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".

As you explore this sonic palette, you can get a feel for how certain timbres fit "naturally" in certain frequency ranges, how tunings and timbres and chords intertwine.

Droneo can also be used as a pitch source for instrument tuning purposes, or as an aid for learning the difference between Just and Equal Tempered intervals. Droneo is a relative of one of my other iPhone Apps, **SrutiBox**, and like Srutibox, it can also be used to simulate the pumped reed organs used in Carnatic Indian music. Droneo expands on this sonic material.

Droneo uses 8 tone sources, here called "*reeds*". The relative pitch and volume of each reed can be set individually, making for a wide variety of drones. They can also be randomly detuned and chorused. The reeds can be set to various timbres suitable

for drones, including vocal-like timbres and evolving, dynamically generated timbres.

The settings for all the reeds, timbres, modulations, volume levels and tunings (called a "*Droneo voice*") can easily be recalled. A set of six of these Droneo voices, called a "*voice bank*," can be named, saved, renamed, and deleted. Voices can be exported and imported as text strings.

Droneo's audio can be saved as a file which you can export from the iTunes Documents interface, or send to another app via

[Retronyms' AudioCopy](#) program

Droneo supports the [Audiobus](#) standard, and can stream audio directly to other Audiobus compatible programs. Droneo voices can be saved and recalled by Audiobus. See : http://audiob.us/

Droneo supports Apple's own Inter Application Audio (IIA) as an audio generator.

Skins

Droneo has two skins, which you can change via the Settings App.

For most of the examples given here, you'll be seeing the **Blue-Green** skin.

Honeycomb	Blue-green
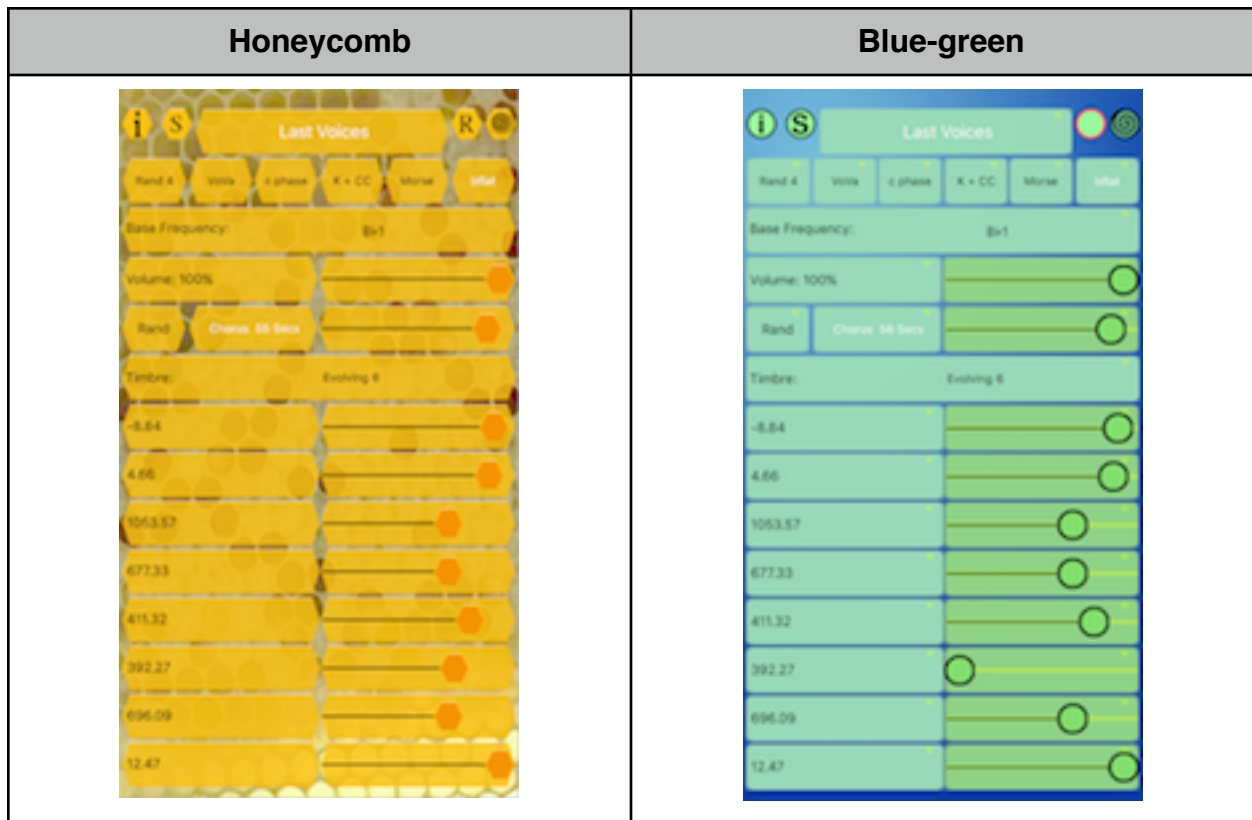
Concepts
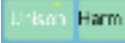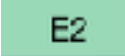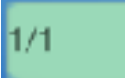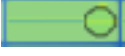
A **Droneo voice** is made of these parts:

• Each voice is made of up to 8 "reeds".

• Each reed has an interval associated with it, which is used to determine its frequency in reference to a single, shared frequency, the "base frequency".

• There are many ways to specify the reed interval and base frequency.

• The intervals' values can be perturbed with a slight amount of randomization.

• Each reed can alternate ("churn") between two amplitudes and two timbres at a specified rate.

• Each voice can apply a chorus effect, at a specified rate.

• Some of the timbres change themselves while they are playing ("evolving timbres"). Usually, this means a few harmonically related sine waves are added into the timbre randomly, sometimes replacing it.

• Some of the evolving timbres ("evolving mirrors") use the "other" churn timbre as sonic material instead of a sine wave timbre.

• There are also timbres that play the reeds in a ordered combinations (counting), and play timed patterns of harmonics (patterns).
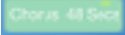
• There are also collections of Timbres ("consorts") which put a different timbre on each reed.

• A master volume control is used to set the volume of the entire sound.

Main Screen

Interface

	Info button is used to see these instructions!
	Save button takes you to a list of saved Droneo voice banks.
	Record button makes a recording of the current drone and saves it, where it can be found by the iTunes document interface and the AudioCopy app (by Retronyms).
	The **Tone Spiral** is a way to set up the intervals in a Droneo voice interactively.
	Voice buttons are six buttons that change the settings that make up a drone.
	Base Frequency sets the fundamental frequency of Droneo's drone.
	Volume sets the overall volume of Droneo.
	Randomization Slightly changes the frequencies of reeds with random offsets to put more beating into otherwise harmonically pure drones.
	Modulations Chorus and Churn modulations are set with this button and slider.
	Timbres Sets a timbre for a reed.
	Intervals Sets the pitch interval of a reed in relation to the base frequency.
	Volume Sliders control the volume of each reed.

🪙 **Save**

The **Save button** takes you to a list of saved Droneo voice banks.

Droneo comes with a few preset voice banks to start with. They are listed later in this document.

Their names are in blue, indicating that they cannot be changed, but you can load them and alter them, and then save them under new names. Droneo voice banks always save *the entire* set of Droneo voices, so if you have related Droneo voices, they can be saved together. You can also save individual voices from the Droneo voice editing screen.

The voice banks first list the banks that come preinstalled, and then your saved banks, sorted alphabetically. The first bank is always named " Last Voices" , which is the way Droneo was set when you last left it, or if it was interrupted by a phone call. When you start or restart Droneo, it always loads the " Last Voices" voice bank, even though the title area says "Droneo". After five seconds, though, the title changes to " Last Voices" so you can click on it to reload them.

When you choose a voice bank, the title area on the Main screen - which is actually a button - will change to be the name of that bank. Double tapping the title will reload a bank if you have changed it and want to revert to its saved version. Double tapping helps cut down on accidental reloads!

To pick a voice bank, tap the name in the list and it will instantly be put into effect. You can save the Droneo voices currently in use as a voice bank by tapping the **Save** button. If you have chosen a voice bank already and changed it, the **Save** button acts more like a "Save As" button. Typing an existing saved voice bank name will overwrite that bank.

