



La Monte Young's The Well-Tuned Piano

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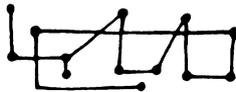
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LA MONTE YOUNG'S *THE WELL-TUNED PIANO*



KYLE GANN

LA MONTE YOUNG'S *The Well-Tuned Piano* may well be the most important American piano work since Charles Ives's *Concord Sonata*—in size, in influence, and in revolutionary innovation. Significantly, both immense works were developed through improvisation. Ives published a complete notated version of the *Concord*, and his improvisations survive in recordings and the various alternate readings he penciled into different scores. By contrast, the *W.T.P.* isn't notated in detail; it exists only as improvisation, and Young's "score" contains themes in various versions, chordal areas, scales, and ornamental patterns. Despite the *W.T.P.*'s improvisatory form, though, its overall structure is so intricately worked out, and so consistent from one performance to another, that much of it is susceptible to analysis. In lieu of a fixed score, but with

the aid of Young's private notations, this article will analyze the Gramavision recording of the 25 October 1981 performance of the *W.T.P.* as a document of a typical performance of a work *sui generis*.

THE TUNING

Young has kept the tuning to the *W.T.P.* secret since he began work on it in 1964, and there is virtually no way to analyze the piece without it. Since the work is now recorded on compact disc, however, it is not terribly difficult for someone with a tunable synthesizer, a calculator, a discriminating ear, and a knowledge of tuning theory to reconstruct at least ten pitches of the tuning. (The author did just that.) Because of that relative accessibility, Young has agreed to release the tuning into public discourse.

All octaves of the *W.T.P.* follow the same elegant, logical, twelve-pitch tuning in seven-limit just intonation ("seven-limit" meaning that no prime numbers larger than seven appear as factors). The tuning is based on E_b as 1/1, a choice that evolved from Young's saxophone improvisations. His favorite scale for improvising was G Dorian, in which he developed extended material on the subdominant seventh chord on C—concert E_b —and that material grew into the tuning of the *W.T.P.* The term "tonic," however, will not designate in this analysis what it does in discussion of European classical music. The *W.T.P.* uses tonics not in the sense of being established by contrast with dominant and subdominant chords, but in the sense of being established by pedal point or drone. "Tonic" in the *W.T.P.* generally refers to a bass note over which the intervals being sounded are predominantly consonant.¹

Young's tuning, numerically complex but conceptually simple, is based on ratios between multiples of 2, 3, and 7, deployed in analogy with the five-limit tuning from which the normal twelve-pitch equal-tempered scale was originally derived. Five-limit tuning is often represented as a two-dimensional grid, with $3/2$ ratios running one direction (here horizontal), $5/4$ ratios the other (diagonally upward from left to right)—see Example 1:² In this configuration, every three-note triangle pointing upward spells a well-tuned major triad, and every three-note triangle pointing downward spells a well-tuned minor triad. The pitches within the parallelogram represent a conventional tuning for a five-limit, twelve-pitch just intonation scale.

In principle, seven-limit tuning requires a three-dimensional chart, one axis based on $3/2$ ratios, one on $5/4$, and the third on $7/4$. Young, though, cites a personal distaste for intervals derived from the fifth harmonic (the $5/4$ major third, $6/5$ minor third, and their complementary

	$\frac{50}{27}$	$\frac{25}{18}$	$\frac{25}{24}$	$\frac{25}{16}$	$\frac{75}{64}$	$\frac{225}{128}$	$\frac{675}{512}$	
	B	F#	C#	G#	D#	A#	E#	
	$\frac{40}{27}$	$\frac{10}{9}$	$\frac{5}{3}$	$\frac{5}{4}$	$\frac{15}{8}$	$\frac{45}{32}$	$\frac{135}{128}$	$\frac{405}{256}$
	G	D	A	E	B	F#	C#	G#
$\frac{32}{27}$	$\frac{16}{9}$	$\frac{4}{3}$	$\frac{1}{1}$	$\frac{3}{2}$	$\frac{9}{8}$	$\frac{27}{16}$	$\frac{81}{64}$	$\frac{243}{128}$
E _b	B _b	F	C	G	D	A	E	B
$\frac{64}{45}$	$\frac{16}{15}$	$\frac{8}{5}$	$\frac{6}{5}$	$\frac{9}{5}$	$\frac{27}{20}$	$\frac{81}{80}$	$\frac{243}{160}$	
G _b	D _b	A _b	E _b	B _b	F	C	G	

EXAMPLE 1

sixths $8/5$ and $5/3$). Therefore, he omits the $5/4$ axis. The twelve pitches used in *The Well-Tuned Piano* can be ordered within a two-dimensional grid, ratios along the horizontal axis related by $3/2$, those on a vertical axis related by $7/4$ (see Example 2).

			$\times 3/2$		
	$\frac{49}{32}$	$\frac{147}{128}$	$\frac{441}{256}$	$\frac{1323}{1024}$	
	B	F#	C#	G#	
$\times 7/4$	$\frac{7}{4}$	$\frac{21}{16}$	$\frac{63}{32}$	$\frac{189}{128}$	$\frac{567}{512}$
	C	G	D	A	E
	$\frac{1}{1}$	$\frac{3}{2}$	$\frac{9}{8}$		
	E _b	B _b	F		

EXAMPLE 2

Young's notation for his themes and chords is artificial in that, while it shows what piano keys to play, it gives no specific picture of intervallic relationships. The efficient microtonal notation developed by Ben Johnston shows the relationships clearly. In the latter, a flat (\flat) lowers a note by $24/25$ (70.7 cents), a 7 lowers it by $35/36$ (48.8 cents), a 7 affixed to a flat (\flat_7) by $14/15$ (119.4 cents), and a plus sign (+) compensates for the syntonic comma of $81/80$ (21.5 cents). Johnston's notation also assumes that F:C:G:D is a series of $3/2$ perfect fifths, and that F:A, C:E, and G:B are $5/4$ major thirds. The *W.T.P.*'s scale is given in Example 3 in both Young's notation and Johnston's, with each pitch's distance from E_b calculated in cents (rounded to the nearest cent).

