



**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.

Droneo's audio can be saved as a file which you can export from the iTunes Documents interface, or send to another app via [Sonoma WireWorks' Audio Cut and Paste](#).

# Skins

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



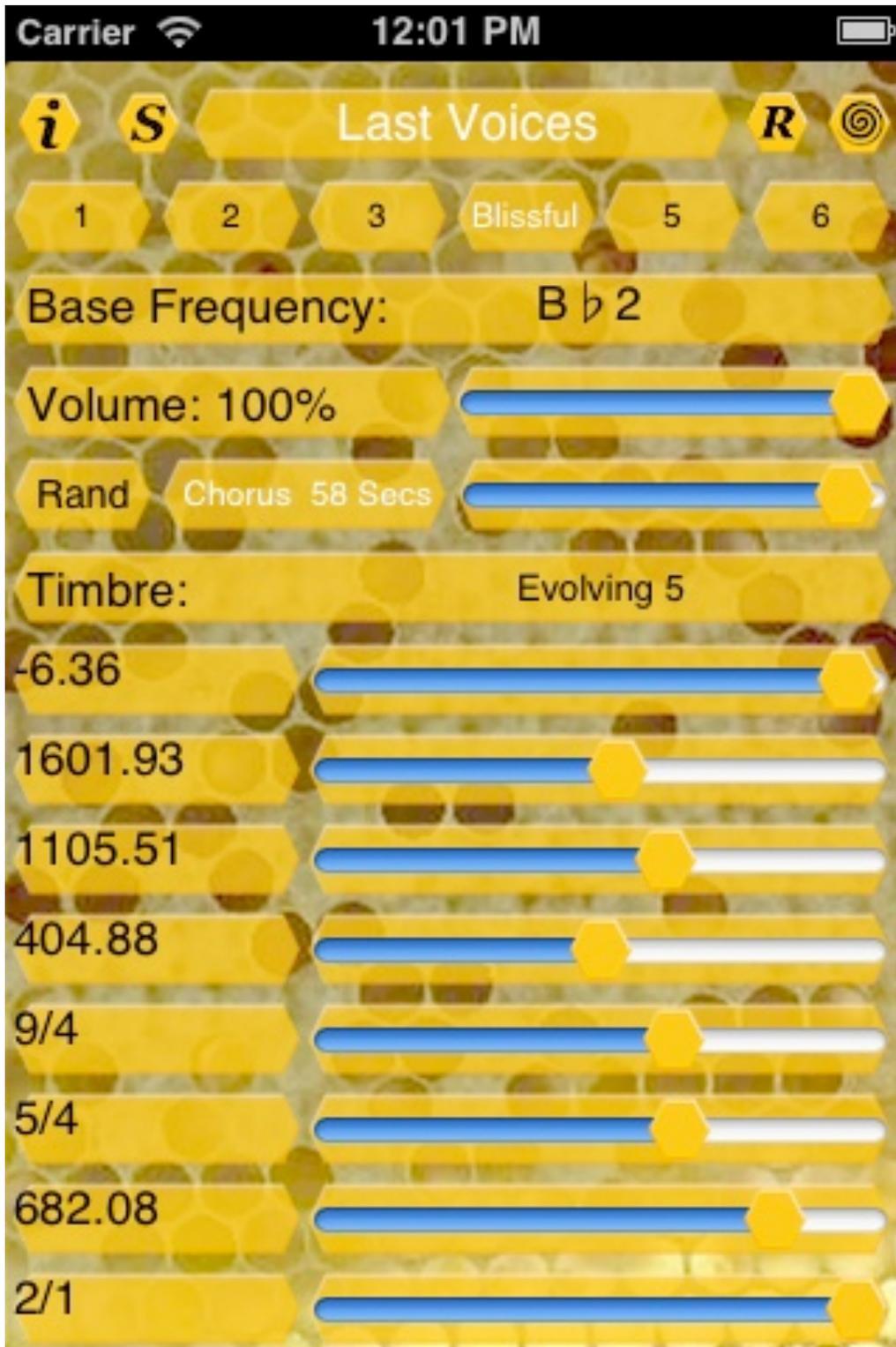
For most of the examples given here, you'll be seeing the Honeycomb skin.

# Concepts

A Droneo voice is made of these parts:

- Each voice is made of up to 8 "reeds".
- Each reed is set to an interval based on a single 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 intervals are added to the timbre randomly. 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, and play timed patterns of harmonics.
- A master volume control is used to set the volume of the entire sound.

# Main Screen



# Interface

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

	<b><u>Intervals</u></b> Sets the pitch interval of a reed in relation to the <b><u>base frequency</u></b> .
	<b><u>Volume Sliders</u></b> control the volume of each reed.

# Save Button



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

Droneo comes with a few [preset](#) voice banks to start with.

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.

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.

# Recording



You can now record your drone and either pick it up from the iTunes Document interface, or use Sonoma WireWorks' Audio Copy to transfer it to another program via the clipboard!

Touch the **Record button** to begin recording. When recording, the button turns red, and a little notices comes up to remind you that you are recording.