Pressing "Edit" will let you either delete a voice bank by tapping the minus icon (-) or rename a voice bank by tapping the name itself.

The voice banks are a convenient way to save related Droneo voices, but individual voices can be loaded and saved by triple tapping the voice name, or just pressing and holding then name for a while.

🔴 **Recording**

You can record your drone, and either pick it up from the iTunes Document interface or use Retronyms' AudioCopy to transfer it to another program via the clipboard.

Touch the **Record button** to begin recording. When recording, the button turns red to remind you that you are recording.

Touch the Record button again to stop recording. An automatically named file will then be saved and put on the clipboard. An alert comes up with the name of the recording, which is in the format:

[voice name]-YYYYMMDD-HHMMSS.wav

You can then switch to a compatible program an use the recorded drone right away.

In the Settings App, there is a Setting that optionally erases all previous recordings when you save, so that you don't have a lot of recordings building up in the iTunes documents directory.

🌀 Tone Spiral Screen
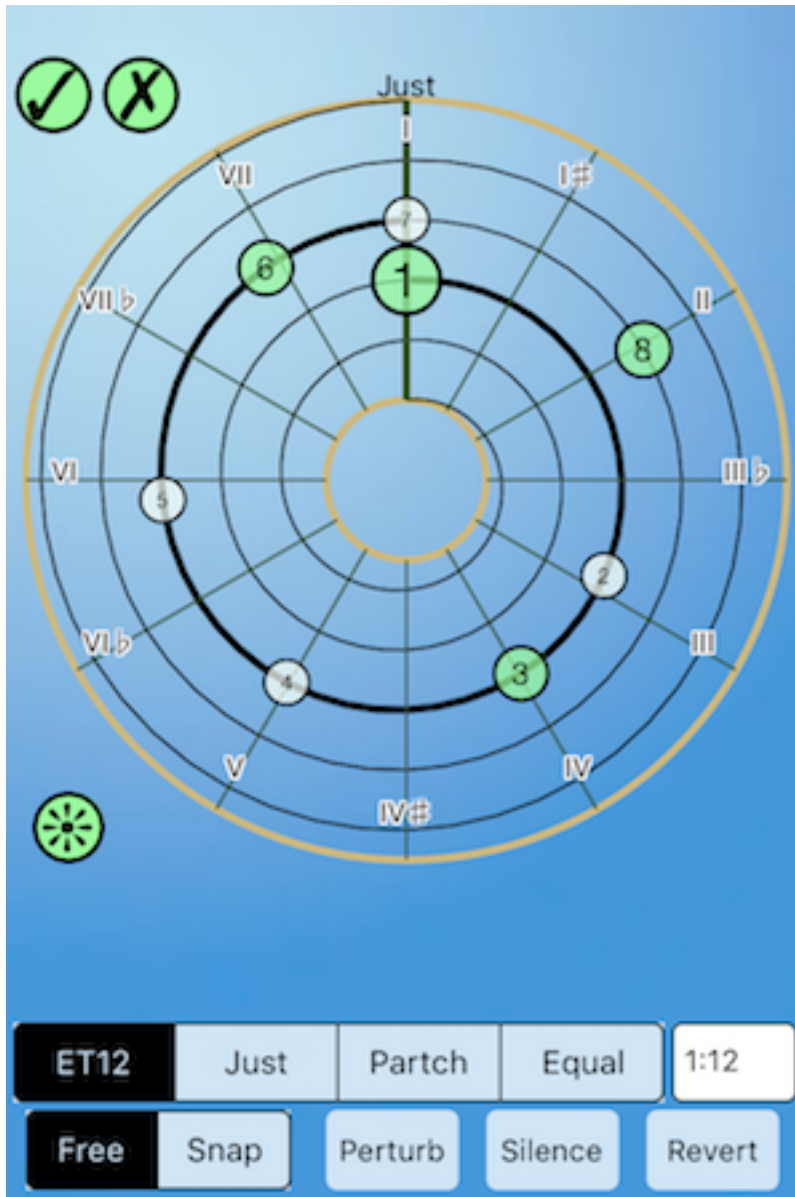
This large spiral is an interface for displaying and changing intervals for all of your reeds. You can set a reeds interval value interactively, and visualize its relationships with the intervals of other reeds. The Tone Spiral can, with care, be used as a performance interface!

The value of each reed's interval is represented by a small circle with a number in it (a "tone spot"). You can set the interval you'd like for a reed by dragging its tone spot to a position on the spiral. The angular position of a tone spot is related to that reed's interval, so that equal radial distances represent equal intervals.

Each loop of the spiral represents another octave, and tone spots' intervals are placed logarithmically on that spiral. The interval from 1/1 to 2/1 is marked by a wider line, which will help you find your way in interval space. If the reed has no interval, its tone spot put near the center of the spiral, out of range.

The size of the tone spot is related to its current volume. This display shows four octave's worth of interval information by default. Moving tone spots into the lower or upper octave will rescale the spiral when you are done moving it. To move into more than one new octave, you will need to do it in steps. Intervals outside the range of -15600 to 18000 cents are clamped to the top or bottom circles, which are colored red if there's clamping going on. You must be doing something very special to use those intervals!

Tone Spots are uncolored if their volume is always zero. Remember, a "zero volume" is different from having an "off" interval. The size of a tone spot varies with the volume setting. Churning intervals will change their tone spot sizes in synch with the churn!

If more than one reed shares the same interval, the tone spots will pile up in in a row at that interval.

 Touching this "check" button will accept this set of intervals and use them in the current Droneo voice. After touching it, the interface reverts to the Main screen.

When the Main screen returns, the reed intervals are shown as cents. However, the actual labels are either set as cents or set to the best name it can determine from the actions on the tone spiral. You can customize them after they have been changed. Note that this wipes out previous settings for the intervals, so if you want them back, you should reload the whole Droneo voice bank that the voice is associated with.

 Touching this button will revert back to the settings before the Tone Spiral screen was displayed. The interface then goes back to the Main screen.

 This title area reminds you of the Droneo voice name. In the upper right corner, you will see a description of the reed interval you are changing when you start to change it. This description shows the reed number in a circle (1 to 8) followed by the interval in cents or, if you are "snapping" the interval to one of the interval guides, the interval name as shown in the interface.

 This button is the **transposing button**. When you click it, it gets highlighted, and when you move one of the tone spots, all the others will transpose together by the same interval. This is especially useful when building sets of reeds with relative intervals.

Interval Guides

You can show various interval guides for intervals, which can help you visualize and decide where to place the tone spot to define an interval in relation to some well known intervals.

| ET12 | Just | Partch | **Equal** | 1:12 |

- **ET12**: shows the familiar 12 tone equal temperament scale lines. Yes, they are equally spaced!

- **Just**: shows a nice selection of commonly used just intervals.

- **Partch**: shows the famed 43-tone just scale used with many of Harry Partch's fixed tone instruments.

- **Equal**: lets you specify another equal division of an octave. The value in the text box can be any interval, expressed as a Droneo interval spec, such as an EDO like 1:19, a just ratio like 18/17, or cents value like 43.224, or something perverse, like 1:10@7/4 (the 10th root of 7/4).

| **Free** | Snap | Perturb | Silence | Revert |

| Free | **Snap** | Retune | Silence | Revert |
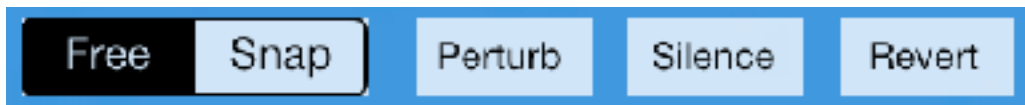
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Two modes, "**snap**" or "**free**", control whether the intervals you choose are constrained to the interval guides or not.

If you are in "**snap**" mode, your changes are constrained to intervals and octaves of intervals of the current interval guide. The button next to the "snap" button becomes the "**retune**" button, which when tapped will retune each tone spot to the interval closest to it in the current guide.

If you are in "**free**" mode, your changes are not constrained. The button next to the "free" button becomes the "**perturb**" button, which will add or subtract a small random amount from all the intervals.