Johnston

Young

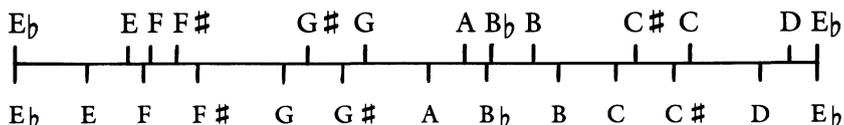
ratio:	1	567	9	147	21	1323	189	3	49	7	441	63
	1	512	8	128	16	1024	128	2	32	4	256	32
cents:	0	177	204	240	471	444	675	702	738	969	942	1173

EXAMPLE 3

For simplicity's sake, and because Johnston's system is not yet well known, musical examples below will be notated as Young would play them on his keyboard. Attempts to play the musical examples in this article on an equal-tempered piano will have misleading results. The easiest solution is to tune a tunable electronic keyboard to Young's scale.³

This is a very original twelve-pitch tuning, quite unlike the keyboard tunings of any other composer. Perhaps the first remarkable feature is that the chromatic scale does not uniformly ascend: $G\sharp$ is *lower* than G , and $C\sharp$ is lower than C . This is to ensure that the $3/2$ perfect fifths are consistently spelled as such; were the pitches arranged in correct ascending order, the keyboard "tritones" $F\sharp-C$ and $G\sharp-D$ would be $3/2$ intervals.⁴

The second unusual feature is the varied spacing of adjacent pitches, ranging from as close together as 27 cents to as far apart as 204.⁵ Graphed onto a logarithmic (perceptually linear) scale and mapped against equal-tempered half-steps, the scale appears as in Example 4.⁶



EXAMPLE 4

Note that no pitches appear in the areas representing E (100 cents), G \flat (300), A (600), B (800), C (900), or D (1100). The scale is structured somewhat as a pentatonic scale with pitches grouped around 0, 200, 450, 700, and 950 cents above the tonic, with three tunings each for two of those pitches and two each for the remaining three. In melodic terms, Young has imposed extreme limitations on himself in the *general sizes* of intervals he has available. The closest intervals to an equal-tempered, 100-cent half-step are 63 cents or 177. What he gains from limiting his scale steps is, not only an exotic abundance of tiny intervals, but a flexibility in harmonic modulation potential that few just-intonation tunings possess. Harmonic flexibility is given precedence over filling out the melodic space. The tuning grew from the harmonic structure, and melodic considerations came afterward.

Like the just-intonation scale based on $5/4$ s and $3/2$ s, Young's *W.T.P.* scale is efficient in terms of interval sizes. Any twelve-pitch scale contains sixty-six possible two-pitch combinations, or 132 if complements (say, major-third C–E and minor-sixth E–C) are counted separately. Example 5 lists all the dyad intervals of the *W.T.P.* in order of increasing complexity. As it shows, among the sixty-six two-pitch combinations in Young's

<i>Interval</i>		<i>Inversion</i>
<i>Ratio</i>	<i>Cents</i>	<i>Cents</i> <i>Ratio</i>
$\frac{3}{2}$	702	498 $\frac{4}{3}$
$\frac{7}{4}$	969	231 $\frac{8}{7}$
$\frac{7}{6}$	267	933 $\frac{12}{7}$
$\frac{9}{7}$	435	765 $\frac{14}{9}$

EXAMPLE 5: DISPOSITION OF THE NINETEEN POSSIBLE INTERVALS

9
8 204 996 $\frac{16}{9}$

21
16 471 729 $\frac{32}{21}$

27
14 1137 63 $\frac{28}{27}$

27
16 906 294 $\frac{32}{27}$

49
32 738 462 $\frac{64}{49}$

49
36 534 666 $\frac{72}{49}$

49
48 36 1164 $\frac{96}{49}$

63
32 1173 27 $\frac{64}{63}$

81
56 639 561 $\frac{112}{81}$

81
64 408 792 $\frac{128}{81}$

147
128 240 960 $\frac{256}{147}$

189
128 675 525 $\frac{256}{189}$

441
256 942 258 $\frac{512}{441}$

567
512 177 1023 $\frac{1024}{567}$

1323
1024 444 756 $\frac{2048}{1323}$

EXAMPLE 5 (CONT.)

scale, there are nineteen possible intervals, or thirty-eight if complements are counted separately (as compared to only six or eleven in an equal-tempered scale). Thirty-two of the sixty-six dyads, almost half, are expressible by numbers no larger than 16, and these dyads account for the majority of intervals in all of Young's themes. The consonances which resonate throughout the *W.T.P.* are predominantly those in Example 6.

<i>Ratio</i>	<i>Cents</i>	<i>Name</i>
3/2	702	Perfect fifth
4/3	498	Perfect fourth
7/4	968.8	Septimal minor seventh
7/6	266.9	Septimal minor third
9/7	435.1	Septimal major third
12/7	933.1	Septimal major sixth
14/9	764.9	Septimal minor sixth

EXAMPLE 6

My experience of hearing the *W.T.P.* live has been that you spend the first four hours becoming familiar with the cozy septimal minor third, the expansive septimal major third, and by the fifth hour you can hardly remember that intervals had ever been any other sizes.