Touch the Record button again to stop recording. An automatically named recording will then be saved and put in 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.

There is a Setting you can set that erases all previous recording when you save so that you don't have a lot of recordings building up.

# 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!

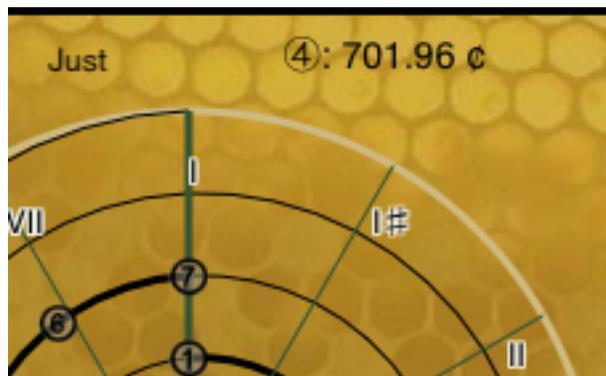


Touch this so that this set of intervals will be accepted and used in the Droneo voice, and the interface reverts to the Main screen.

The labels of each reed are changed to express the interval as cents, if it can't figure out a better name. You can go in and 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.



Touch this to revert 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 "snapping" the interval to one of the interval guides, the interval name as shown in the interface.

The value of each reed's interval is represented by a small circle with a number in it (a "tone spot"). The size of the tone spot is related to its current volume. The tone spot is placed on a black spiral which represents three octaves of interval values. The slider below the spiral sets the low end of the range in octaves, which can be from  $1/64$  (-7200 cents, down 6 octaves) to  $32/1$  (6000 cents, up five octaves). Intervals outside this range are clamped to the top or bottom circles, which are colored red if there's clamping going on.

Each loop of the spiral represents another octave, and tone spot 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.

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

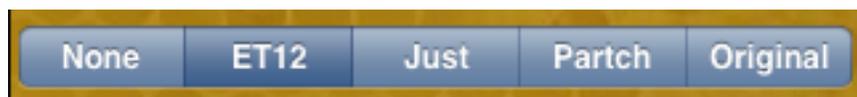
If more than one reed shares the same interval, the tone spot will pile up in a row at that interval.

You can set the interval you'd like for a reed by dragging its tone spot to a position on the spiral. You can show various [interval guides](#) for intervals, which can help you see where to place the tone spot to define an interval in relation to standard intervals.



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 move all intervals to the closest one 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.

# Interval Guides



These are interval guides that help you to see and specify intervals using the tone spiral.

- **None:** removes all guides.
- **ET12:** shows the familiar 12 tone equal temperament scale lines. Yes, they are equally spaced!
- **Just:** shows a nice selection of just intervals.
- **Partch:** shows the famed 43-tone just scale of Harry Partch's fixed tone instruments.
- **Original:** shows the scale as specified when you called up the tone spiral. The labels are set to the same labels as they are on the Main screen.

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

Note that if you are using the "Original" interval guide, and your original ratios were all "off", and you have "snap" on, it won't let you set anything!

# Base Frequency



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 "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:



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.

Low frequency sounds may be hard to hear through the built-in speaker (if you have one); 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 frequencies rather than setting it directly. Here's how it works:



Base Frequency: K 116.54

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.

# Preset Voice Banks

Here is a description of the banks of Droneo voices that come pre-installed:

[Last Voices](#)

[Blank](#)

[Consorts](#)

[Droneo](#)

[Evolving](#)

[Features 1.3](#)

[Insects](#)

[McAnalog 1.3](#)

[Potpourri](#)

[Voices](#)

**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.

**Blank:**

A completely empty bank

- **1:**
- **2:**
- **3:**

- **4:**
- **5:**
- **6:**

## **Consorts:**

### Consort Voice Examples.

This bank conveniently names all the members of the consort.

- **Voices:** All the voice timbres
- **Sines:** All the Sines
- **Analog:** The Analog Consorts
- **Org-Voc:** Organs and Voices
- **Anasect:** Analog and Insects. The insects are set to much lower frequencies than the organs, so they will "chirp".
- **Lowly:** Vocal consort, pitched very low, like insects.

## **Droneo:**

These are the default Droneo Voices.

- **Just:** The Just intervals 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:** These is a Minor Scale in 12 tone equal temperament.
- **Cust1:** a blank place for a custom Droneo voice
- **Cust2:** a blank place for another 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:** A major scale, with "U" vocal timbre and Evolving timbre 2.

## **Features 1.3:**

Fast Evolving chants, counting, organ with E chant consort

- **oec:** Organ 3, churning with evolving Chant 4.
- **oec 2:** Organ and evolving chant consort.
- **cnt:** 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 2 with A Voices.

## **Insects:**

A bank of chirping drones.

- **Bug1:** One insect, chirping once a second.
- **Bug Duo:** Two insects, chirping 3 against 2.
- **Hi & Lo:** Two differently pitched insects churning with each other, chirping 2 against 1.
- **Synched:** Eight insects, all chirping at integral multiples.
- **Random:** Eight insects chirping a little out of phase with each other.
- **Party:** A bug party, involving three evolving mirrored insects.

