Microtonal Music by Prent Rodgers

Made with Csound

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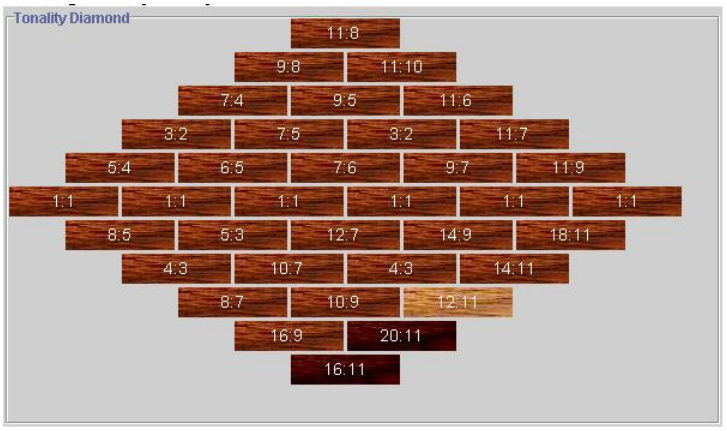
For more details, see http://prodgers13.home.comcast.net
Or email to PrentRodgers@comcast.net



This is a CD of original music created using the Csound digital signal-processing program, and using other programs I wrote. Csound takes as input a set of text file orchestras and scores and creates a sound file output.

The music is Microtonal. I use intervals that are closer together than the 12-tone equal temperment scale that has dominated western music for the past three centuries. The type of microtonality I employ is called Just Intonation. Under this system, each interval is derived from the overtone series, or its opposite, the undertone series. For a more complete description of the tuning system, I would recommend reading Genesis of a Music by Harry Partch. Internet users are encouraged to visit my web site at http://prodgers13.home.comcast.net. There you will find pointers to web sites that discuss microtonality, Csound, tuning systems, Harry Partch and other topics.

Here are short descriptions of each of the songs on the CD. They were created between 1997 and 2008 on an assortment of laptop computers.

01- Whisper Song in 53 EDO

Whisper Song is written in a scale with 53 equal divisions of the octave (EDO), which is a microtonal equal temperament that allows for relatively accurate just intonation to the 15 limit. The ratio of 77/76 is one step in 53. 9 steps are a good approximation of a 9/8 major second, 17 steps are a very good 5/4, and the rest of the intervals map out quite well. Thematic material includes extensive use of modulating around a circle of fifths from a distant tonality to a major, as shown in the chart at right. I also modulate by 77/76 up and down in almost imperceptible ways. It is scored for finger piano, cello, alto flute, and dry spring.

Degree	Name	Acci-dental
17	E	𝅘𝅥
39	A	𝅘𝅥
8	D	𝅘𝅥
30	G	𝅘𝅥

02- Balloon Drum Music

This piece is scored for Balloon Drums, Oboe, Flutes, Guitar, and Finger Piano. The piece starts out with a simple chord progression for the winds, with finger piano bass, that sounds sort of like this:

* B major * E major * G minor * and so on.

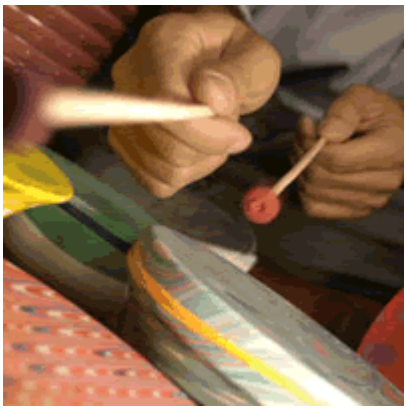
When it is played, it sounds like a conventional progression. But in actuality, the chords are from the Partch Tonality Diamond, and their names in Sagittal notation are shown in the chart at right. There are notes in each key that are in common with the next key, and some that are slightly different. Some are off by very small ratios, and at later points in the piece when the flutes and oboe slides from one to another, the slide is unsettling to the non-microtonal ear.

Primary Key	16/9	B	major
Bridge	8/7	D	major
	3/2	G	minor
	16/15	D	major
	4/3	F	minor
	1/1	C	major
	7/6	E	minor
	16/9	B	major
	5/4	E	minor
Primary Key	16/9	B	major

For example, in the movement of chords from the B16/9 major to the D 8/7 major, the B 16/9 goes down by 27:28 to fifth of the D 8/7 chord, which is A 12/7. There's another movement of a 35:36 and a 15:14. Each of these movements are decidedly different from conventional 12 tone equal temperament, whose minor second pitches approximate a 15:16. But even with these movements, the chords sound rather conventional at the start of this piece. When the slides come in, things get more microtonal.