The "**silence**" button turns all the intervals off.

The "**revert**" button resets all the intervals to what they were when you called up the tone spiral.

Different labels for intervals that map to the same "tonic angle" will be drawn on top of each other. Sorry!

Base Frequency

Base Frequency: C#2

All the reeds reference a base frequency to tune their intervals relative to that frequency. The **base frequency** can be set to values between 0.00 Hz and 1/8th of the sample rate:

1378.125 Hz for Low, 2756.25 Hz for Medium, 5512.5 for High

You can change the base frequency to a new value in Hertz by tapping it and typing it in. You can also type in a standard note name and it will take that as a base frequency. To specify sharps, you can use '#' or 's', and to specify flats, you can use 'b' or 'f', for example: bb (B flat), c# (C sharp), Df (D flat), Fs (F sharp). These names are not case sensitive.

These "named note frequencies" are set in octave "3" (based on A3 = 220.0 Hz) by default, for example, typing an "E" is the same as "E3". For other octaves (0 through 4), you can type the octave as part of the name, for example, Bb2, C4, Ds1, fs0.

You can quickly fine tune the base frequency using the base frequency slider that pops up when you tap the setting:

C#2
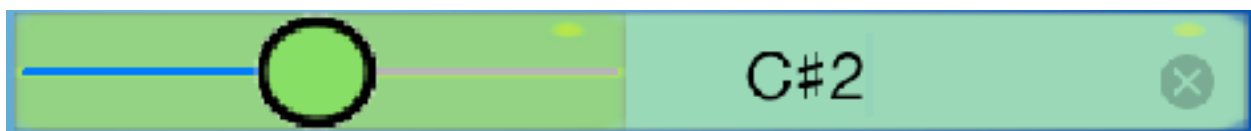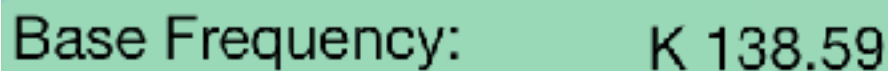
Its range is - 50 cents to + 50 cents. There's a little dead zone in the middle to help you get back to the original setting. This is particularly useful if you want to use Droneo with live instruments that cannot be fine tuned.

 Low frequency sounds may be hard to hear through the built-in speaker, so try using higher frequencies, larger intervals in the interval sets, richer timbres, or plug it into a sound system!

One more feature of the Base Frequency is the ability to use existing bases rather than setting it directly. Here's how it works:

Base Frequency: K 138.59

Every time you specify a frequency explicitly, with a name or Hertz value, it's also stored in a constant called the **Kept Frequency**, or "K". It's like the memory in a simple calculator. You can refer to **K** as a base frequency instead of a specific one. For example, if you set one voice to run at G2, a voice set to "K" which is chosen right after it will also run at G2. This will be displayed as "K [effective frequency], e.g. `K 196.00`

If you move the slider to fine tune it, it stops being relative and becomes an explicit tuning. You can also transpose the kept frequency up or down by octaves by saying "K+n" or "K-n" where n is 0 to 9 octaves. Thus, you can have some very high or very low intervals all in the same voice bank and transform them near each other for the proper timbral effect. When using a "Kept Frequency", it's displayed as "K+/- octave [effective

frequency]" as its name, e.g. `K+2 440` or `K-4 13.75` Kept base frequencies are saved in Droneo Voices just like any other base frequency.

Volume

The **Volume** slider sets the master volume for Droneo's synthesizer. You can also use the buttons on the side of the device, but they don't work if you are docking it and using the mini phone jack on the dock. There's an useful, if obscure, side effect of setting the volume to 0 : it also resets the phases of all the reeds to 0. This is normally not a concern, but if you are doing a trick with an ultra-low base frequency and some insect timbres, this will get them all to start at the same time. It will also reset the pattern pointer for pattern and counting based timbres.

Preset Voice Banks

Here is a description of the banks of Droneo voices that come pre-installed. Al of these voices are also available from the Voice Button list thing …

Last Voices:	The bank that was saved the last time you left Droneo. This bank is always loaded when you start Droneo, and when you come back after a phone call. You can save these voice bank under another name if you like them enough.
1 - 6	(whatever was there)

Blank	Completely blank - ready for your experiments!
1 - 6	blank

Consorts	Consort Voice Examples
Voices	All the vocal timbres
Sines	All the Sines
Analog	All the Analogs

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Consorts	Consort Voice Examples
Org-Voc	Organs and Vocals
Anasect	Analog and Insects. the insects are set to much lower intervals than the organs, so they will "chirp".
Lowly	Vocal consort, pitched very low, like Insects.

Droneo	The default Droneo voices
Just	The Just intervals are are chosen to give a wide spread of harmonious tones
Major	This is a Major Scale in 12 tone equal temperament.
Harm	The Harmonic intervals are to help build chords that fuse into timbres.
Minor	This is a Minor Scale in 12 tone equal temperament.
Cust1	a blank place for a custom Droneo voice
Cust2	another blank place for a custom Droneo voice

Evolving	A bank of Evolving drones.
Unison	Randomly perturbed unison and fifths, which ripple with evolving amplitude changes.
Harm-E3	Harmonics 1-8, with extra harmonics added by the Evolving 3 timbre, amplitudes biased toward the 4th harmonic.
E6-H/8	Undertone harmonics in a medium range get compensated with overtone harmonics from the Evolving 6 timbre
Mir-Duo	Sine 9 (a shimmery sine) churned through the Evolving Mirror 3 with only two reeds, making a kind of duet.
Em3-I	Justly tuned "I" vocal timbre in a low register is churned through Evolving Mirror 3.
Em2-U	Em2 U: A major scale, with "U" vocal timbre and Evolving timbre 2.

Features 1.3	Interesting demos of 1.3 features
Voices	All the vocal timbres

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Features 1.3	Interesting demos of 1.3 features
Sines	All the Sines
oec	Organ 3, churning with Evolving Chant 4
oec 2	Organs and evolving chant consort.
int	Counting Mirror 1 with organ 3
cnti	Counting Mirror 2 with insect 3
ec3&4	Evolving Chant 3 and Evolving Chant 4
cnt vo	Counting Mirror with A voices

Consorts	Consort Voice Examples
Voices	All the vocal timbres
Sines	All the Sines
Analog	All the Analogs
Org-Voc	Organs and Vocals
Anasect	Analog and Insects. the insects are set to much lower intervals than the organs, so they will "chirp".
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Features 1.5	Interesting demos of 1.5 features
Rand 4	Pattern 4 (very very fast) with random 8-16 harmonics
VoVa	Voices O and A, Custom Consort
c phase	Custom pattern: slow phase, nice scale
K + CC	Constant Hz with /k , insects, and custom consort
Morse	Custom random patterns, and a pair of synched beeps
323 long	Long form, 323 phase, Custom Pattern

McAnalog	Evolving Mirror Voices
McAnalog	Evolving Mirror 2 and Analog Consort
McAn2	Evolving Mirror 3 and Analog Consort
1/1 9/8	Two intervals evolving
e6 1/1	Evolving 6 on near unison and octave higher
ah-oh	Churning Chants
em4ico	Evolving Mirror 4 and Insect Consort

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Lost Chords	"Lost Chords" are very slow phases
Lost 1	A220, 0.01 cents
Lost 2	A220, 0.05 cents buzzy
Lost 3	4/3 1/1 3/2 lost phasing
Lost 4	nice lost chord
Lost 5	four by four
Lost 6	I just 7, I.01 just 7

Voice Buttons

These are a series of buttons that choose pre-set Droneo voices.
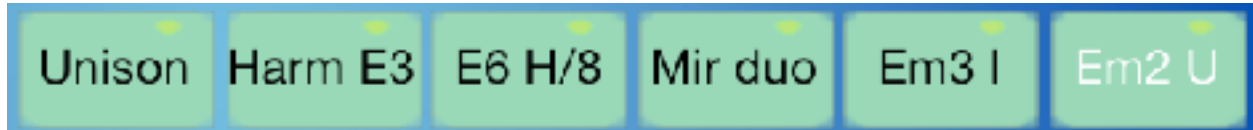
This comprises the settings for base frequency, volume, randomness, churn, chorus, timbres, reed volumes and intervals.