Note, too, that the tuning exists as a theoretical possibility, and the pitches are neither equal in importance nor all used in every performance. On the Gramavision recording, the 441/256 C# occurs only on the fifth compact disc, in the sections indicated as being in "The Elysian Fields." Young rarely uses G# 1323/1024, and the pitch doesn't occur on the recording at all. Unused pitches, however, do add resonance, since the entire scale consists of overtones of a low E_h ten octaves below the lowest E_h on Young's Bösendorfer grand. And resonance is all the uppermost two octaves offer. Young rarely ventures more than an eleventh above middle C, because he feels that in the piano's upper range pure intervals are harder to hear, tune, and identify; they "don't represent themselves as well," he says, nor have the impact of pure intervals in the lower octaves.

ORIGINS

The *W.T.P.* was born in 1964 as a forty-five-minute improvisation on a retuned upright piano in La Monte Young's Church Street loft in New York City. Subsequent transcriptions by Michael Harrison of the tape of that early private performance show that the piece originally consisted of "clouds" (see below) on three chords, separated by silences and transitions. Nine of the pitches were tuned in 1964 as they are now. The others, G#, C#, and E, were tuned to perfect fifths above the thirty-first harmonic. C# was originally 31/16, G# 93/64, and E 279/256. The entire scale ran as in Example 7. The grid for this tuning required three axes, for 3, 7, and 31. (Young's *Pre-Tortoise Dream Music*, an early drone improvisation work, was based on a subset of this tuning.)

	E _b	E	F	F#	G	G#	A	B _b	B	C	C#	D
Ratios:	$\frac{1}{1}$	$\frac{279}{256}$	$\frac{9}{8}$	$\frac{147}{128}$	$\frac{21}{16}$	$\frac{93}{64}$	$\frac{189}{128}$	$\frac{3}{2}$	$\frac{49}{32}$	$\frac{7}{4}$	$\frac{31}{16}$	$\frac{63}{32}$
Cents:	0	149	204	240	471	647	675	702	738	969	1145	1172

EXAMPLE 7

In 1973, however, in preparation for a private performance, Young tuned the 279/256 E up twenty-eight cents to 567/512, a perfect fifth above A. In 1981, he adjusted C# and G# to keep the tuning within the seven limit. This is why he gives the date of the *W.T.P.* as "1964–1973–1981–Present," to indicate the stages in the work's development as determined by tunings. Many of Young's drone-based sine-tone installations center around pitches slightly higher and lower than an octave-multiple above the drone (for instance 31/16, 63/32, and 129/128), and after the thirty-first harmonic left the *W.T.P.*, it made its way prominently into the installations.

The *W.T.P.* is structured according to chords and larger harmonic areas, and every entity—chord, cadence, theme, harmonic area—is identified by a name. The original three chords were the ones he now calls the Tamiar Dream Chord, the Opening Chord and Rodeo-Rainforest Chord (the latter being the former with bass octave doublings), and the Early Romantic Chord. The Tamiar and Opening Chords were identical in 1964 to their present form (given below). The Early Romantic Chord

was a subset of what is now simply the Romantic Chord. Oddly, considering its minor role in recent performances, Young began with the Tamar Dream Chord. The Romantic Chord, then as now, appeared only in the second half.

Themes already present in the first performance are the Chorale Theme and the Transition from the Opening Chord to the Magic Chord. These show that Young's initial interest in the tuning was the possibility of septimal thirds and septimal triads ($9/7/6$). Sequences of $9/7$ intervals like those in Example 8 transcribed from the 1981 recording (0:10:58–0:11:38), are present on the 1964 tape as well.⁷ The same can be said for the Chorale Theme, a melody of parallel $6:7:9$ triads and their inversions (2:49:07–2:49:21), shown in Example 9.

Example 8 is a musical score in bass clef. It features a sequence of chords. Above the first four chords are the interval ratios $\frac{3}{2}$, $\frac{9}{7}$, $\frac{9}{7}$, and $\frac{9}{7}$. The chords are: a triad of G2, B2, D3; a triad of G2, B2, D3; a triad of G2, B2, D3; and a triad of G2, B2, D3. The final chord is a triad of G2, B2, D3.

EXAMPLE 8

Example 9 is a musical score in bass clef. It features a sequence of chords. Below the first five chords are the interval ratios $\frac{9}{7}$, $\frac{9}{7}$, $\frac{9}{7}$, $\frac{9}{7}$, and $\frac{12}{9}$. The chords are: a triad of G2, B2, D3; and a triad of G2, B2, D3.

EXAMPLE 9

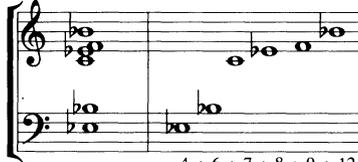
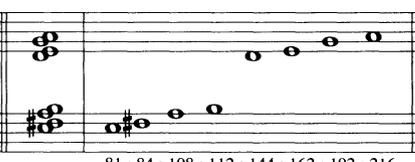
For the first ten years, the *W.T.P.* existed only as a tape work. Not until 1974 was Young offered conditions that he felt were adequate to obtain and hold a pure tuning. The Gramavision recording is of the work's fifty-fifth live performance. More recent performances (1987) have extended to over six hours long.

HARMONY AND TERMINOLOGY

By my count, the recorded performance contains about fifty-one themes, sequences, improvisation patterns, and other events in nine major harmonies, and Young has developed at least seven newer themes in subsequent performances. In the Gramavision recording's extensive liner

notes, Young provides a detailed analysis of what can be heard at any given moment. Following the recording with a stopwatch or CD second-counter is indispensable for gaining a more-than-superficial acquaintance with the work. Timings given in this article note where each musical example occurs within the 5:01:22 (five hours, one minute, and 22 seconds) of the recording.

