Thoughts on Droneo 1.5

The iOS app Droneo is a tool for exploring consonance and dissonance through precisely tuned, synthesized timbres. It has been generally available since 2009.

Droneo is a synthesizer for exploring the sonic possibilities of a single pitch. It drones with various timbres and precise intonations that blur the distinction between tones, timbres and chords.

Droneo is also an excellent way to explore the way chords fuse into timbres. It has many ways to specify musical intervals which are related to the main drone pitch, including an interactive "Tone Spiral".

With this latest release, 1.5, Droneo can (again) participate in some of the musical infrastructures made available on the iOS platform. That means its drones can be recorded and sampled, run through effects, and transmitted to other devices by using other programs.

This update has been a long time coming - about two and a half years! That’s because I kept going back and forth between making a new app or fixing this one. After my most recent attempt at making a newer app (which was pretty powerful) I found I didn’t like the user interface, and kept running into obscure synthesis problems. I’ll probably

make another powerful droning app, but most likely, it won’t have much in common with Droneo, except for the Tone Spiral, which I find extremely useful.

Droneo 1.5 New Features

Droneo 1.5 adds a few powerful features:

- A way to directly pick Droneo Voices rather than to use the cumbersome and opaque Voice Banks.
- A way to randomize the selection of harmonics in pattern generation synthesis.
- A customizable way to set up "reeds" as generators with their own patterns, timbres and transition parameters.

Droneo Voices As Compositions

Droneo's voices can be considered as precise instructions for creating unending generative compositions. Some of these compositions repeat and have no random component, while others have some randomness built into their choices. Some of the internal settings of the formerly preset generative processes have been opened up in the new Custom Pattern generation timbre.

Droneo, because of its really old internal structure, restricts its control rate, and therefore, can't track the rhythms of other programs, or have fine grained control over its generation timing. It doesn't participate in any beat synchronization infrastructures like Ableton Live. However, there is some flexibility, and also, the door is open for long form - very long form - musical composition. Generative transitions can now happen over much longer timescales than before, and the transition from one harmonic to another can also be made very long or even incomplete.

In the next section, I'll detail a few techniques that make for some engaging (or disengaging) generative synthesis, and describe paths you may want to explore yourself.

Droneo Techniques

Random Harmonic Patterns:

Droneo has had a pattern feature for some time: you can specify a coded sequence of harmonics, which actually are sped up copies of its corresponding timbre, so they may have much more harmonic content than pure, sinusoidal harmonics. This was specified with a very simple scheme:

0 for silence

1 for the 1st harmonic

2 for the second (octave)

3 for the third (perfect fifth)

… and so on

9 for the ninth

a for the tenth
… and so on

g for the 16th

… and so on

w for the 32nd

Through this scheme, you could set up harmonic sequences that could create sequences and harmonies that could be mathematically consonant - or nearly so if the reed's interval were not related to other intervals in a simple way. You can also discover that high harmonics are indeed highly pitched, so you either have to drop the base frequency, or a reeds interval to a few octaves below the base frequency to hear these intervals!

In Droneo 1.5, this system has been expanded all the way up to the 64th harmonic, as detailed in this chart:

0 : 0	1 : 1	2 : 2	3 : 3	4 : 4	5 : 5	6 : 6	7 :7
8 : 8	9 : 9	a: 10	b : 11	c : 12	d : 13	e : 14	f : 15
g : 16	h : 17	i : 18	j : 19	k : 20	l : 21	m : 22	n : 23
o : 24	p : 25	q : 26	r : 27	s : 28	t : 29	u : 30	v : 31
w : 32	x : 33	y : 34	z : 35	A : 36	B : 37	C : 38	D : 39
E : 40	F : 41	G : 42	H : 43	I : 44	J : 45	K : 46	L : 47
M : 48	N : 49	O : 50	P : 51	Q: 52	R : 53	S: 54	T : 55
U : 56	V : 57	W : 58	X : 59	Y : 60	Z : 61	+ : 62	- : 63
= : 64							

Chart entries in red are intervals that could be considered parts of the familiar just diatonic scale, which is entirely available starting with the 24th harmonic, (oruwAEJM), should you wish to use it that way.