You can chose a Droneo voice by clicking on its name.

By **triple clicking or pressing for 1 second** on a Droneo voice name, and a new page appears with some controls on it. Triple click is used to avoid accidents!
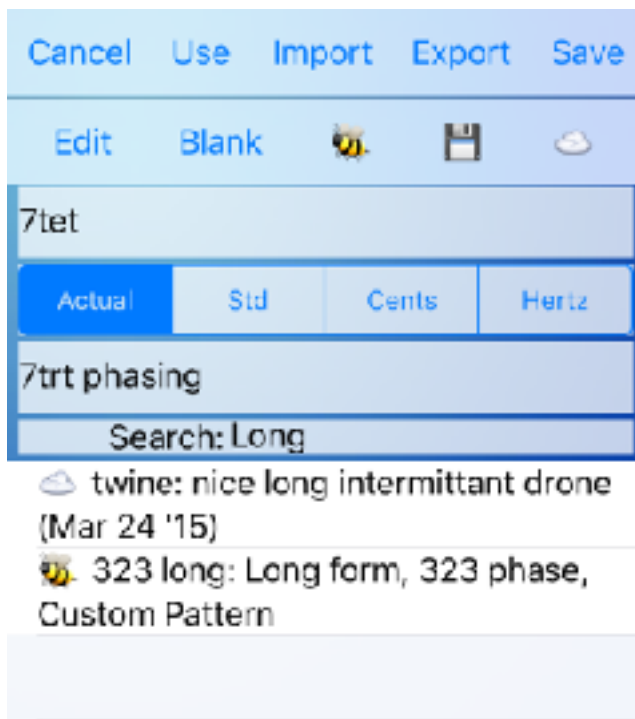
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The two toolbars have the following features:

CANCEL: reverts to the voice previously in use

USE: use this voice

IMPORT: import a voice from the clip board

EXPORT: export a voice to the clipboard

SAVE: save this voice in the Document Library

The lower bar refers to the list of Droneo Voices shown below:

EDIT: lets you delete Voices in the Document Library

BLANK: pick a blank voice

 jump to Voices that come with the app

 jump to voices that are in the Document Library

 jump to voices that come from the online Droneo Voices Library (See it at `http://www.jhhl.net/iPhone/Droneo/Voices/`)

SEARCH: You can search the list by typing into the search area! It ignores upper case, and search names and descriptions.

Search: search string Today Hours Recent
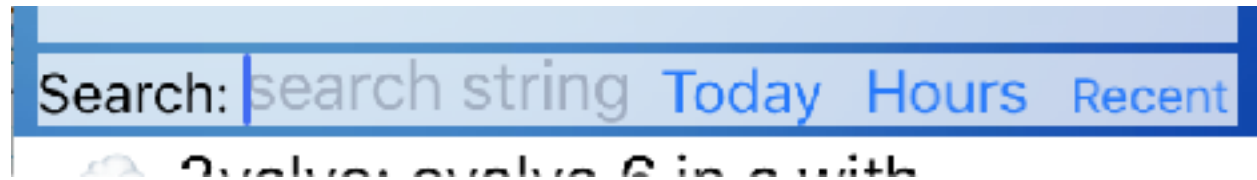
You can also search for "**today**", and it will match voices made since 00:00AM today, "**hours:NN**", e.g. "**hours:4**", will match voices made within the last NN hours, and "**recent:NN**" will show the last NN files you saved in the Document Library, most recent first. There are handy little shortcut buttons which appear next to the search string box.

The buttons to the left of the **Search** label just fill the search field with these reserved words so you do't have to type them. Using **hours**: with no hour specified means 24 hours, using **recent**: with no number implies the most recent 10.

You can rename it, describe it, specify how the intervals are displayed in the interface, and also export and import the Droneo Voice.

A list with Droneo Voices is presented below these bars, and you can try a voice out by selecting it.

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How the interval is displayed can be changed so you can get some information that is otherwise hard to calculate.

The four interval display choices are;

- **Actual**: the interval as it is actually described, that is, as a just intonation ratio, cents value, or equal temperament setting, possibly showing a more meaningful label instead of that internal specification. Example:

      1/1 Root
  will show as "Root".
  Patterns, used with pattern voices, are really a specially interpreted label.

- **Std**: the reed frequency as interpreted as a standard 12ET western name, with a possible cents offset. Example:
  With base frequency of "C", **3/2** will be displayed as "G3 +1.96¢". If the octave is below "0", it displays "<", and if the octave is above "9", it displays ">".

- **Cents**: the reed interval in cents, Example: **7:13** (The seventh degree of 13-equal temperament) will be displayed as "646.15¢"

- **Hertz**: the reed frequency in Hertz. Example: With base frequency of "C", **1/1 Root** will be displayed as "261.63 Hz"

Droneo Voice Loading:
You can directly load individual voices as well! A big table view

with a few dozen voices in it is underneath the Interval Choice bar.
 These voices come from 3 places:

- Voices in the default voice banks.

- Voices from the online Droneo Voices Library.

- Voices that you have saved.

  I don't make it easy to save your exported voice in the internet library because I don't want to have to weed out any voices, and furthermore, even if you do save a voice in there, I reserve the right to delete it and make it available in this special downloadable list.

Import and Export

Droneo can load and save voices in an easy to read format. It does this via the Export and Import buttons, and it also imports Droneo Voices it knows about via the Droneo Voice Picker. Voices selected from the picker load immediately. They come from Droneo's own internal collection, the cloud, and the documents directory.

Export will put a human-legible specification of this Droneo Voice on the clipboard. From there it can be emailed out, pasted in a text app, blogged, otherwise shared, or modified with an editor. Export also saves the current Droneo Voice to Droneo's Documents directory, and you can use iTunes to transfer the voice out to other programs that way, and also, it's now available in the Droneo Voice picker.

Import imports one of these exported Droneo voices. You may also want to generate voices programatically. The import, if successful, takes effect immediately when you load it, and you can revert to the old patch by touching "Cancel" or keep it by touching "Save".

Furthermore, Droneo responds to the "droneo://" web scheme, so you can keep a set of Droneo voices on a website, point to them like this:

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```
<a href="droneo://path-to-droneo-voice">Hear them in
Droneo!<a/>
```

When that link is clicked, Droneo will launch and load with that Droneo Voice.

See this in action at
  http://www.jhhl.net/iPhone/Droneo/Voices/
where I've put a lot of saved Droneo voices.

Another way you can save voices is as a preset in Audiobus! Audiobus can save the whole setup that you have built so you can save the Droneo Voice, and whatever custom tweaking you may have put in subsequent effects!

The format is pretty easy to understand. It's basically

```
Keyword:value ;
```

Imports that Droneo can't read will be noted in a popup. The reed names are in angle brackets because they can be pretty complicated strings with spaces in them. Don't forget that the base frequency is a string also! Any of the base frequency name variants should work. The Export files are in UTF-8 format.

Import keys are not case sensitive. The "values" will accept non-superscript version of the Sine timbres, for example: "Sine11" is treated as "Sine^{11}". It will also match the "short name" of the timbres, (like "s11") which is even better.

The reason it says "droneoahet" at the top is so you can use a search engine to find Droneo voices easily with a search on the Internet!

The format of an exported voice looks like this:

```
Droneo FV1.1 droneoahet;
version: 1107;
name: E6 H/8;
desc: Droneo: undertone harmonics with evolving timbre
6;
created: 2016-07-17 02:13:11 AM;
baseFreq: A;
volume: 0.99999;
timbre1: Evolving 6;
timbre2: Sine;
```

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```
chorusFreq: 30.27132;
churnFreq: off;
pulse: 1;
isRandom: NO;
nameStyle: Actual;
modulationState: Chorus;
reed0: <8/8>,0.1,0.8233517;
reed1: <7/8>,0.2,0.8233517;
reed2: <6/8>,0.33,0.8233517;
reed3: <5/8>,0.45,0.8233517;
reed4: <4/8>,0.6,0.8233517;
reed5: <3/8>,0.8,0.8233517;
reed6: <2/8>,0.9,0.8233517;
reed7: <1/8>,0.99,0.8233517;
process: Droning;
processBlendRate: 0;
```

The semicolons delimit the settings, so it can be wrapped and still correctly interpreted. The order of settings is not important, and you can leave some out if you intend to make them by hand, the missing settings being provided with benign defaults. Settings are truncated to their normal limits. You can comment out a line by putting a "#" in front of it.