In broadest terms, the *W.T.P.* is conceived as an alternation between harmonic areas. There are at least nine important “chords” in the 1981 performance of the *W.T.P.*, but the two most seminal are the Opening Chord and the Magic Chord. Between them they divide the ten most-used pitches with no duplication (Example 10).

The Opening Chord	The Magic Chord
	
4 : 6 : 7 : 8 : 9 : 12 2 : 3 2 : 3	81 : 84 : 108 : 112 : 144 : 162 : 192 : 216 27 : 28 27 : 28 8 : 9 8 : 9 7 : 9 7 : 9 27 : 32

EXAMPLE 10

In the recorded performance, the entire first nine minutes and thirty-eight seconds use only the pitches of the opening chord. At 00:09:38, the first pitch of the Magic Chord appears. The Magic Chord dominates the recording from 00:21:47 to 1:00:47. (Transposed upwards, it also became in 1990 the basis for Young’s one-hundred-minute-plus string quartet, *Chronos Kristalla*.)

Note that not only the pitch-class content, but the actual pitches in specific registers are essential in Young’s chordal definitions. The Magic Chord is not merely a collection D E F# G A B; it is a peculiarity of the chord that it contains an F# in the lower octave, a G in the upper. All of Young’s chords represent specific areas on the keyboard, which pitch-class terminology is inadequate to specify. Themes tend to be grouped together, however, on the basis of similarity of pitch class, and so pitch classes will be used below only to characterize chord families and the large sections they define.

In terms of pitch class, the Magic Chord is a subset of the historically earlier Romantic Chord, as are several of the other chordal areas (see Example 11). Other chordal areas are based on the Opening Chord with an occasional added pitch (Example 12).

Romantic Chord	Gamelan Chord	Tamiar Dream Chord	189/98 Lost Ancestral Lake Region
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84	81	27	27
81	64	24	24
72	54	18	21
64	42	14	18
56			14
54			12
48			

EXAMPLE 11

The Brook	The Pool
-----------	----------

21	224
18	192
16	147
14	144
12	128

EXAMPLE 12

Young's terminology for his chords is idiosyncratic, but analytically consistent. When a chordal area combines two previous chords, their names are combined. For instance, the Magic Opening Chord consists of the notes of both the Opening Chord and the Magic Chord, and the transitions from the Opening Chord to the Magic Chord and back again uses the pitches of the Magic Opening Chord. "Harmonic" indicates that a chord's pitches are duplicated through several octaves, with wider intervals at the bottom and smaller ones at the top after the pattern of the harmonic series; thus, the Harmonic Opening Chord contains E_h, B_h, C, and F in several octaves. The term "Böse," used, for example, to distinguish the Ancestral Boogie from the Ancestral Böse Boogie, indicates that the theme descends to the lowest octave of Young's Bösendorfer grand, a major sixth lower (to C) than the normal grand piano. Fractions in the names of chordal areas refer to characteristic intervals relative

to the tonic E_b . The 189/98 Lost Ancestral Lake Region is named for the dyad B–A. Even though the ratio of the B–A seventh is 27/14, the ratio is stated as 189/98 with reference to E_b . Similarly for the 288/147 Premonition of the Theme of the Dawn of Eternal Time, which features the interval G_b –F.

STRUCTURE

Within these harmonic fields, the materials of the *W.T.P.* divide into clouds, five types of themes, and two other categories of melodic material, which might be outlined as follows:

I. Clouds

II. Thematic materials

A. Themes

1. Motivic
2. Row
3. Scalar
4. Cloud
5. Melodic

B. Harmonic/contrapuntal formulas

1. Cadences
2. Sequences

Example 13 divides the recording into nine sections based on the pool of pitch classes used over large periods of time. The starting and ending time of each section are given, followed by the pitch classes present, and Young's name (if any) for the chordal area that the section represents. Although the number, ordering, and especially length of these sections vary from one performance to another, this plan represents a typical harmonic/melodic layout that Young follows with some consistency.

Section 1 (0:00:00–0:09:38): The opening section contains only the Theme of the Dawn of Eternal Time (abbreviated ToDET hereafter) and its Refrain, using four pitch classes.

Section 2 (0:09:38–0:21:47): Young doesn't label the transitions as separate sections; they are less harmonically stable than the titled sections, and don't establish their own tonalities by way of drones or prominent bass pitches. The pitch-class spectrum does change markedly at this

<i>Sec.</i>	<i>Timing</i>	<i>Pitch Classes Present</i>	<i>Name</i>
1	0:00:00–0:09:38	E _b F B _b C	Opening Chord
2	0:09:38–0:21:47	E _b E F F# G A B _b B C	D [Transition]
3	0:21:47–1:02:29	E F# G A B	D Magic Chord
4	1:02:29–1:21:54	E _b E F F# G A B _b B C	D Magic Opening Chord
5	1:21:54–2:06:06	E _b F G _b (G) B _b C	Magic Harmonic Rainforest Chord
6	2:06:06–3:01:15	E _b E F F# G A B _b B C	D [Transition]
7	3:01:15–4:01:51	E F# G A B C	D Romantic Chord
8	4:01:51–4:59:41	E F# G A B C C#	D Elysian Fields
9	4:59:41–5:01:22	E _b E F G B _b B C	Ending

EXAMPLE 13

point, though, introducing the Magic Opening Chord. The ToDET is joined by the Transition from the Opening Chord to the Magic Chord. The pitches of the Magic Chord are added two or one at a time:

At 0:09:38 B and D are introduced

At 0:11:07 F# and A are introduced

At 0:12:32 G is introduced

At 0:13:15 E is introduced

By 13:15, then, we've heard the ten pitch classes which are all we will hear in the first four hours of the recording.