The oboe has the ability to be in more than one place at the same time in this piece, or think of it as two oboists. The timbre of the oboe is subject to some alteration by choosing samples that are higher or lower than originally recorded. The result is kind of an English Horn sound, or sometimes like an angry cat.

As with most of my pieces, this one has a lot of indeterminacy. Each instrument can choose what to play next, by selecting from many alternative pitch and rhythm sequences. There are programmatic controls that drive the choice of sequences either towards or away from repetition.



The basic structure of the piece is a chord progression as a bridge between the longer sections of B 16/9 major. There are lots of triads based on 4:5:6 overtones, or 7:9:11, or slides between the two. These triads alternate in the chords and arpeggiations. Other chords take advantage of wider intervals, like the 5:7:11:16, 6:9:13:20, 8:11:18:24, and other quasi fourth-based intervals.

The balloon drums are made from a four foot long sewer pipe with a balloon membrane over one end. I recorded one and use Csound to bring it up in pitch. Each note played on the balloon drum is actually 5-10 strikes of the drum separated by a few milliseconds. It gives it a sense of many drummers playing at once.

03- Resolution in Blue

This is a piece based on utonal scales that modulate up the otonality. In it, I explored many different ideas. In no particular order:

1. Applying a frequency function table to a piano note, so that it slides up or down and has a vibrato at the end of the slide, much like a slide guitar.

2. Change the piano sound by applying an amplitude function table to notes. Some have a normal piano sound, some have a gradual crescendo, some are very truncated and dry, some have no attack, also like a country slide guitar.

3. There is more indeterminacy as the piece moves on. At first, almost everything is scripted, but over time, less and less is specified, until at the end, almost anything is possible.

4. I just finished reading Kent Wheeler Keenan's book, "Counterpoint, based on eighteenth century practice", and attempted to use some of the ideas in the context of the Partch hexany.

5. The title of the song, by the way, is from the lead up to the Iraq war. in March 2003, the British Foreign Minister, Sir Jeremy Greenstock, was trying to rally the Security Council to create another resolution to endorse the impending attack. The French suddenly announced that they would veto any resolution put forward by Britain or the US, regardless of language. Sir Jeremy was quoted in the lobby of the U.N. building as saying, "Given this situation the co-sponsors have agreed that we will not pursue a vote on the draft UK-US-Spanish resolution in blue."

Resolution in Blue is the diplomatic language for a permanent resolution. The security council decided to remain siezed of the matter, and the rest is history.

04- For the Down Winders

Starting in 1944, the Hanford Reservation in central Washington produced Plutonium for nuclear weapons, including producing the components for the legendary "Big Boy" atomic bomb that was dropped on Nagasaki on August 9, 1945, to hasten the surrender of the Japanese and end World War II. It continued to do this for many years to support the cold war arms race.

Because of the war-time rush, the Hanford plutonium plants processed the irradiated fuel without allowing the radioactivity enough time to decay. For still unknown reasons, Hanford kept processing this very radioactive fuel even after Japan surrendered. As a result, vast quantities of pollution, especially iodine-131, were discharged into the air. In 1945 alone, more than a half million curies of Iodine-131 were released. The accident at Three Mile Island was estimated to have released about 20 curies. People were exposed to the airborne

radiation by breathing the air and consuming certain foods, especially milk from goats or cows that grazed on contaminated vegetation.

Those who lived "downwind" of the plant have been seeking compensation for their losses, including cancers and related injuries. Those who claim harm have taken their case to court, and won a partial victory. They won several counts, but their monetary damages were far less than their legal costs

Because I am so glad that my children and I are not forced to speak Japanese today, I have enormous sympathy for the victims of this tragedy.

The piece is scored for finger piano, guitar, alto flute, bass clarinet, and percussion. On of the key percussion instruments is the Spring, made from very thick spring steel wire bent under heat into twisted shapes, and amplified with a magnetic pickup. See the picture at right. I made this back in 1978 in San Diego. It makes a bell-like sound. I manipulate samples of recordings of the instrument with Csound to slide up and down, sometimes both at the same time, for an evocative sound.