This is a good way to make up some really, really complicated patterns that are too confusing to use the usual UI for!

Note: `pulse`, `process` and `processBlendRate` are currently not being used.

Randomize

The **Rand** button, adds a random amount of detuning to each reed. This can be used on any Drone voice. This detuning is in the range of an "eighth tone" (25 cents) sharp or flat from the original interval. This is reflected in the interval's label as, for example "+12¢". Repeatedly tapping the Drone voice's button will make new detunings from that voice. Tap the Rand button again to turn off this feature.

When saving a Droneo voice that has the random feature on, the fact of "randomness" is saved, but not the actual random interval offsets.

Modulations

The **modulation slider** controls the speed of sound modulation changes. These can add a lot of life to the sound of the drone. By tapping the name of the modulation (Chorus or Churn), it chooses the type of modulation you wish to set.

-

  Chorus is a modulator that slowly detunes the left and right channels from each other (they are also slightly mixed) to provide some "motion" in the sound. The speed of the chorus runs from 1 to nearly 60 seconds. Setting the modulation slider to its maximum value will turn the chorus off. To use the slowest speed, nudge it a bit to the left from the maximum value. Reeds set with a rich timbre or in a complex chord will reveal more "motion".

-

  Churn: When you move the modulation slider in "Churn" mode to the left, the churn feature is turned on and a new timbre setting and a second set of eight volume sliders appears. Churn is a modulator that slowly interpolates the timbres and settings of volume sliders to the other set and back again. The speed of the churn runs from 1 to nearly 60 seconds. Setting the modulation slider to its maximum value will turn

the churn off. To use the slowest speed, nudge it a bit to the left from the maximum value. When it's turned off, only the left set

of sliders is used as the volume sliders. A **triple touch** on the volume sliders works the same on the two columns of sliders: they all will follow the slider you move. A **double touch** on a volume slider will let you set both left and right volume sliders simultaneously for a particular interval.

Timbres

The **Timbre** button lets you select the reed timbres. Tapping the timbre's name brings up the timbre picker:

The left side is a category index to make finding a timbre easier.

It sets the right side to the first timbre in its category class. As you scroll through the timbres, the timbre playing will immediately adjust to the currently selected timbre. You can continue to use it by tapping "Use" or go back to the previous one with "Cancel".

There are a large of timbres to choose from, each with differing qualities.

Sines:

These wave forms are made by raising a sine to successive odd powers, each time adding more harmonics.

Name	Short Name	Description
Sine	s	a simple sine wave, no harmonics at all.
Sine^3	s3	you can hear a fifth
Sine^5	s5	you can hear a third
Sine^7	s7	you can hear a seventh
Sine^9	s9	you can hear a ninth
Sine^{11}	s11	it goes to eleven

Organs:

These waveforms have a few higher harmonics, like an old electronic organ with a few draw bars pulled out.

Name	Short Name	Description
Organ 1	o1	harmonics 1,2
Organ 2	o2	harmonics 1,2,3,4,5
Organ 3	o3	harmonics 1,2,3,4,5,6,7,8
Harmonium 1	h1	similar to the spectrum of a harmonium reed
Harmonium 2	h2	also similar to a real harmonium, good with low pitches!
Buzzy Organ	buzz	very buzzy. mostly odd with some light even harmonics. Very much like a sawtooth wave.

Analog:

These waveforms are similar to those found in analog synthesizers.

Name	Short Name	Description
Triangle	t	Triangle, peak at 1/2 cycle
Triangle 1/4	t4	Triangle, puts peak at 1/4 cycle
Triangle 1/8	t8	Triangle, puts peak at 1/8 cycle
Square	sq	Square wave
Square 1/4	sq4	Square wave, 1/4 duty cycle
Square 1/8	sq8	Square Wave, 1.8 duty cycle

Voices:

These human-like voices are constructed by summing harmonics, which are scaled to the harmonic shape (formants) of the intended vowel, based on the pitches of the reeds. As a side effect, each of the waveforms used by the reeds differs, so each reed may sound quite different in a related way. It calculates these waves when you choose them, and depending on the reed's frequency, it uses either bass, tenor, alto , or soprano data in creating the voice waveform, which is why there may be a little pause before playing them.

Voices benefit from low base frequencies - near that of real human voices - and a little randomness.

Name	Short Name	Description
A Voices	va	"karma"
U Voices	vu	"tuning"
O Voices	vo	"drone"
E Voices	ve	"best"
I Voices	vi	"bees"

Insects:

Designed for very low frequencies, they are a short, enveloped "chirp". Setting the base frequency to 1 Hz is a good start for experimenting with these, and I often go a lot lower. At higher frequencies, they distort quite badly, which you may also like! There's an useful, if obscure, side effect of setting the volume to 0 : it also resets the phases of all the reeds to 0. This is normally not a concern, but if you are doing a trick with an ultra-low base frequency and some insect timbres, this will get them all to start at the same time.

Name	Short Name	Description
Insect 1	i1	Insect 1
Insect 2	i2	An octave higher than insect 1
Insect 3	i3	An octave higher than insect 2
Insect 4	i4	An octave higher than insect 3

Evolvers:

These timbres all blend randomly chosen harmonics into the existing waveform for each reed. Each timbre has different criteria for how many harmonics they add, how often they change, and how rapidly they blend into the existing voices.

The new harmonics are sometimes scaled in volume so the resulting timbre is not so high in high frequencies. Each reed has its own separately evolving voice, so they can blend in and out with each other.

Name	Short Name	Description
Evolving 1	e1	merely fades a sine wave timbre in and out randomly (but slowly)
Evolving 2	e2	randomly adds none, 1, 2nd or 3rd harmonics.
Evolving 3	e3	randomly adds up to the 8th harmonic.
Evolving 4	e4	randomly adds up to the 12th harmonic, more slowly.
Evolving 5	e5	randomly adds up to the 16th harmonic, more slowly.
Evolving 6	e6	randomly adds up to the 16th harmonic, more quickly

Using the evolving timbres with chorus, churning and carefully (or carelessly) designed interval sets makes for a richly evolving palette of droning!

Evolving Mirrors:

Like the evolving timbres, Evolving Mirrors change with time, but take their timbre waveforms from the "other" churn voice instead of a sine wave! The "right side timbre" can be hidden (that is, **churn** can be turned off, and usually is) and still be used as harmonic material by the left side's evolving mirror. You can make both voices mirror each other, but after a while, the sound fades out, so it's not much fun. In fact, I discourage using any "Mirrors" or"Evolvers" on the "right" side of the churn.

Name	Short Name	Description
Evolving Mirror 1	em1	fades the opposing timbre in and out randomly (but slowly)
Evolving Mirror 2	em2	uses the opposing timbre to build random harmonics, from the 6th to the 12th harmonic. So set the base frequency low!
Evolving Mirror 3	em3	uses the opposing timbre to build random harmonics, up to the 10th harmonic, but the harmonics are not scaled so there is more definition in the individual tones
Evolving Mirror 4	em4	uses the opposing timbre to build random harmonics, up to the 8th harmonic, slowly choosing a new harmonic, but adding it quickly

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Name	Short Name	Description
Evolving Mirror 5	em5	uses the opposing timbre to build random harmonics, up to the16th harmonic, very slowly choosing a new harmonic, and slowly adding it
Evolving Mirror 6	em6	uses the opposing timbre to build random harmonics, up to the16th harmonic, quickly choosing a new harmonic, and slowly adding it.

These voices recalculate at a control rate that sometimes is audible as a slight ticking, mostly with purer drones.

Counting mirrors:

These timbres play the 8 reeds in various orders at various speeds, a process related to counting. All the counters are mirrors to make them flexible. You can reset the count by setting the volume to 0 (and then back). If you are running via Audiobus, there's a button you can push that looks like a rewind symbol that also resets the counter.