Section 3 (0:21:47–1:02:29): Like the Opening Chord section, the Magic Chord section is virtually monothematic, a set of variations on the Theme of the Magic Chord set off by three cadential figures—the Classical Cadence, Romantic Cadence, and Cadence of Paradise—along with a brief sample of the Rome Introduction.

Section 4 (1:02:29–1:21:54): The colorfully titled themes of the Magic Opening Chord section:

The Goddess of the Caverns under the Pool

Sunlight Filtering through the Leaves

The Fountain

The Clearing

Sunshine in the Old Country

are primarily chords for improvisation, what I will call below the *cloud* themes. Themes in this section make evocative use of a microtonal alternation of D and E \flat , related by an interval of only 63:64 (27.3 cents) and, on the recording, barely distinguishable. The ToDET returns with an added G \flat , making “shimmering” intervals of 147/128 and 288/147 with E \flat and F respectively.

Section 5 (1:21:54–2:06:06): In theory, the Magic Harmonic Rainforest Chord combines the pitches of the Magic Chord with those of the Harmonic version of the Opening Chord, spread through all octaves; in this performance, however, the section primarily reduces the pitch spectrum back to the Opening Chord, though with the addition of a mournfully dissonant minor third, 147/128 G \flat , and occasionally the “flat” septimal fourth 21/16 G as an alternative. The Theme of the Lyre of Orpheus is introduced in the Interlude of the Wind and the Waves, a cloud of pitches related to the Opening Chord, and Young’s improvisations take the form of “boogies,” fast, rhythmic improvisations. The first of Young’s homages to earlier composers appears in the Homage to Brahms Variation of the Theme of the Dawn of Eternal Time with emphasis on the Romantically dour E \flat –G \flat (240 cents).

Section 6 (2:06:06–3:01:15): As with Section 2, this second Magic Opening Chord transition isn’t titled separately, but it again increases the pitch spectrum after the stripped-down tonality of the Magic Harmonic Rainforest Chord. The first half consists almost entirely of themes from the first Magic Opening Chord section. The second half, though, thickens the texture toward three- and four-note chords with the Chorale Theme interspersed among a remarkable series of “sequences,” deliberately imitative of the cadential formulas of tonal music: The Hommage à Debussy Sequence, the Simple Sequence, the Final Sequence, the Modern Sequence, and the Classical Sequence.

Section 7 (3:01:15–4:01:51): The Romantic Chord is the area Young was developing in 1981 when the recording was made, and thus receives the most extended treatment, both here and in the following section. Following a minimalist arpeggio quasi-dominant preparation called the Moonlight Sonata Passage, the section includes most of the work’s *melodic* themes, often over drone pitches of G, B, or D. A wealth of new themes is found here, closely related by common pitch cells, some named after locations where Young first played them:

The Bonn Theme

The Bremen Theme

The Ornamental Return

The Penultimate Theme

The Gamelan Chord and Theme

The Tamiar Dream Chord

Scheherazade and Theme

The Flying Carpet

The Classical Theme

The Theme of the Magic Chord returns along with the Romantic and Classical cadences, since the Romantic and Magic Chords have similar pitch content, and the ToDET is brought back for the first time on a new tonic, G, a tonality titled the 189/98 Lost Ancestral Lake Region.

Section 8 (4:01:51–4:59:41): The primary purpose of this section is to introduce (or recall) the Themes of the Dawn of Eternal Time and the Lyre of Orpheus in a new pitch area, the Elysian Fields, with 63/32 D as tonic. Otherwise, most of the material, especially in the second half, is drawn from the Romantic Chord section. C# appears for the first time in this recording, at 4:01:51. In performances in which Young uses G#, it occurs in this Elysian Fields section.

Section 9 (4:59:41–5:01:22): After two hours spent in the area of the Romantic and Magic Chords, the passage titled the Ending draws a brief (forty seconds) transition back to the opening chord.

CLOUDS

Themes and Clouds define the two levels on which the *W.T.P.* functions. The clouds are more important to the acoustic innovations in the work, whereas the themes and chordal areas determine the form. The clouds, fast articulations of a static harmony, are generally unnotatable except as pitch groups or chords for improvisation. They are well named for rain imagery: they sometimes begin with a light patter of tones increasing in density, other times they start abruptly as full-blown storms. Themes thicken to become clouds, clouds thin out to reveal themes, and themes can occasionally be heard singing through the middle of clouds. Some of the clouds are merely reiterations of a few pitches, in which Young attempts to create a resonance system by synchronizing his rhythms with the pulsing of the acoustical beats. Other clouds are more thematic in function, moving upward or downward through a series of tremolos.

The buildup of resonances during the clouds is similar in purpose to Young's sine-tone sound-sculptures, in which a group of sine tones tuned to exact harmonics (using the Rayna synthesizer, which is precise to within one beat a year) create a vibration pattern that appears to change

as one moves around the listening space. Like the installations, Young's clouds elicit impressive aural illusions. Once a cloud is set in motion, the ear may hear what sound like foghorns, voices, bells, even machinery, and often the "missing fundamental" resulting from the complexes of rationally tuned periodicities. As one moves around the room, the audible overtones change markedly over the distance of a few inches, dependent on where one is among the nodes of pitches reinforced by the acoustics of the room. This aspect of the *W.T.P.* is almost entirely unrepresented by the recording under average circumstances; since it is determined by room acoustics and position in space, no microphone can entirely convey the variety of audible phenomena the *W.T.P.* generates. Analysis of such transient effects lies outside the scope of the present paper.

