the harmonic series, a secondary result is that the use of this intonational adjustment creates a slightly different just fabric, for the tuning of the tritone (Eb-A) is almost exactly that of the 7/5 ratio, and the minor second (Eb-E) is surprisingly close to the 21/20. In fact, over the course of composing the Harmonia, Tenney began to consider the tritone and minor second as the "extended just" ratios 7/5 and 21/20, respectively, rather than the "harmonic series" intervals 11/8 and 17/16. The 7/5 is 583 cents, and so the "A" in the above chart becomes only 3 cents wide. The 21/20, 84 cents, also improves the approximation, making the E natural only 2 cents wide. (A close look at the cents deviations in the score for #2 will reveal that these ratios

are being used there as well). In the remaining Harmonia, where the intonation is not so specified, Tenney probably considered the ideal intonation to be a 7-limit one, but the structural motivation is, I believe, still strongly related to harmonic series primes. The use of seventh partial relations is something that has become important in Tenney's thinking (as we shall also see in Chromatic Canon), especially in the approximation of the harmonic series. Ironically, this is similar to some of the 7-based tunings that Lou Harrison has been working with recently (in the Gamelan Si Darius among others), but it also suggests that these systems of the "7 limit", (as Partch would call them), are fundamental to the extended tonalities of modern harmony.

The form of #3 is similar to #2: a continuous modulation of this chord, which is the result of two major triads superimposed a tritone apart (sometimes called the "Petrouchka chord", and an harmonic relationship common in the music of Ives as well), through different keys a fifth apart. These modulations are made gradually, often by small shifts in intonation between the "same" note on different harps (as in the Bb in Example XIII.4). The first four sections of the piece build up the chord and the temporal density, beginning in eighth notes and working up to the sixteenth note quintuplets that become a durational ostinato. The voice leading in the buildup of the six note chord is identical to that of the first half of #1, with the same resultant voice canons. The center sections of the piece (the bulk of the work) are simply modulations from one chord/six-note tonality to the next a fifth below, and as such there are eleven sections of the piece (the next would be back in the initial key, G). The quintuplet pattern is also a kind of phase pattern, in which the upward and downward arpeggios pivot around the highest pitch (21/20) so that each measure starts on the tonic (see Example XIII.3). Much of the modulation, as in Example XIII.4 from the beginning of the piece, sounds like the change from major to minor, because of the minor seventh of the new key (7th

Example XIII.4

The musical score for Example XIII.4 consists of three staves. The first measure is marked with a circled '2' and '(x3)'. The second measure is marked with '(x4)'. The third measure is marked with '(x5)'. The fourth measure has a circled '3' above it. The fifth measure also has a circled '3' above it. The notation includes notes, rests, and dynamic markings like 'mf'. There are also some handwritten annotations like 'bê' and 'bê' above notes in the second and third measures.

partial) replacing the major third (5th partial) of the old. This modulatory motif shows up in many of the Harmonia and related works (like the Chromatic Canon). The final section takes the tempi up to sextuplets forming a rather difficult hocket (Example XIII.5) in which the chord is finally stated as the octatonic scale of Chorales and Clang without the 13th or 19th harmonic.

#4 (for 10 instruments and tape delay) is in many ways the clearest exposition of certain of the Harmonia-related ideas. It is scored for clarinet, alto sax, tenor sax, vibraphone, piano, two violins, viola, 'cello, and bass. Certain devices are spelled out here more precisely than in any of the others. The piano, for example, is assigned the fundamental of each new tonality, and so it is assured that all the intonational adjustment must be made to an absolute pitch. The idea of a continuous, ever-modulating sound is also stated explicitly in the notes to the piece:

"Rather, a player's choice of which pitch to play at any moment should be governed by an awareness of the over-all sonority, which ought to have all of the available pitches in a segment sounding simultaneously and continuously, even though the timbre of each tone will be changing."

The tape delay (also used in Saxony, in an earlier piece seldom performed anymore called Symphony, and in Glissade,

Example XIII.5



one of his newest pieces) helps to create this idea of a single gestalt. One of the central ideas of all the Harmonia, and one that is also prevalent in such works as Beast, is the sonority of harmonic interference. Because of the tape delay ("delay time of 10-12 seconds, and a fade out time of about 45 seconds") and the overlapping of tonalities, the

"transition from one segment to the next will thus include a period of about 45 seconds, during which there may be considerable interferences between new and old pitches. Each segment should last long enough for this interference to subside, and the new pitch to become clearly established in the texture"
- (from the instructions to the piece)

The amplitude envelope of each pitch is specified as (~~ppp~~ ^x) or a swell from nothing to the current dynamic level of the whole piece and back. In addition, as in the first harmonium, the entire piece has a similar envelope. In this version, the dynamic level rises from piano to forte over the first four sections, and then remains there for sections IV and V. In the last section, there is a decrescendo to "niente". Another refinement occurs in the use of natural string harmonics to provide the proper intonations to which all the wind instruments might tune, and the viola is slightly scordatura to facilitate this. Harmonics up to #11 (approximating the 7/5) are used, as the remaining one (the 17th) is both too high a node and too close to tempered intonation to be concerned with.