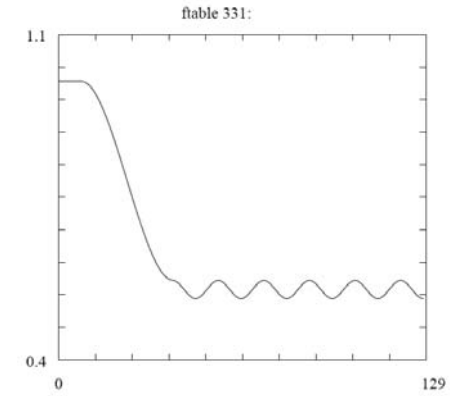
05- The Stick Shift Chevy Shake

This piece is based on a chord progression consisting of seven chords:

F minor, Ab major, G minor, A# major, A-- minor, C-- major, F minor, C minor, F major.

Each chord is played 1-3 beats before moving to the next chord. There are five different major variations that play this chord progression. Each has a different approach to the sound, from driving unison instruments, to slow contemplation, to reggae-like beat, jazz, and world-beat.

Some of the techniques include glissandi and unusual envelopes. For example, the tuba plays some long slides, generated by multiplying the sound sample waveform by another waveform, such as the one shown on this page.



The shape of this graph is generated by using the Csound ftable statement:

```
f331 0 129 -6 1 4 1 4 1 16 0.7857 16 0.5714 4
0.5514 4 0.5314 4 0.5514 4 0.5714 4 0.5514 4
0.5314 4 0.5514 4 0.5714 4 0.5514 4 0.5314 4
0.5514 4 0.5714 4 0.5514 4 0.5314 4 0.5514 4
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0.5514 4 0.5314 ; 0 g30 7:4 D+ to E++
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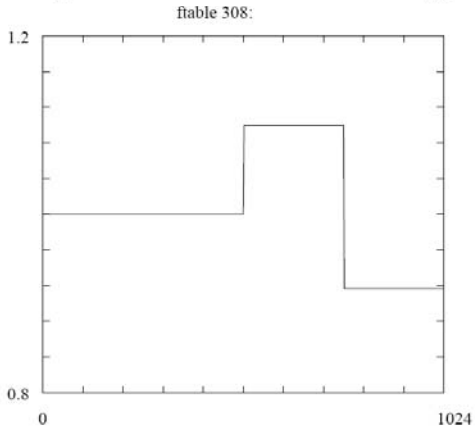


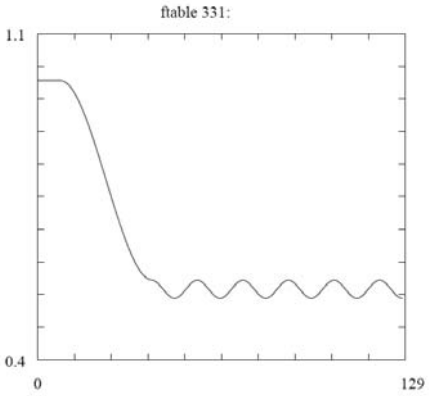
The shape of the function table takes a note from the 3/2 of the scale down to the 7/4, a drop of 12/7, almost an octave. There are another 10-12 up and down glissandi used at different points.

Another useful glissando is the up and down and back function table. For each note in the major and minor 6 note just scale that I use, there is a function table to take the note up to the next degree, and then down to the previous one. An example of the graph and function table are here:

```
f308 0 1024 -7 1 512 1 0 1.1 256 1.1 0 .9166667 256 .9166667 0 ; g7 2 3 1 = C D- B-
```

This function table takes a note on the second degree of the just minor scale up to the third degree, and then down to the first. In ratios, it starts at 12:11, up to 6:5, down to 1:1. There is a different glissando function table for every step in the major and minor six note scale.

The six notes I use for minor are 1:1, 12:11, 6:5, 4:3, 3:2, 12:7 and finally 2:1. If reduced, they can be written as 12:12, 12:11, 12:10, 12:9, 12:8, 12:7 and 12:6, or 12:11:10:9:8:7:6. The second degree (12:11) is a pleasantly harsh note, and the six degree (12:7) is also challenging. The six tones of the major scale are 1:1, 9:8, 5:4, 11:8, 3:2, 7:4 and 2:1. In shorthand, they are 8:9:10:11:12:14:16. I make heavy use of triads. In the major scale, the key ones are 4:5:6 and 7:9:11. The 7:9:11, with its heavy tension is resolved to the 4:5:6 in many different inversions. The same technique in the minor scale takes the 12:10:8 as the resolution of the 11:9:7.



There is a good deal of indeterminacy in the piece, where each instrument has many choices at each point. It may be silent, or play one of several possible chords, in several different rhythms. It will always play in the same key as all the other instruments. The time spent in each key is indeterminate, but always 1-4 or more beats, sometimes 0 beats. The result of skipping a chord changes the character of the progression in interesting ways.

The title is taken from a tongue twister used in some bilingual classrooms to help teach English to immigrant children. Try saying “stick shift Chevy” five times fast. Or even twice!

06- Circle Dance #2 -Tsantsa Celebration

This is a piece based on the otonalities of the Partch Tonality Diamond. The primary tonality is what I call D++, an 8:7 above the center of a tonality diamond based on C as 1:1. The song moves around the diamond in a kind of circle of chords, from D++ (8:7) to F (4:3) to A flat (8:5), C (1:1), G-- (16:11), to A# (16:9) and back to D++. If you voice the chords just right, you can go around this cycle three times and end up with a kind of chromatic scale that drops an octave. The song spends most of its time in D++ major. The opening section uses a horn glissando on a triad 7:9:11 to the triad 8:10:12. The glide is gradual over a whole note. At the start of the glide, there is a prominent difference tone three octaves below the 9:11:14. At the end, the difference tone is one octave below the 10:12:16. I play around with shifting difference tones all throughout the piece, some more noticeable than others. The instruments used are trombones, tuba, flute, cello, violin, guitar, finger piano, and percussion. Bass gongs that glissando down appear at different times. The title is taken from the South American native Jivaro warriors, who smeared themselves with blood and danced with the shrunken heads of their enemies dramatizing the killing. Tsantsa is the native word for shrunken head. Imagine hearing the trombone glissandos across the forest valley, the triumphant victory dance of revenge. Set the *riffmobile* to *triademonium*, sit back and listen to the changes. Notice your head getting smaller?

07- Mirror Walk

This is a piece with musical material from the Partch Tonality Diamond. The primary scale is based on the overtone series starting on A#, expressed in ratios as 8:8, 9:8, 10:8, 11:8, 14:8, 16:8. In note names, they are A#, C, D, E-, F, G++. The piece modulates to chords chosen from the undertone series of C: A#, Ab, G--, F, D++, and C, or expressed as ratios, with A# as 1:1 they are 9:9, 9:10, 9:11, 9:12, 9:14,

9:16, 9:18. At any one time, only the overtones of one undertone are played.

After an opening chord progression of four otonalities on the utonality (overtones on A#, Ab, G--, F or 9:9, 9:10, 9:11, 9:12), the cello plays a melody in A# otonality, with modulations to the utonalities after a few measures. This is the basic structure of the song: melody moving from one otonality to another, following the progression of the utonality. This is separated by occasional slow chord progressions through the utonality progression.

I voice the chords so that the progression sounds like it is rising, as the fundamental of the chord descends. This contrary motion is used throughout the song, with frequent upward or downward glissandi from one set of overtone triads to another, sometimes simultaneously. A favorite glissando takes an 8:10:12 triad down to a 7:9:11, or back up. At about 4:50 into the piece, there is a slow progression through the overtones of the undertone series, using a set of glissandi for each of the notes in the scale.