Name	Short Name	Description

Counting Mirror 1	cm1	This voice counts in a binary fashion, where reed 7 is the lowest order bit and 0 the highest. So this sequence starts:
		
		`0000000 nothing 0000001 reed 7`
		`0000010 reed 6`
		`0000011 reed 6 and reed 7`
		`0000100 reed 5`
		`0000101 reed 5 and reed 7`
		`0000110 reed 5 and reed 6`
		`0000111 reed 5, 6 and 7`

Counting Mirror 2	cm2	Binary in pairs, so each bit controls two reeds.
		
		`0000 nothing`
		`0001 reeds 6 and 7`
		`0010 reeds 4 and 5`
		`0011 reeds 4,5,6,7`
		`0100 reeds 2 and 3`
		`etc`

Name	Short Name	Description
Counting Mirror 3	cm3	Binary alternating pairs. In this case, a '0' means the first of the pair, a '1' means the second.
Counting Mirror 4	cm4	It plays each reed in turn, which makes a simple sequencer.

Counting Mirror 5	cm5	It plays like Counting Mirror #1, but using Gray code instead of binary counting. Gray code is a way of counting such that only one bit changes at a time as you advance (or decrease). It begins:
		`0000 0001 0011 0010`
		`0110 0111 0101 0100`
		`1100 1101 1111 1110`
		`1010 1011 1001 1000`
		I sometimes refer to Gray code as "counting fractally."

Here's an example where the intervals alternate between a major triad and a fifth above it, but not all at once.
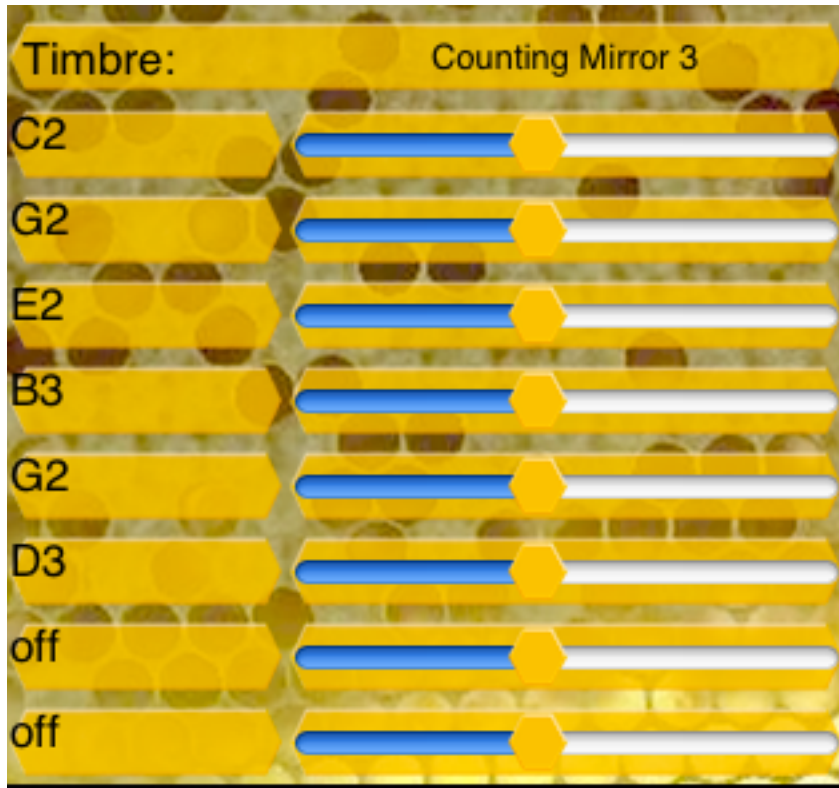
Patterns:

Here is where Droneo starts to get a bit off the beaten track and walks into the woods. Patterns are a way to do something like sequencing, but only by adding harmonics to a reed. Here is where timbre, melody, and harmony all merge together.

A Pattern Mirror timbre counts off and advances character by character through the label of the reed, which is decoded into which harmonic it should add next.
There are now 64 harmonics to choose from! This means you can set up some just diatonic scales with these harmonics, and of course, lots of non conventional harmonic scales.   For reference, the "diatonic when divided by 24" harmonics are marked in red!
 The harmonics are specified by these characters:

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							

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	l: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					

The label of an interval is set to a pattern made out of these characters. For example,

```
1/4  4568965
```

will play `1/1, 5/4, 3/2, 2/1, 9/4, 3/2, 5/4` because the reed itself is set to play `1/4` and it plays with harmonics `4, 5, 6, 8, and 9.`

Each reed will repeat its own pattern, so it's very easy to make polyrhythms. In fact, you could make any of the patterns that the counting mirror timbres make, if you felt like typing in a string that long. You could also use an editor or script to make your patterns as part of an importable voice and paste it in.

You can also put a "?" as the first character of a pattern and it will randomly pick from among the harmonics you specified. By repeating harmonic letters, you can alter the chance that a harmonic will be chosen, and '0' is also a choice, so the reed can fade in and out randomly as well.

Pattern timbres are always mirrors. Because these harmonics go up so high, it makes sense to "mirror" simpler timbres, but don't let that inhibit you! You can also start with a low base frequency and play with harmonics 16-32 to find new sonic material.

There are five pattern timbres available:

Name	Short Name	Description
Pattern Mirror 1	p1	A slowly changing pattern counter.
Pattern Mirror 2	p2	A quickly changing pattern counter.
Pattern Mirror 3	p3	A very quickly changing pattern counter.
Pattern Mirror 4	p4	A very, VERY quickly changing pattern counter.

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Name	Short Name	Description
Custom Pattern	cp	See below for details !

This make for some VERY INTERESTING melody experiments. It's analogous to putting a series of harmonic frets on an open string, or blowing overtones in a long tube.

For example

You can make a familiar major scale out of harmonics on three reeds, with intervals related by perfect fifths:	`4/3  00040500`
	`1/1  40506008`
	`3/2  03000050`
	Now you can swap over to the Tone Spiral and move those perfect fifths around.

This makes a just major ninth and repeats the harmonics at different speeds, phasing and hocketing.	`1/1  10`
	`5/4  100`
	`3/2  1000`
	`7/4  10000`
	`9/8  100000`

This voice, mirroring Insect 2 at a base frequency of 1Hz, makes a nice polyrhythm.	`1/1  4` `1/1  10203`
Randomly chooses a harmonic, 1-4, and sometimes goes silent.	`1/1  ?111122223344000`

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This is just the tiniest step into the explorations you can do with patterns.

I usually rough out a voice using pattern mirror 2 or 3, and later swap to pattern mirror 1 when I have more patience.
You can reset the pattern position by setting the volume to 0 (and then back). The counter can also be reset in the Audiobus environment by tapping the "rewind" button.

Custom Patterns:
The Custom Pattern takes a somewhat more elaborate string that gives you a handle into making your own pattern playing behaviors.

The way to code it is like this:

```
interval  timbre, time between changes, time to fade in, pattern
```

for example:

```
1/4 s11,50,10,456789a
```

For this to work, the "mirrored timbre" is automatically set to "Custom Consort 1," which lets every reed have its own timbre. The timing is based on Droneo's control rate, which is 4096/44100 or about 0.092879 seconds. "10.76" or 11 is pretty close to one second. In BPM, 1 unit is about 646.00, or 8 of them is about 80.750.

Because all these parameters are under your control, you can do some amazing compositions! By making the time to fade in longer than the time between changes, you can get a dreamy mix of changing harmonics. By making the timing numbers large, you can set up compositions that take hours – or days! And you can also put a lot of subtlety into the pattern itself, using doubled or tripled codes, and '0' to add a little articulation. You can also randomize as with other patterns by prefixing it with a '?'.

I find I like to make up a custom pattern got one reed, copy it, and paste it into other reeds - then adjust them from there.

Evolving Chants:

These are like the Evolving voices, but they randomly choose a vocal timbre as part of their "evolution". They never add higher harmonics, the choices are silence or one of the vocal timbres. They don't work well with Evolving Mirrors though.