Here are all the odd harmonics ordered in octaves for all harmonics under 31:

0 : 0						
1:1	2:2	4:4	8:8	g: 16	w: 32	= : 64
3:3	6:6	c:12	o:24	M: 48		
5:5	a:10	k:20	E:40			
7:7	e:14	s:28	U:56			
9:9	i:18	A:36				
b:11	m:22	I:44				
d:13	q:26	Q:52				
f:15	u:30	Y:60				
h:17	y:34					
j:19	C:38					
l:21	G:42					
n:23	K:46					
p:25	O:50					
r:27	S:54					
t:29	W:58					
v: 31	+:62					

Even the older Droneo could be used to explore the role of harmonics in scale creations, by setting up patterns like:

4/3 00040506

1/1 40506008

3/2 03004050

Which generates the aforementioned diatonic scale using only 5-limit harmonics. You can then go into the tone spiral and move around the reeds' intervals to make new scales that are structured the same, but of course don't sound the same.
You might even be able to see that these patterns are really different pieces of a bigger pattern:

00300405060708 9abcdefg

which is actually a crudely quantized natural sequence of harmonics which would come from a resonator excited with an exponentially expanding impulse. With that in mind, you can come up with other scales to work with with a purely physical justification.

You may have noticed that high harmonics are really high - and distorted - so you may want to make your interval a few 2/1's lower, for instance, use 1/16 instead of 1/1.

Custom Patterns

Custom Patterns are a new feature in 1.5 .They are laid out like this:

```
Interval Spec. Timbre,decision speed, transition speed,pattern

1/4 t4,16,8,45678
```

Custom Patterns lets the speed of the transition to a new harmonic be controlled. Making this a large number relative to the speed between decisions, means it doesn't really get all the way to that harmonic, but does add it into the sound you are hearing. If you create a pattern that repeats the harmonic, it will continue to grow in strength until it changes again. So this technique gives you fine-grained control over harmonic content, without specifying a lot of numbers. Setting up a few reeds with these patterns can make some interesting effects. For instance, making the intervals just a little different but still close will fade in a shimmer or comb filter effect.

Making the pattern random with a ? as the first code, and repeating harmonic codes to the extent you would like them in proportion, makes for a good compromise between predictability and randomness.
For other effects, I create a pattern and paste it to another

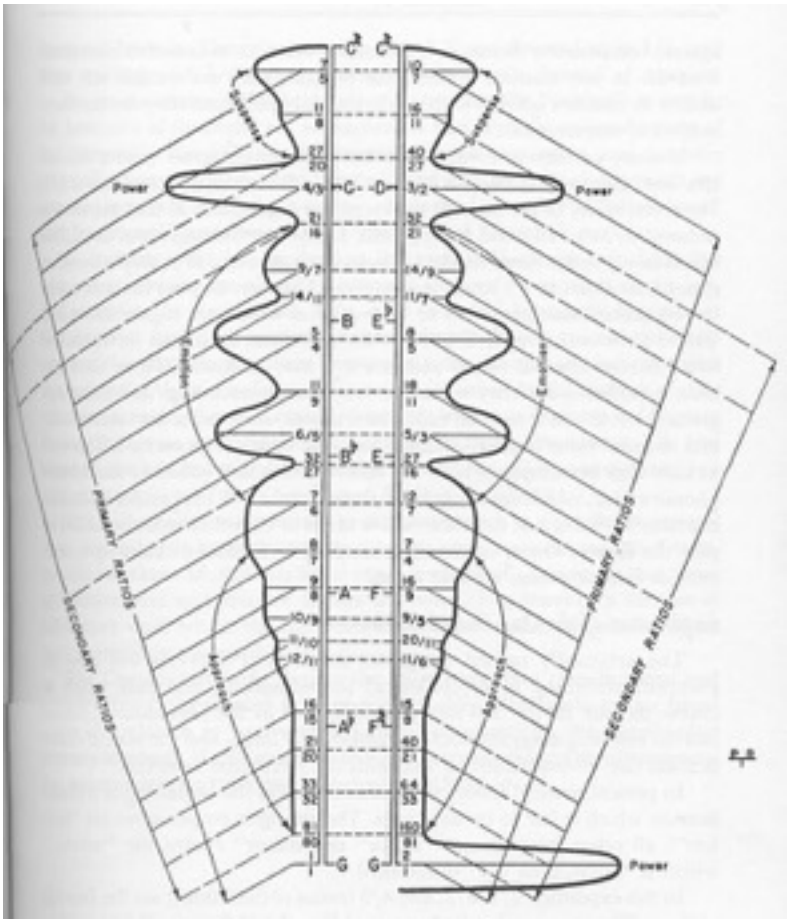
reed or two. Then, with the patterns in synch, I make one have a fast transition speed and the other a slower one. the effect is like changing the decay, or adding reverb. You can hear this in the Droneo Voice "Morse".