The form of #4 closely resembles #1, and in many ways #4 is simply a specific realization of #2 (in a different "key"). The first four sections build the "1-3-5-7-11-17" chord in the same way as before, with the higher partials entering before the fundamental. At section V the new fundamental (F) enters below the old series. Its partials gradually replace those of the old one, and at section VI the same process occurs with the tritone-related key. This use of the tritone is a simple device for shortening the number of harmonic steps through which the piece must pass, (in this case 7; in #3, 12), and also a horizontal referent to the vertical sonority. During section VI, the higher ratios/harmonics drop out one by one until only a full dominant seventh chord is sounding (1-3-5-7). In the final section, this chord "resolves" to a dominant seventh in E without its fifth (third partial). The resolution is done according to the "rules" of traditional harmony (D#-D; A-G#; B,F#-E) and in this we can catch a glimpse into a sort of grand musical pun inherent in the whole set.

#5, for John Cage (the string trio), takes its place alongside of the Chorales, For Ann (rising), and a few others as what Tenney might call his "ur" pieces - those in

which an idea is presented in a manner so essential and clear that it seems to be more of a revelatory process than a composed piece of music. It is dedicated to Cage, because, among other things, Tenney inadvertently perhaps invokes the famous "square root" method (as in Cage's First Construction, String Quartet, and several other pieces; see glossary in Appendix) in its canonical structure. The canonic, rhythmic and harmonic structure of this work are quite complex, and deserve at some future date a more detailed analysis than time and space allow me here. Harmonically, the trio is similar to the others in the set. The movement here traverses 10 "keys", the final two somewhat anomalous with respect to the previous Harmonia schemes. The tritonal chord is constructed slowly - not until the sixth 11 measure section (in F) are all the six pitches sounding. As before, they enter in the order of their partial number - 1,3,5,7, 11,17. The final two sections (X and XI) do not, as far as I can see, correspond exactly to the general Harmonia idea, rather, they provide a distinctive and beautiful ending to this particular version. Section X, which "should" be the "Harmonia chord" in Db tonality, is only partially so, for the upper voice contains the notes: G-D-A-E, which incidentally suggest the use of the "missing primes" 13 and 19. However, I don't think this is the primary intent. Instead Tenney is effecting a general disintegration of the previous harmonic texture into a kind of C pentatonic in which the piece ends. This is then the only one of the Harmonia that does not travel full circle to the dominant of its initial key. In other words, instead of completing the cycle through the Gb and then B, the last two sections settle into a kind of harmonic stasis in the simple C pentatonic mode. This is more of a timbral decision than an harmonic one, for it gives Tenney the chance to use the bare, skeletal sound of the open strings and natural harmonics. (Example XIII.6).

A remarkable rhythmic canon occurs in the string trio! The piece is eleven sections of eleven measures long (thus the "square root method"). In each section, there is a different rhythmic arpeggiation aggregate which is the result of the canon. These aggregates are the resultants of the "Harmonia chord" (in partial and full harmony) arpeggiated in the various rhythmic configuration caused by the canon. The note duration values within each section for the leading voice (the violin) in divisions of the measure are:

$3/2, 1/2, 1/8, 1/12, 1/16, 1/24, 1/12, 1/16, 1/8, 1/12, 1/8.$

In addition, the rhythmic arpeggios are carefully crafted to coincide with the distribution of the chord in the three voices (Example XIII.7). Note that for the first six sections there is a kind of exponential decrease in duration (rounded to convenient metrical values), and that during the second half of the piece there is a kind of sinusoidal shape in this parameter. The aural reasons for this become obvious upon hearing the resultants of the superimpositions of

Example XIII.6

XI (measures 5)

Vln.
Vla.
Cello

Example XIII.7

Vln.
Vla.
Cello

the three canonic voices. During the first half, the temporal density of the piece exponentially increases (as in Hocket), and the second half represents not so much a decay

as a settling into a single sonorous gestalt, one that is continually "modulated" by the shifts in the vertical placement of the rhythmic material. Example XIII.7 shows this in two selected measures from the latter half of the piece. With the exception of the very beginning of the work, in which the violin and 'cello present a clear example of Tenney's "swell" devices (Example XIII.8), and in which the 'cello is a kind of leading voice, the violin is the imitated voice. Note that the canon is applied not only to rhythmic material, but also to the arpeggio voicing in each line.