Name	Short Name	Description
Evolving Chant 1	ec1	Quickly changing chanting.
Evolving Chant 2	ec2	Slowly changing chanting.
Evolving Chant 3	ec3	More quickly evolving chant.
Evolving Chant 4	ec4	Very quickly evolving chant.

These voices recalculate at a control rate that sometimes is audible as a slight ticking, mostly with purer timbres.

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Consorts:

Consorts are small ensembles of different timbres, associated with specific reeds.

Name	Short Name	1	2	3	4	5	6	7	8
Sine	**cs**	Sine	Sine	Sine^3	Sine^3	Sine^5	Sine^7	Sine^9	Sine^{11}
Organ	**co**	Organ1	Organ1	Organ2	Organ2	Organ3	Harm1	Harm2	Buzzy
Analog	**ca**	Sine	Sine3	Triangle	Triangle 1/4	Triangle 1/8	Square	Square 1/4	Square 1/8
Voices	**cv**	A	A	U	U	O	O	E	I
Insect	**ci**	Insect 1	Insect 1	Insect 2	Insect 2	Insect 3	Insect 3	Insect 4	Insect 4
Organ & Vocal	**cos**	Organ 1	Organ 2	Harm 1	A	U	O	E	I
Analog & Insect	**cai**	Sine	Sine^3	Triangle	Square	Insect 1	Insect 2	Insect3	Insect 4
Organ & E-Chant	**coe**	Organ 1	Organ 2	Harm 1	Evolving Chant 1	Evolving Chant 2	Evolving Chant 3	Evolving Chant 4	Evolving Chant 4
Custom Consort 1	**cc1**	uses label	uses label	uses label	uses label	uses label	uses label	uses label	uses label
Custom Consort 2	**cc2**	uses label	uses label	uses label	uses label	uses label	uses label	uses label	uses label

Consorts are especially useful when working with pattern mirror timbres. The Custom consorts decode the reed's label to set the timbre, and for churning, you can put two labels separated by a comma:

```
1/1 s11,t8
```

Volume Sliders

8/8
7/8
6/8
5/8
4/8
3/8
2/8
1/8
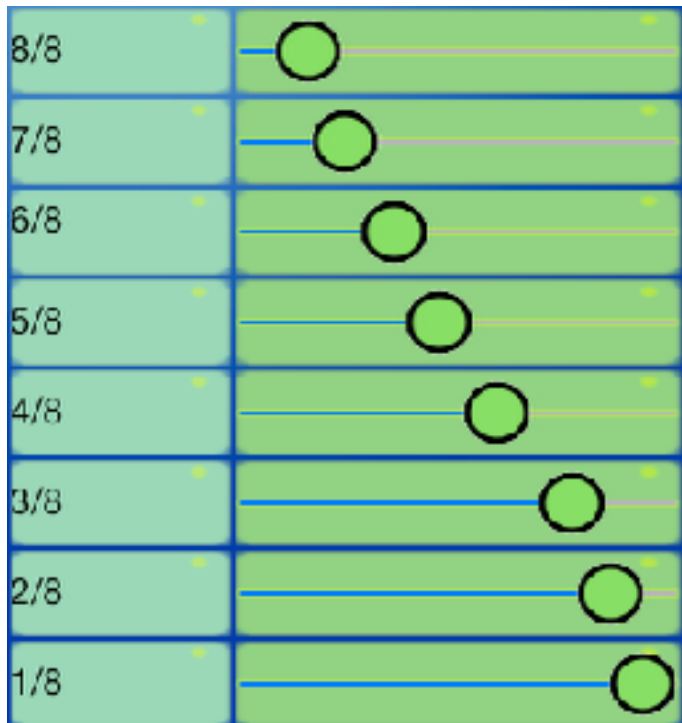
Each reed's **volume** can be individually set, to create a precise mix of intervals and harmonics. Here is where you can have a lot of fun exploring chord voicings and harmonic textures. You don't have to slide these (or any Droneo) sliders, just tap them where you want them to be set. The lowest and highest values have special icons to help you out. If you want to set all the volumes to the same value quickly, triple tap a slider which is set to that value. Since this also works for the "zero" level, it's a fast way to zero out the sound.

Just intonation interval sets, such as "Harm" and "Just" found in the "Droneo" voice bank, are well suited to making chords which fuse into timbres. There are a great many philosophies about which intervals should be used to derive scales, and how to use them to build harmonies, dissonances, melodies, and timbres, and I've only chosen to include some in the Droneo voice banks to get a taste of the possibilities of microtonal scales

and intervals in this context of drone accompaniment. To this end, all the Droneo voices' interval sets are customizable — Droneo lets you replace and rename all intervals in the Droneo Voices.

Interval Name

By tapping in the interval name area, you can specify the interval you wish by:

- typing in an interval ratio (e.g `3/2, 21/20, 81/256`). Just intonation systems use ratios of whole numbers to specify intervals. You can get lazy a little; `5/` is equivalent to `5/1`.

- typing in a number indicating the number of cents (e.g. `110, 133.33, 701.9`). A cent is an interval of 1/100th of a semitone. Thus, there are 1200 cents in an octave. Cents are commonly used for comparing intervals in different scales.

- typing in a degree, a colon (:), and a division of an equally divided octave (e.g. `5:19` is the 5th degree of 19 tone equal temperament, which is pretty close to a 6/5!). These degrees are numbered from 0!
  Normally, a degree is based on dividing an octave (or 2/1) into equal parts. Droneo lets you divide any interval into equal parts by putting an at sign (@) after the equally tempered interval string followed by another interval specification. For example, the 4th degree of a 4/3 divided into 5 equal parts would be written `4:5@4/3`. There are derivative versions of this: `18:17@3` is the same as `18:17@3/1`.
  Instead of a ratio, you can also use just a cents value, but you have to prefix it with `&`, otherwise it'll think it's a harmonic! e.g. `15:23@&200`.
  Combining these with a prefix of double quote (`"`) will make

this offset relative to that of the previous reed. This way you can set up a "scale" of relative intervals. The first reed is assumed to have a 1/1 as its predecessor. However, manipulating these reeds with the Tone Spiral will turn them into absolute intervals, losing this relative feature.

Sometimes, you just want a constant frequency, no matter what the base frequency is. The usual trick is to take the frequency you want and divide it by the base frequency. That is, for 750 Hz, and a base frequency of 220, you make a ratio: `750/220`. But if you change the base frequency, that Hz value will be wrong. For this case, there's a notation, you can put a 'k' as the denominator and it will always replace it with the current base frequency. Thus, `750/k` will always be `750 Hz,` no matter what the base frequency is.

You can get pretty creative here. Since these numbers can even be "real" numbers, you can even make a "ratio" like 1.01/1 or "quarter-tones" in an equal temperament like 7.5:31. and they can of course be negative. I don't let any of these intervals resolve to a ratio larger than 256/1, that is, 256 times the base frequency. You can set it to really low ratios though, and choose a proper base frequency to get about the same effect.

An interval is calculated to a frequency that is the base frequency times that interval name, for example, with a base frequency of 110 Hz, 3/2 will become 165 Hz, 15/8 would be 206.25, etc. Cents are somewhat more complicated, but every hundred cents represents a 12 tone equally tempered halftone:

100 would be a minor second, 400 a major third, 750 a quarter tone higher than a perfect fifth. There are a lot of references you can find that translate historical, ethnic and experimental scale intervals into cents.

The formula for turning cents into a frequency, for those with a calculator, is

`frequency = base_frequency * 2`$^{(\text{cents/1200})}$

For the arbitrary divided equally tempered octave notation (**a:b**), the formula is a similar:

`frequency = base_frequency * 2`$^{(\text{degree/division})}$

and doing the same for divisions of an arbitrary interval:

`frequency = base_frequency * (interval)`$^{(\text{degree/division})}$

For more information on scale construction and historical intonations, you can get pretty deep into it if you pick up a copy

of Scala by Manuel Op de Coul.