The instruments include cello, violins, double bass, tuba, contrabassoon, oboe, flutes, finger piano, harp, vibraphone, French horn and many different trombones. All are subject to up and down sampling to create tiny versions of the instruments. A tenor trombone, downsampled by a few notes and then taken up an octave sounds like a soprano trumpet. All instruments can glissando, including the harp, finger piano, oboe, flute, and cello.

There is a certain amount of indeterminacy, but not as much as some of my other music. In this piece, each instrument can sometimes choose from many different alternative measures at any one time. At other times, they are more constrained. I did this to ensure that the parts that sounded best before I imposed constraints made it into the finished product. The cello melody at the beginning was specified explicitly. The only choices the cellist had was whether to glissando or slur some passages. The trombone, oboe, and finger piano accompaniments had many more choices, but still constrained to a short list. Later in the song they could chose from many more alternatives. Some interesting parts showed up just because it was their time to be heard. I especially like the *oom-pah-pah* part at 2:45, following some trombone glissandi. I like to think of it as an improvisation, subject to control.

08- Subduction Zone

Subduction Zone is a piece for Alto Flute, Bass Clarinet, Guitar, Marimba, Finger Piano, and percussion. It is based on four chords in the Partch Tonality Diamond: F 4/3 minor; A 8/5 major; C 1/1 major; and A 5/3 minor. There are many notes in common between these scales, and many more that are only slightly different. The subduction takes place where the differences lie.

Start Scale				End Scale
F 4/3 minor	Bend Ratio			A 8/5 major
1 F 4 / 3	9	:	10	5 E 6 / 5
2 G 16 / 11	77	:	80	6 G 7 / 5
3 A 8 / 5	1	:	1	1 A 8 / 5
4 B 16 / 9	81	:	80	2 B 9 / 5
5 C 1 / 1	1	:	1	3 C 1 / 1
6 D 8 / 7	77	:	80	4 D 11 / 10
A 8/5 major				C 1/1 major
1 A 8 / 5	15	:	16	5 G 3 / 2
2 B 9 / 5	35	:	36	6 B 7 / 4
3 C 1 / 1	1	:	1	1 C 1 / 1
4 D 11 / 10	90	:	88	2 D 9 / 8
5 E 6 / 5	25	:	24	3 E 5 / 4
6 G 7 / 5	55	:	56	4 F 11 / 8
C 1/1 major				A 5/3 minor
1 C 1 / 1	1	:	1	3 C 1 / 1
2 D 9 / 8	80	:	81	4 D 10 / 9
3 E 5 / 4	1	:	1	5 E 5 / 4
4 F 11 / 8	80	:	77	6 F 10 / 7
5 G 3 / 2	10	:	9	1 A 5 / 3
6 B 7 / 4	80	:	77	2 B 20 / 11
A 5/3 minor				F 4/3 minor
1 A 5 / 3	24	:	25	3 A 8 / 5
2 B 20 / 11	44	:	45	4 B 16 / 9
3 C 1 / 1	1	:	1	5 C 1 / 1
4 D 10 / 9	36	:	35	6 D 8 / 7
5 E 5 / 4	16	:	15	1 F 4 / 3
6 F 10 / 7	56	:	55	2 G 16 / 11

This piece exploits the challenging ratios between many of the notes in the four scales. in the following chart, the second degree of the F 4/3 minor scale, G 16/11, has to drop down by a 77:80 to reach the 6th degree of the A 8/5 major scale, which is G 7/5. That's about 1/2 of the normal 12 tone semi-tone. The movement from the 4th degree of the F 4/3 minor scale, B 16/9 to the 2nd degree of the A 8/5 major scale, B 9/5 is much smaller. It's a movement of an 81:80, nearly imperceptible. The thematic material is about how those changes come about, at the margins of the chord changes, the tectonic plates in the analogy to geological processes. There are similar charts moving from A 8/5 major to C 1/1 major, and then to A 5/3 minor.

I had a lot of fun with the glides within the scales as well. There are movements from one scale degree to another, up and down. The guitar, flutes, clarinets, and finger pianos move often from the 1,3,5 degrees to the 2,4,6 degrees. Triads made of the 1,3,5 sound like typical minor or major chords. The 2,4,6, sound pretty far out. The tension is in the movement from one to the other.

I also exploit 4 note chords based on scale degrees 1,4,6,3 or 2,5,1,4 or others. These sound more like typical fourth based harmonies rather than the triadic 1,3,5 and 2,4,6.

I also played around with trills, from one scale degree to the other.

The finger piano is made from samples taken from an instrument I built many years ago, consisting of spring steel tongues tuned with little bits of solder to ensure the overtones are in tune with the fundamental. The sounds are picked up with hand wound magnetic transducers.

The marimba plays either single notes or rolls on chords, but very fast rolls that sound more like bamboo gamelan instruments than a traditional marimba.

The title is taken from the geological phenomenon of plate tectonics. The uppermost part of the Earth is subdivided into a small number of rigid plates which comprise about 85% of the surface. In places these are separated by non-rigid (deforming) zones. Elsewhere plate boundaries of