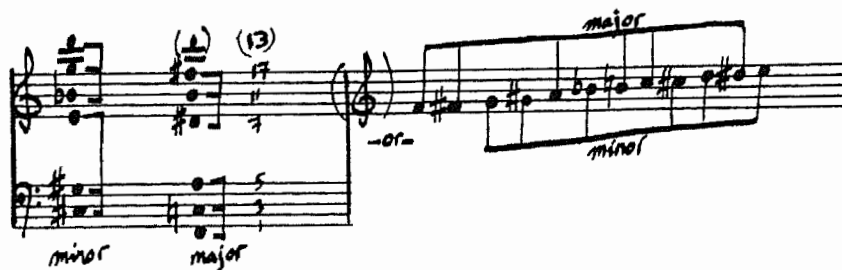
On a different level, the string trio represents a degree of internal consistency and integrity that is quite astonishing. The instruments play nothing but arpeggios throughout, and so the piece has the feel of a kind of contrapuntal study, yet once the listener becomes aware of the fact that the texture will not change significantly, he is free to experience and appreciate the small changes in rhythm, harmony and texture that happen constantly. As in so much of his other music, the intent is to free the listener from the notion of surprise, and to present ergodicity in at least one dimension so the perception of the others might be more complete. In this way, the string trio succeeds like few other pieces of music that I have heard.

Band, for concert band, is a kind of appendix to the Harmonia. The main harmonic structure is the construction of a chord of all those pitches not in the "1,3,5,7,11" chord, and then a gradual modulation to the latter. Example XIII.9 shows the two chords whose fundamentals are a minor sixth apart. Note that the first chord, the complement of the "Harmonia chord", is simply two minor triads a tritone apart. The score itself is two pages of music and about five of instructions, with notes for the conductor on the tuning of the instruments (in a manner similar to #3), the

Example XIII.8

The image shows a musical score for two instruments: Violin (Vln.) and Cello ('Cello). The score is written on two staves. The Violin staff is in treble clef and has a tempo marking of 'J=80' and a dynamic marking of 'pizz (on E)'. The Cello staff is in bass clef and has a dynamic marking of 'p'. Both staves show arpeggiated figures. The Violin part starts with a quarter note followed by a half note, then a quarter note, and then a half note. The Cello part starts with a quarter note followed by a half note, then a quarter note, and then a half note. The two parts are in a canon relationship.

Example XIII.9



various articulations (which are a nice glimpse into the kind of attacks, envelopes, etc., that Tenney favors), and the performance structure of the piece. One gets the feeling that it is intended for a high school band, and I recall that once Tenney mentioned to me that he felt he should at some time write music that could be played by "amateurs", though this of course does not suggest that the piece is any less serious. I think in one sense Tenney is happily tapping into the tradition of American high school bands, which is often the first place that young musicians get any real training in this country (at least it was in my case), and where they first encounter notions of ensemble. Tenney is exploring in the *Harmonia* and in this piece a more refined meaning of ensemble, and this is perhaps the marching band music of the future!

The temporal structure of the piece is a Fibonacci series from long to short (in seconds: 233, 144, 89, 55, 34, 21, 13, 8, 5, 3, 2) adding up to a little over ten minutes. The instruments are divided into three categories (see Example XIII.10, the tuning page for *Band*), and are tuned to make the same sort of 5th harmonic approximations as in #3. Each new note is assigned to instruments from a specific intonational group, and there is the same kind of aural/orchestrational meticulousness that we can hear in *Clang*, though we have not yet had the good fortune to hear *Band* played. The full chord which is the complement of the major tritone chord is built up more or less in fifths, and is complete at 9'15". In the next minute or so that follows, it changes into the "Harmonia chord" (Example XIII.11 shows this modulation). The pure sound of this piece will, I think, when we finally hear it, be quite fantastic, and will reveal strong influences of both Ives and Varèse.

Chromatic Canon, for two pianos (Example XIII.13), is dedicated to Steve Reich, who is a close friend of Tenney's and someone with whom, over the years, he has enjoyed a mutually supportive musical relationship. Tenney was one of

Instrumentation and Tuning System for BAND

	<u>group 1 (14 cents flat)</u>	<u>group 2 (± 0)</u>	<u>group 3 (14 cents sharp)</u>
4 flutes		# 1-3	# 4
2 oboes		# 1-2	
7 clarinets	# 1	# 2-6	# 7
3 bass clarinets	# 1		# 2-3
2 bassoons	# 1	# 2	
2 alto saxophones	# 1	# 2	
2 tenor saxophones	# 1		# 2
8 trumpets (or cornets)	# 1-2	# 3-6	# 7-8
4 horns	# 1	# 2-3	# 4
4 trombones	# 1	# 2	# 3-4
1 baritone horn	x		
1 euphonium		x	
4 tubas	# 1-2		# 3-4
1 <u>percussion</u>			
45 <u>instruments</u>	<u>12</u>	<u>(Glockenspiel)</u> 21	<u>12</u>

Example XIII.11



the original performers in Reich's groups in the sixties, and the latter was responsible for two very important concerts of Tenney's music in N.Y. a few years ago.