THEMES

The themes of the *W.T.P.* thread gloriously through the work in a Wagnerian wealth of anticipatory and reminiscent references. Enjoyable as the work can be for a passive listener, it is the ability to track these themes through the various harmonic areas that reveals the *W.T.P.*'s structural complexity. In this way, the *W.T.P.* fuses Eastern and Western philosophies of music. In an "Eastern," timeless way, the work can be listened to as a static articulation of a set tuning, a continuous present in which concepts of before and after are irrelevant. In a "Western" way, it can also be heard as a unidirectional time-pattern of thematic development in which earlier melodies return altered and at different pitch levels. Perhaps it is more accurate to say, avoiding quotation marks and overworked stereotypes, that the *W.T.P.* manifests with equal emphasis both poles of the psychic qualities immanent in all musical listening. Few works so satisfy the desires of both structuralist and ambient listeners.

Many of the themes, especially the motivic, scalar, and cloud themes, are expressed in dyads, two-note chords or intervals. The majority of the *W.T.P.*'s texture consists of an alternation of two pitches at a time versus thick clouds of pitches, with infrequent sections of three-, four-, or five-note chords. Taking the number of themes each dyad occurs in, and distinguishing between complements, the intervals used are, in approximate order of frequency:

12/7

3/2

9/7

4/3

7/6, 14/9, 7/4

128/81

9/8, 27/14, 32/27, 147/128, 256/147

8/7, 28/27, 32/21

21/16, 49/48, 81/64

with the first seven intervals accounting for about 70%. Of the more complex intervals, only 128/81, 147/128, and 256/147 are common; the first is the Pythagorean sixth E–C used as a false parallel to the 12/7 sixths, and the latter two are formed by E \flat and G \flat in the “Shimmering” themes. Intervals smaller than a minor third—9/8, 8/7, 28/27, and 49/48—are frequently treated as traditional dissonances, i.e. the lower note is resolved downward by step, as in the Simple Sequence (Example 14).⁸ The upper note of the septimal major seventh 27/14 is also usually resolved downward by step in the Theme of the Dawn of Eternal Time and in the Romantic Cadence. For all the potential complexity in Young’s tuning, he is clearly most interested in the Pythagorean and septimal consonances. Among isolated dyads, dissonant intervals are largely saved for expressive effect.



EXAMPLE 14

It is an essential aspect of the *W.T.P.* that a single theme can appear in diverse chordal areas, differentiated by both tonic pitch and register. The *W.T.P.*'s seminal theme is the Theme of the Dawn of Eternal Time, given in Example 15 as stated in the recording's opening minutes (0:01:37–0:02:48).⁹ This theme is an example of the *motivic* type, revolving around a characteristic figure. In this type, note succession in general is not fixed, but certain motivic figures recur: in this case, the 8:9:8:7:9 turn, E \flat –F–E \flat –C–F.

The ToDET undergoes more development and variation than any other theme in the *W.T.P.* Its interval complex—4:6:7:9—can be stated

Refrain

EXAMPLE 15

at four transpositions in Young's tuning matrix, using four tonics, E \flat , G, C, and D (Example 16). Young uses three of these, all but the transposition on C. When the ToDET is recalled in the 189/98 Deep Lost Ancestral Lake Region, it appears over a low G (4:04:03–4:04:45) (Example 17).

EXAMPLE 16

189
98

EXAMPLE 17

When recalled in "The Elysian Fields," it is based on D (4:01:51–4:02:20) (Example 18). In "The Deep Pool," it is an octave lower than



EXAMPLE 18

in the Opening Chord. In “The Shimmering Pool Reflecting the 288/147 Premonition of the Theme of the Dawn of Eternal Time Recalled in the 189/98 Lost Ancestral Lake Region” (a premonition on E_b of the later occurrence on G), a G_b in the left hand is added to its characteristic figures whose interval with F prefigures the parallel B–A (189/98) interval (1:21:53–1:22:11) (Example 19). This last example illustrates movement from a theme into a cloud.



EXAMPLE 19

Melodically, Young thinks in terms of antecedents and consequents, and often labels them as such in his scores. Note that in the E_b transpositions of the ToDET, early in the work, the phrases end questioningly on F, the note that represents 9 in the 4:6:7:9 harmony. Later, in the work's second half, Young often switches the last two notes around for a feeling of conclusion, A resolving to G and E to D in an expressive 9–8 suspension. Example 20 shows this more graphically. This move from “open” to “closed” forms of the theme, spread over five hours, is one of the most touchingly beautiful effects in the work.

The only other theme in this recording of the *W.T.P.* to appear at more than one transposition level is the Theme of the Lyre of Orpheus, another motivic theme. Its first appearances are on E_b , in the Interlude of the Wind and the Waves (1:31:51–1:32:14) (Example 21). (The Interlude of the Wind and the Waves is itself a scalar theme, a series of dyads for improvisation.) Later it returns in the Elysian Fields on D (4:09:39–4:10:02) (Example 22).

in the second half of the piece, and

EXAMPLE 20

EXAMPLE 21

EXAMPLE 22

Note that though the notation looks very different, the melodic intervals are identical. One of the oddities of Young's keyboard is that $B_b C E_b$ is the same 6:7:8 interval pattern as $A C\# D$. Harmonically, though, Young uses different intervals, a 4:3 beneath the upper E_b , and a 12:7 beneath the upper D . The Penultimate Theme and the Ornamental Return are further examples of motivic themes.