three types exist: divergent or spreading (e.g., mid-oceanic ridges), convergent (e.g., subduction zones), and strike-slip (e.g., the San Andreas fault zone in California or oceanic transform faults).

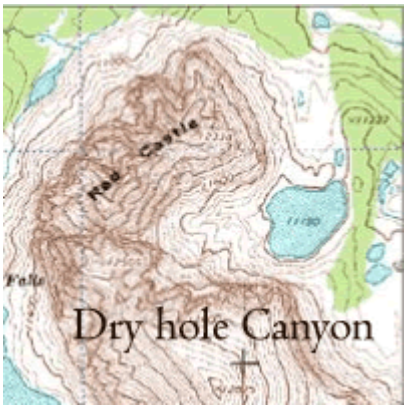
09- Wasatch Front

for Microtonal Woodwind Quintet
This piece is based on a chord progression consisting of eight chords, which is repeated in many different forms as the song progresses. Specifically:

- C minor
- D# minor
- G minor
- A# major
- D++ major
- F minor
- Ab major
- C minor

One of the most interesting parts of the progression is the microtonal intervals moving from one chord to another. For example, consider the movement from the minor third of C minor (E—or 6:5) to D# (7:6). This motion is a movement of 35:36. This is equivalent to about 48 cents, or half a semitone. It would be like moving from the Eb on the keyboard to a note between the Eb and D. The fifth of C minor (G or 3:2) moves to the third above D# (F## 7:5). This is a movement of 14:15, or 119 cents, just over a semitone. These are intervals available in the 12 tone scale. So with the first chord movement we have three different notes that are non-twelve in nature. But as I listen to them, they sound very natural and not at all unusual.

10- Dry Hole Canyon for Woodwind Quintet



This piece is exploits the sonorities of the woodwind quintet, especially the ability to have separate voices or blends of voices to create a new instrument. This piece is based on 15-limit tonality diamond. This piece makes extensive use of minor and sub-minor scales derived from the utonality and otonality series. Minor scales are derived by the ratios of 24/(24:22:20:18:16:15:14:13:12). Sub-minor are based on the ratios 12:13:14:15:16:18:20:22 :24. There is limited use of Major (8:9:10:11:12:13:14:15:16) derived from the otonality and Super Major 1/(18:16:15:14:13:12:11:10:9) from the utonality.

The melody is made up of multiple phrases that are played by different instruments. It moves from one instrument to the other like passing a cup from one supplicant to another at communion. When the main line is played by more than one instrument, they blend together into a single new sonority that is unlike the individual parts, but when they play alone it is relatively easy to hear the individual voices.

There are two main melodic materials. The first starts with a direct statement by the flute and is repeated by the other instruments, in other scales. This melody is fragmented throughout the piece into unrecognizable chunks. The second melodic statement starts as fragments and is not fully assembled until the very end of the piece.

11- Candland Mountain

Candland Mountain is a piece for woodwind quintet: flute, oboe, clarinet, French horn, and bassoon. The tonality is based on three otononalities from the Partch Tonality Diamond. The piece starts on a transition from E 6/5 subminor to E 16/13 major. Those two keys predominate throughout. The primary thematic idea is making the listener relatively comfortable in one key before moving to the next, which is often far away on the diamond. That can be a tall order, since the otonality has some very challenging notes.

The order of keys is as follows:

- E 6/5 subminor
- E 16/13 major
- B 24/13 subminor
- C 1/1 major
- G 3/2 subminor
- A 8/5 major

The relationship between the major and the subminor that follows is 3/2, and they both use the same otonality. For example, C 1/1 is a major scale consisting of C 1/1, D 9/8, E 5/4, F 11/8, G 3/2, A 13/8, B 7/4, and B 15/8. G 3/2 subminor starts on the same G 3/2 and goes up from there, using the same notes, with a different bass and mode. The same relationship exists between the A 8/5 major and the E 6/5 subminor, and between the E 16/13 major and the B 24/13 subminor. So we really only have three different keys. But the notes in each key are microtonally different in many ways.

The structure of the piece is kind of an A, B, C, D, C, B, A design, with a progression towards the middle, and then more a less a retracing of the steps back towards the end. There are short 1/8 note pauses between each section, but they often are so short that you can miss them.

Candland Mountain was named for one of the original settlers in Utah, who had the mountain and a spring named after him. The mountain was where he summer fed the sheep, and the lower elevation spring is where he kept them in the winter. This is the third and final piece for Woodwind Quintet based on themes from the Wasatch Range near the Great Salt Lake in Utah.

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