Although Tenney refers to it as a "minor" work (no pun intended), simply a "communication" to a friend, it remains a rather complex investigation into serialism, canon, and just intonation, drawing on the harmonic concepts of Band and the Harmonia. The "row" of the piece is as follows in Example XIII.12, (taken from the instructions to the piece). A little inspection shows that the inversion at the major seventh is the retrograde of the prime, and that the first six pitches (D,A,F,B,D#,G#) spell out the extended minor tonality of Band, in which minor triads a tritone apart are superimposed. The second half of the row is the "Harmonia chord" (major triads, or the prime partials without 13). Although the piece may be performed in tempered intonation, the suggested just tunings imply the harmonic series as well. Each of the two minor triads is the simple just (1/1,6/5,3/2) as are the major triads (1/1,5/4,3/2), with the tritone relationships 10/7 and 7/5, respectively (thus the necessary ratio transpositions in the example for the C major and G# minor triads). The 7/5 and 10/7 tritones used to split the triads are not particularly close to the 11th harmonic (7/5 = 593 cents, 10/7 = 617 cents, 11/8 = 551 cents), but since the other ratios are based on 3,5, and 7, the harmonic series is approximated somewhat by this "just row". Note also that the complex tuning allows for considering either the B \flat or the D as the tonic 1/1, depending on the major/minor perspective. The tonics of the four chords are reinforced by holding down the same pitches a few octaves below with the sostenuto pedal down (a suggestion of Tenney's wife, Ann Holloway).

Example XIII.12



Chromatic Canon
for two pianos

Example XIII.13

for Steve Reich

James Tenney
1980/83

$\text{♩} = 288$

I (x60) (x40) (x30) (x24) (x20) (x17)

II (x60) (x60) (x40) (x30) (x24) (x20) (x17)

mp Ped. *

I (x15) (x13) (x12)

II (x17) (x15) (x13)

(mf)

I (x11) (x10) (x2)

II (x12) (x11) (x2)

(f)

I (x11) (x12) (x13)

II (x10) (x11) (x12)

I (x15) (x17) (x20)

II (x13) (x15) (x17)

(mf)

I (x24) (x30) (x40) (x60)

II (x20) (x24) (x30) (x40) (x60)

(mp) Ped. *

Example XIII.14

The image shows a musical score for two staves. The top staff is in treble clef and contains a series of notes with accidentals. Below the first staff, a sequence of numbers is written: 4 5 6 7 8 9 10 11 12 13 14 15 16 32 (30) 28 26 24 22 21 20 18 17 16 15 14 13 12 11 10 9 8. The bottom staff is in bass clef and contains notes with accidentals. The score ends with a double bar line and a final chord symbol.

An earlier work, Saxony, for multiple saxophones (one player) and tape delay, is related to the above pieces in its simple harmonic sonority and its use of the harmonic series, but is less complex in the latter. Here, only the harmonic series in its unadulterated form is used (on Eb). The piece has the usual "swell" dynamic envelope, and uses the first fifteen harmonics, in their natural octave spacing (Examples XIII.14) in the first half, and a selected set of the first 32 (one octave extended) in the second. The highest Eb (either 16 or 32) acts as a pivot, and the decay of the harmonic series in the second half of the piece is to the Eb an octave lower than the initial note. This low Eb, out of range of the baritone sax, is a result of the first order difference tones created by the tape-delay, as are the reinforcements and phantom "pre"-occurrences of many of the other pitches. It is one of Tenney's simplest pieces, and could almost be a postal piece. It is also quite beautiful (I have been lucky enough to hear it played several times). The use of the ability of most sax players to play the standard sax choir (soprano, alto, tenor, baritone) is quite ingenious, and the visual effect of one player using all the horns, creating the dense and shimmering harmonic structure, is a startling theatrical device. There exist several later realizations of Saxony for different instrumental combinations (see Appendix I), including a "generalized" version which Tenney says might be called a "stochastic canon." Each of the versions is almost exactly the same as the original, though in different keys. The title pun here is not perhaps so obvious as in Band and some of the other pieces, for it refers to a particular type of woven linen (fabric), and the reader is left to form his own conclusions.