Of course they don’t have to be in synch either, and with some careful work, you can have it beat out synchronized rhythms and phase them by changing the transition speeds.

The Lost Chord

Lots of people have discovered the Lost Chord, but didn't know it or call it that. It's actually a whole class of lost chords. Coming from me, I bet you can figure out that you can't play them in equal temperament.

If you recall Harry Partch's "One Footed Bride" and other measures of interval consonance, you'll see a big lump - the foot if you will - near the octave (2/1):



The Bride's missing left foot (1/1) is actually where the Lost Chords reside. That is to say, the mind altering, fascinating, hypnotic chords of song and story are the extremely close intervals near 1/1. Anyone with a comb filter or chorus/flange effect could have told you that, but here's the thing: as the interference beats get slower, the more this timbral fusion passes from a perceived effect to a composition itself. Also, you need a really stable and pure bunch of sound sources, which my apps Droneo and Srutibox amply provide.

Sir Arthur Sullivan - or rather Adelaide Anne Proctor - appropriately provides a clue in that the Lost Chord is played on an organ, which has the feature of rather stable tuning and lack of modulation - which means a pair of really closely tuned reeds or pipes could actually produce "Lost Chords". In fact, it's hard to imagine any meaningful practical microtonal research without the stability of reed and pipe organ "oscillators". Strings - except for Ellen Fullman's Long String Instrument - have too many unstabilizing influences!

Droneo 1.5 has a Voice Bank of Lost Chords to start you off; it’s really a very simple concept that’s really hard to pull off without Digital Oscillators.

The Long Form

The **Lost Chord** described above is a most minimal version of Long Form music, which stretches to music that is unrepeating and unending. As a long time cloud and tide watcher, my taste, though, is not really to have music that takes decades to experience, but maybe to make some compositions where the changes can be perceived at a human scale. The texture of the timbre used in a long form composition may be at the scale of usual pieces, but there will be larger scale structure to it. Droneo with its custom patterns can now map out a structure that reveals itself very slowly.
If you use the voice import feature, you can make really long, phasing harmonic patterns in an editor more comfortably than with the app itself.

McAnalog2

Here is a musical analysis of one of my Droneo 1.3 patches: McAnalog2. This is one of may favorite voices, sometimes it passes through great and unexpected consonances and dissonances.

```
Droneo FV1.1 droneoahet;
version: 1107;
name: McAn2;
desc: Evolving Mirror 3 and Analog Consort;
created: 2016-07-24 05:57:46 PM;
baseFreq: D1;
volume: 0.4995;
timbre1: Evolving Mirror 3;
timbre2: Analog Consort;
chorusFreq: 19.46565;
churnFreq: off;
pulse: 1;
isRandom: NO;
nameStyle: Actual;
modulationState: Churn;
reed0: <1592.33>,0.7713797,0.999;
reed1: <1197.15>,0.6328892,0.999;
reed2: <702.54>,0.6782983,0.999;
reed3: <2795.65>,0.7662784,0.999;
reed4: <2086.22>,0.7776307,0.999;
reed5: <2289.63>,0.7804688,0.999;
reed6: <700.85>,0.7577642,0.999;
reed7: <3394.94>,0.5250426,0.999;
process: Droning;
processBlendRate: 0;
```

What's going on here?
First of all, it's an evolving patch, using Evolving Mirror 3, which randomly changes the timbre to add partials from 1 to 10 times the original frequency.

That's part of the reason why the base frequency is so low, in this case a low D1.