An example of the *row* theme type is the Theme of the Magic Chord, which occurs as a succession of pitches (Example 23). (Thus Young's score; on the recording the Magic Chord Theme never appears in so simple a form.) Themes of the row type may be only partly suggested or interrupted, and are sometimes built up by additive or subtractive process, adding or subtracting one note with each repetition in a manner typical of early minimalist works by Steve Reich and Philip Glass (and ostensibly predating them). They sometimes take place over a repeated-note pedal point of either B or $F\#$, which occasionally take on the role of temporary tonics in the Magic and Romantic Chords. For example, the Subtractive Variation of the Theme of the Magic Chord Over Repeated Note Accompaniment (4:33:47–4:34:00) (Example 24).



EXAMPLE 23

EXAMPLE 24

The Magic and Romantic Chords over F# and B result in the following scales, respectively (C is absent in the Magic Chord):

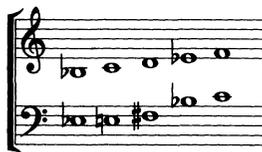
F#	G	A	B	C	D	E
$\frac{1}{1}$	$\frac{8}{7}$	$\frac{9}{7}$	$\frac{4}{3}$	$\frac{32}{21}$	$\frac{12}{7}$	$\frac{27}{14}$

and

B	C	D	E	F#	G	A
$\frac{1}{1}$	$\frac{8}{7}$	$\frac{9}{7}$	$\frac{81}{56}$	$\frac{3}{2}$	$\frac{12}{7}$	$\frac{27}{14}$

(See the Classical Theme below for an example of a pedal point on B). Young favors these notes as pedal points because of the 9/7 major third and the septimal major seventh 27/14, the latter available over no other tonic. G and D, however, are also used as prominent bass notes in the Romantic Chord section.

The *scalar* melodies are based on modal improvisation, and notable only as a series of (usually) dyads through which Young runs backwards and forwards. The Goddess of the Caverns Under the Pools is such a scalar melody, notated in Young's own score as in Example 25. One version of it in performance is shown in Example 26 (1:07:19–1:07:58).



EXAMPLE 25



EXAMPLE 26

conventional melodies of the classical literature. Like the row themes, these often float above a B or F \sharp repeated-note pedal point. Often there is a repeating, regular metric structure and some organization into antecedent and consequent phrases. Most of the melodic themes appear in the Romantic Chord section and its reprise in the second half of the Elysian Fields section. With remarkable economy, Young develops most of these themes from a descending A G F \sharp E scale fragment, ending sometimes in a characteristic F \sharp E C B motive (Example 29). The Gamelan Theme also acts as a row theme, built up additively note by note.

Bremen Theme

Ornamental Return

Gamelan Theme

Scheherazade

Classical Theme

EXAMPLE 29

Two other types of returning material cannot be called themes, though they play quasi-thematic roles: *cadences* and *sequences*. Cadences are found mainly in the Magic Chord section and in the parts of the Romantic Chord section which return to the Magic Chord (Young also notes three cadences, as yet unnamed, in the ToDET). These can be quite varied in their outlines, though structured around the same few pitches. For example, the five appearances of the Cadence of Paradise, shown in Example 30, have in common a descent from A to E followed a note or two later by D, over F \sharp and A in the bass.

EXAMPLE 30

The sequences are sequences in a rather Baroque sense, long, set, harmonic progressions moving downward a step with each repetition, often with dissonant notes resolving into consonance in imitation of classical counterpoint (in which Young excelled as a student at UCLA). On the recording, sequences occur only in the second Magic Opening Chord transition, as a long buildup from 2:33:15 to 2:59:43 preparatory to the Romantic Chord section. Each sequence is organized around the septimal triads, major or minor, or else (as in the dyadic Simple and Hommage à Debussy sequences) around dyads making intervals of $9/7$ or $7/6$. In the Final Sequence, a series of resolution formulas, nearly every other chord resolves to some inversion of a $6:7:9$ septimal minor triad (Example 31).¹⁰ The Modern Sequence begins each phrase with a consonant triad and moves by step to build complex seventh chords (Example 32).¹¹

EXAMPLE 31

$\frac{9}{7}$	$\frac{27}{18}$	$\frac{27}{18}$	$\frac{192}{147}$	$\frac{21}{18}$	$\frac{12}{8}$	$\frac{96}{81}$	$\frac{21}{18}$	$\frac{27}{21}$	$\frac{21}{18}$	$\frac{42}{28}$	$\frac{21}{14}$	$\frac{27}{21}$	$\frac{21}{18}$
$\frac{6}{16}$	$\frac{18}{16}$	$\frac{18}{14}$	$\frac{128}{98}$	$\frac{14}{14}$	$\frac{7}{7}$	$\frac{64}{54}$	$\frac{14}{12}$	$\frac{18}{14}$	$\frac{14}{14}$	$\frac{28}{27}$	$\frac{12}{12}$	$\frac{18}{14}$	$\frac{14}{12}$

EXAMPLE 32

Comparison of these sequences with the Chorale Theme (with which they link via pivot chords) and the Transition from the Opening Chord to the magic Chord shows that, in moving through complex pitch collections, Young let himself be guided along the skeleton of available 6:7:9 and 14:18:21 triads. These areas show how Young's tuning determines his form on a micro level, just as the possible transpositions of the ToDET demonstrate the tuning's influence on a macro level. The piece proves that limitation of interval placements in a just scale can be a spur to ingenious melodic and modulatory solutions.