You can give an interval a descriptive label by typing that label after the numeric specification of the interval, separated by a space. e.g.

```
3/2 Just perfect fifth.
81/80 syntonic comma.
```

You can keep the reed from sounding at all by typing "off" or "zero" or "?" as the interval name. This different from setting it

to "0", which means an interval of 0 cents (that is, the base frequency itself). You can then set the interval value by tapping **save** (which you hear immediately if the volume for that reed is up), and also you can both save and pick a new interval value to set by tapping the interval name of the next reed you want to work with.

You can see these intervals expressed in different ways by triple clicking the button with the Drone voice's name and using the segmented selector to change how the interval values are displayed. The internal setting is still what you typed in originally, though.

Notes and Tips

Please rate or write a review for Droneo!

As with other iPhone audio applications, if you are connecting the device to an amplifier, you may want to disable the phone function so you don't hear the occasional noise resulting from GSM synchronization.

Putting it in "Airplane Mode" will help a lot with that and battery usage! Similarly, shut off Bluetooth, push mail, location services, or anything else that might cause the phone to decide to do some non-droning work. This will make it more like an instrument.

If the phone is enabled, incoming calls will will cause Droneo to save its settings in a voice bank, fade out and let you have have a conversation. After the call, Droneo will relaunch using that saved voice bank. Sometimes I find the audio doesn't come back. In that case, stop and restart Droneo.

Headphones or earbuds are recommended for a good stereo effect. Make sure the volume is not too high - your ears - and the iPhone's earbuds and speakers - are delicate!
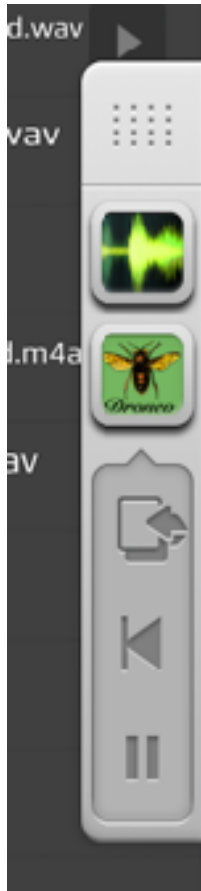
Droneo is very forgiving of strange requests like playing a vocal timbre way below its normal range (like 0.15 Hz). Try it!

Good effects to process on Droneo output are chorus and distortion effects. If Droneo is generating a lot of sporadic sounds, then reverbs and delays make more sense!

Audiobus / IAA support

Droneo can use Audiobus to send live streams of audio to other Audiobus compatible programs. Droneo has a few buttons added to help control it from Audiobus compatible programs:

The "Rewind" button resets the timer of the counting and pattern voices, and the "Pause" button stops the audio (or rather, swaps it to a silent audio to keep the app running in the background).

Droneo is also available as a generator for Inter App Audio (IAA) applications like Garage Band and AUM.

When Droneo is being hosted by another IAA app, its icon shows up in the top line over the current Droneo Voice Name. When you tap this icon, you are switched to that host app.
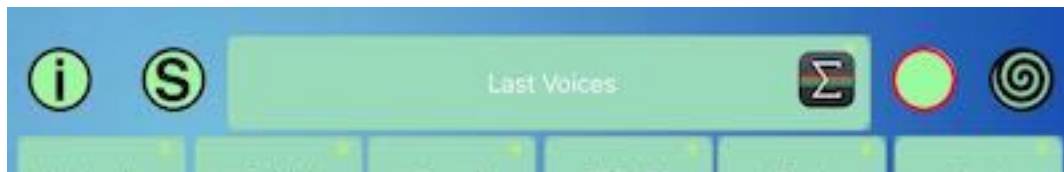
Droneo Website

More information can be found on the Droneo Web pages at:
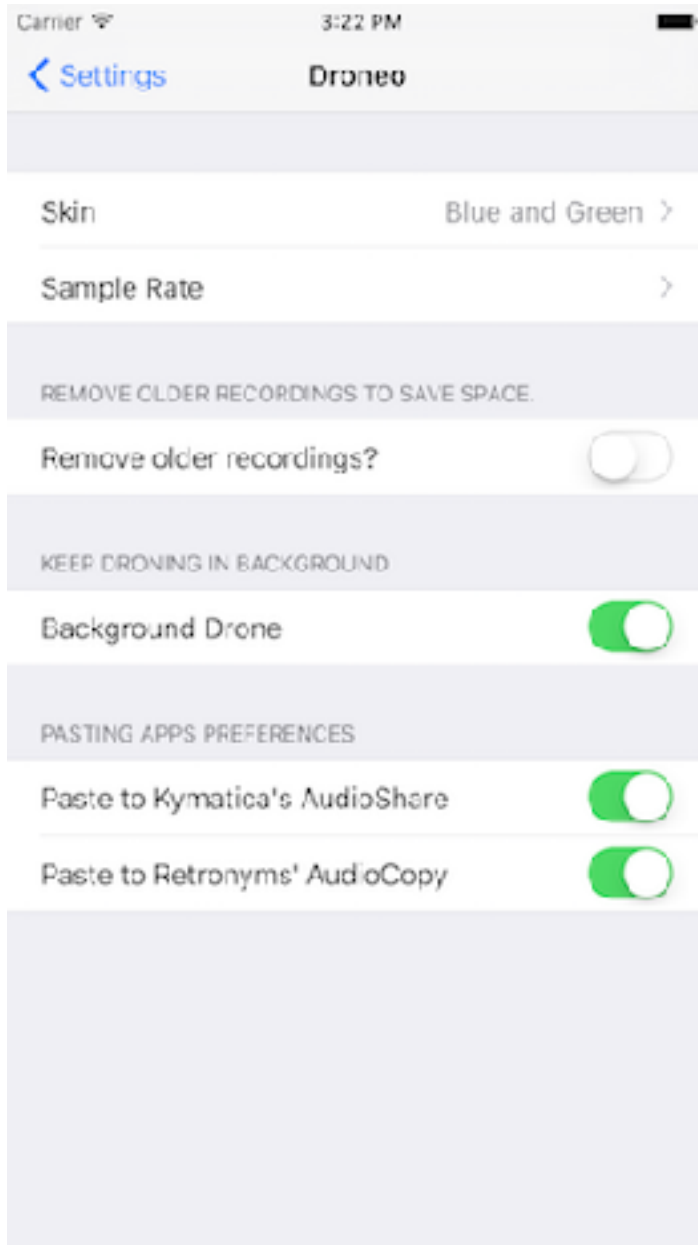
http://www.jhhl.net/iPhone/Droneo/. That website will carry the current, revised version of these instructions, as well as samples, tips and links.

You can also get and save Droneo voices from

http://www.jhhl.net/iPhone/Droneo/Voices

Settings App features

The **Settings App** can be used to set some infrequently changing characteristics of Droneo.

Droneo can change its "skin." The two choices are the original "Honeycomb" skin, or the "Blue and Green" skin. I may make more skins in the future.

You can also change the sample rate that the drone is running at. Droneo may play better with lower sample rates. You should set the sample rate to "High - 44100" if you use the audio cut and paste for maximum fidelity! A lower rate will also affect latency, but since this is a drone app, maybe that's not too important.

Droneo has the ability to record your drones. These recordings can be maintained via the iTunes Document interface. To make it a little easier, I've put in a new setting which erases all the old recordings before saving a new one. That way, not too much space is wasted with recordings you cannot maintain.

When Droneo finishes recording, it can also paste the recording into the pasteboard, and use the two popular music document management apps to save and distribute that recording. These apps are:

 AudioCopy, by Retronyms, and

AudioShare, by Kymatica (Jonatan Liljedahl)

If you don't have these apps - or don't want to paste to them, you can enable and disable that with the appropriate switches.

Droneo can play in the background - and often does! If you don't want that to happen (To save the battery somewhat), there's a

setting which lets you turn off the background sound. It's on by default, though.

Credits

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Drone picture from http://tvtropes.org/

The formant data for the vocal timbres is taken from CSound.
http://www.csounds.com

AudioCopy is available from Retronyms, Inc.:

http://retronyms.com/audiocopy/

AudioShare is available from Kymatica (Jonatan Liljedahl):

http://kymatica.com

Audiobus is from http://audiob.us

AUM is available from http://kymatica.com