Actually what happens with all the evolving timbres is that sped up versions of the wave table are merged in with it, so if the wavetable is not just a simple sine wave, it's adding a lot more texture than a simple harmonic would. Evolving Mirror 3 also has a pretty fast transition time, so instead of a dreamy merging of timbres, it is more like a sequencer bopping from note to note.

The Mirror is aimed an the Analog Consort, which means each reed is assigned its own special timbre.
1:Sine
2:Sine3
3:Triangle
4:Triangle 1/4
5:Triangle 1/8
6:Square
7:Square 1/4
8:Square 1/8

It's like a little octet of players, each with an instrument that can play its assigned pitch or any of the ten harmonics of that pitch, but using roughly the same timbre. And what are those pitches? They started out all just, and then I tweaked them a little so that there would be some movement in there, but still sound pretty pure.

1: F#2 -7.67 cents like 5/2
2: D2 -2.85 cents like 1/1
3: A2 +2.54 cents like 3/2
4: F#3 -4.35 cents like 5/1
5: B3 -13.78 cents like 10/3
6: C#3 -10.37 cents like 15/4
7: A2 +0.85 cents like 3/2
8: C4 -5.06 cents like 64/9

That makes a kind of a matrix of possible tones here over a span of four octaves or so.

folded into 1/1-2/1:

	1	2	3	4	5	6	7	8	9	10″
5/4:	5/4	5/4	15/8	5/4	25/16	15/8	35/32	5/4	45/32	25/16″
1/1:	1/1	1/1	3/2	1/1	5/4	3/2	7/4	1/1	9/8	5/4″
3/2:	3/2	3/2	9/8	3/2	15/8	9/8	21/16	3/2	27/16	15/8″
10/4:	5/4	5/4	15/8	5/4	25/16	15/8	35/32	5/4	45/32	25/16″
10/3:	5/3	5/3	5/4	5/3	25/24	5/4	35/24	5/3	15/8	25/24″
15/8:	15/8	15/8	45/32	15/8	75/64	45/32	105/64	15/8	135/128	75/64″
3/2:	3/2	3/2	9/8	3/2	15/8	9/8	21/16	3/2	27/16	15/8″
16/9:	16/9	16/9	4/3	16/9	10/9	4/3	14/9	16/9	1/1	10/9

and as cents:

	1	2	3	4	5	6	7	8	9	10″
5/4:	386.3	386.3	1088.3	386.3	772.6	1088.3	155.1	386.3	590.2	772.6″
1/1:	0.0	0.0	702.0	0.0	386.3	702.0	968.8	0.0	203.9	386.3″
3/2:	702.0	702.0	203.9	702.0	1088.3	203.9	470.8	702.0	905.9	1088.3″
10/4:	386.3	386.3	1088.3	386.3	772.6	1088.3	155.1	386.3	590.2	772.6″
10/3:	884.4	884.4	386.3	884.4	70.7	386.3	653.2	884.4	1088.3	70.7″
15/8:	1088.3	1088.3	590.2	1088.3	274.6	590.2	857.1	1088.3	92.2	274.6″
3/2:	702.0	702.0	203.9	702.0	1088.3	203.9	470.8	702.0	905.9	1088.3″
16/9:	996.1	996.1	498.0	996.1	182.4	498.0	764.9	996.1	0.0	182.4″

At any one time, the eight reeds are simultaneously playing any of the pitches in their row.

Low Frequency Vocals

The vocal timbres in Droneo are generated based on the frequency it thinks it will be playing, that is the base frequency * the reed interval. It actually limits that generated voice to 64 non-zero harmonics, so lower voices don't have quite the resolution of higher ones! Within the range of human voices, it's pretty predictable, but you can also go much, much lower, and the high frequency elements of the voices will come out a a little chirp. These chirps, like the insects, are great fun to play with.
Playing "harmonics" of a low voice does NOT result in the resynthesis of what the voice would have been at that pitch. So, from A0,

```
1/1 va,32,2,456
1/2 va,32,2,8ac
1/4 va,32,2,gko
1/8 va,32,2,wME
```

These all calculate to the same frequencies, but sound different! The crunchiness and glitchiness becomes more useful at lower speeds, as discussed above (just change the base frequency to 1Hz or lower!).