The *W.T.P.* also makes an argument for how pure-ratio tuning can aid in structural hearing. With increased exposure to the *W.T.P.*, a listener who lacks perfect pitch (such as myself) learns to recognize each pitch by the sizes of the intervals it makes with pitches around it; for example, the interval 27/14 occurs over only two pitches, B and F#, and other contexts can determine which is being played. That type of discrete relationship is lost in equal temperament, as can be intuitively felt by playing a just-tuned piano and an equal-tempered piano side by side. One can imagine how much more vivid the harmonic structure of Beethoven's *Hammerklavier* Sonata might become in a tuning in which the tonalities related to B \flat had a different quality than those related to B. Equal temperament makes the opposition of tonalities less real, more merely theoretical.

A final note on the *W.T.P.*'s overall form: Just as the Theme of the Dawn of Eternal Time began with questioning, upward gestures (C moving up to F and eventually to high B \flat), the sequences and melodic themes of the Romantic Chord drop back downward by step, in a large-scale contrast of melodic contours. Young acknowledges a kind of mythology which has grown up within the *W.T.P.* over the years, and though his attitude toward modal improvisation and tuning are drawn from an Indian sensibility, his overall form is ultimately Western. The *W.T.P.* arches upward from the primitive unity of Eternal Time, diffracts into pitch-contrasted first and second themes, enters a more "civilized,"

culture-oriented phase in the classical contrapuntal sequences, sinks back down through a decay temporarily postponed by the ornate pleasures of the Romantic Chord, dissipates into the heavenly diffuseness of the Elysian Fields, and finally collapses in an unanswered reiteration of the eternal question.

CONCLUSION

The above should serve as a prolegomena to fuller analysis of the *W.T.P.* for anyone who has access to the recording. Large sections of the *W.T.P.* are transcribable, and Young's timed list of themes and chordal areas aids in analyzing the transcriptions. Still, an analysis using such means will remain an open-ended effort, for Young is still adding sections and themes to the *W.T.P.*, and no description made during his lifetime will be definitive. Like Indian musicians (Young has studied classical Indian raga singing with Pandit Pran Nath since 1970), Young believes in teaching the *W.T.P.* directly to apprentices, and has no desire to publish the score in order for pianists to learn the piece from the printed page. (Besides Young, only Michael Harrison has performed the work.) Ultimately, analysis will require comparing Young's own score with transcriptions of the many performances that exist on tape and video.

Young's tuning itself, though, is a lesson in what can be done in seven-limit just intonation, and in how just tuning can be shaped to lend itself to large-scale, modulating structure. *The Well-Tuned Piano*—combining as it does Classical counterpoint, Romantic theme transformation, symphonic harmonic structure, and modal improvisation within a modern ambience of overtone-centered acoustics—suggests what a wealth of possibilities for new musics still exists.

ACKNOWLEDGMENT

Much thanks to La Monte Young for providing materials that made this article possible, and for his helpful suggestions.

NOTES

1. It's intriguing that composers who want to establish an opening key at length and with particular emphasis so often choose E_b —as in Beethoven's *Eroica*, Mahler's Eighth, Wagner's *Ring*, and the *W.T.P.*
2. In tuning theory, ratios or fractions are divided or multiplied by 2 to bring them within the octave, i.e., between 1/1 and 2/1. For example, for tuning-definition purposes, 6/5, 3/5, 3/10, 12/5, 3/20, and 24/5 are all equal and all denote the same pitch class, a purely tuned minor third above the tonic defined as 1/1. In this article, all would be reduced to 6/5, as being the only ratio between 1/1 and 2/1.
3. Because the Yamaha DX7 II-FD is a common tunable synthesizer (with 1024 possible pitches per octave, still fewer than desirable), the tuning numbers needed to create Young's scale on it are given here:

Octave:	1	2	3	4
Pitch:				
C		4002	5026	6050
C #		3978	5002	6026
D		4176	5200	6224
E_b	3175	4199	5223	6247
E	3326	4350	5374	6398
F	3349	4373	5397	6421
F #	3379	4403	5427	
G	3577	4601	5625	
G #	3553	4577	5601	
A	3751	4775	5799	
B_b	3774	4798	5822	
B	3804	4828	5852	

Interval sizes for other tunable keyboards can be obtained using the formula ($\log(a/b)$ times X divided by $\log 2$), where a/b is the tuning ratio and X is the number of possible pitches per octave.

4. I am indebted to Young's protege and piano tuner Michael Harrison for pointing this out.
5. For comparison, here are the minimum and maximum difference in cents between adjacent half-step scale degrees in some other just keyboard scales:

	<i>minimum</i>	<i>maximum</i>
Terry Riley, <i>The Harp of New Albion</i> (five-limit):	70	112
Ben Johnston, Suite for Microtonal Piano (nineteen-limit):	63	151
Michael Harrison, <i>From Ancient Worlds</i> (five-limit):	70	134
Michael Harrison, <i>From Ancient Worlds</i> (seven-limit):	63	141

6. In terms of absolute pitch, Young's E_b is actually 74.7 cents flat, closer to D than E_b . This is because A is one of the highest pitches relative to its place in Young's scale, and it's better for the piano to tune the strings downward than upward. Conveniently, Young tunes his A to 440 Hz. All pitch references in this article will be stated relative to Young's E_b of 297.989 Hz. Those who match pitches on their "badly-tuned" piano with the recording will need to think of their keyboard as three-quarters of a half-step sharp.
7. Transcriptions are by the author unless otherwise stated.
8. Young's transcription.
9. Young's transcription.
10. Young's transcription.
11. Young's transcription. Hearing differences between intervals as small as 63:64 among inner voices of four-note chords is the most difficult part of transcribing the *W.T.P.*