## **McAnalog1.3:**

Evolving Mirror voices

- **McAnlg:** 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.

**Potpourri:** A grab bag of drones.

- **Just EM:** Just scale with Evolving Mirror 2.
- **F/G:** FM7 / Gm7 Harmoniums
- **eight :** eight very slow nearly unison bugs in an evolving mirror get out of synch.

- **Square:** A square wave built out of Sine waves. Turn on the churn and change the other timbre to hear "square" versions of other timbres!
- **31 ET :** Some 31 Tone equal temperament tones to play with.
- **Brain:** Tones designed to produce a 10Hz difference tone. Adding randomness will muddy this somewhat.

**Voices:** A bank of Vocal-based drones

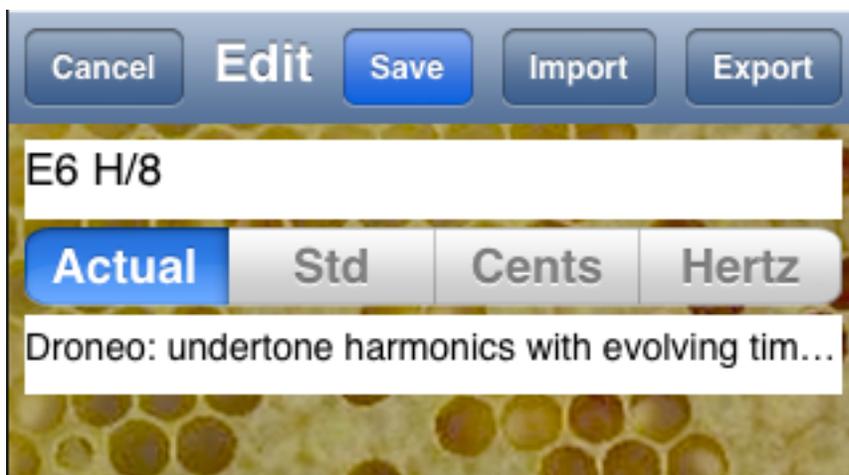
- **major:** A Major chord (D major) in standard 12-tone intonation, using "A"
- **major J:** A Major chord (D major) in just intonation, using "A"
- **A - U:** Churning A and U timbres
- **O - E:** Churning O and E voices in random unison.
- **I mirror:** Churning Evolving mirror and I timbres, using just intervals.
- **U low:** U timbre , random unison, low pitch.

# 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. [Here is a description of the banks of Droneo voices that come pre-installed.](#) You can chose a Droneo voice by clicking on its name.

By **triple clicking** on a Droneo voice name, you can rename it, describe it, specify how the intervals are displayed in the interface, and also [export and import](#) the Droneo Voice. Triple click is used to avoid accidents.



The four interval display choices are;

- **Actual:** the interval as it is actually described, that is, as a ratio, cents value or equal temperament setting, possibly showing a more meaningful label 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"

# Import and Export

**Export** will put a human-legible specification of this Droneo Voice on the clipboard. From there it can be emailed out, pasted in Notes, blogged, otherwise shared, or modified with an editor. You may also want to generate voices programatically.

**Import**, similarly, imports one of these exported Droneo voices. 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 as `<a href="droneo://path-to-patch">` and Droneo will launch and load with that Droneo Voice. Check this out at <http://www.jhhl.net/iPhone/Droneo/Voices/>.

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.

Importing is case sensitive, except in the case of "timbre1" and "timbre2" names, which accept non-superscript version of the Sine timbres, for example: "Sine11" is treated as "Sine<sup>11</sup>".

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 Web!

The format of an exported voice looks like this:

```
Droneo FV1.1 droneoahet;  
version: 1103;  
name: Unison;  
desc: Random Unison + perfect 5th;  
created: 2010-03-19 02:04:46 AM;  
baseFreq: K 164.81;  
volume: 0.7300385;  
timbre1: Evolving 1;  
timbre2: Organ 2;  
chorusFreq: 47.65116;  
churnFreq: 19.75194;  
isRandom: YES;  
nameStyle: Actual;  
modulationState: Churn;  
reed0: <1/1>,0.999,0.999;  
reed1: <1/1>,0.7914156,0.7914156;  
reed2: <1/1>,0.5968052,0.5968052;  
reed3: <1/1>,0.3762468,0.3762468;  
reed4: <3/2>,0.531935,0.531935;  
reed5: <3/2>,0.518961,0.518961;  
reed6: <3/2>,0.4021948,0.4021948;  
reed7: <3/2>,0.3113766,0.3113766;
```

With this format, 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.

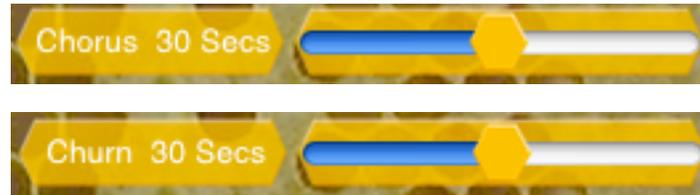
# Randomize



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



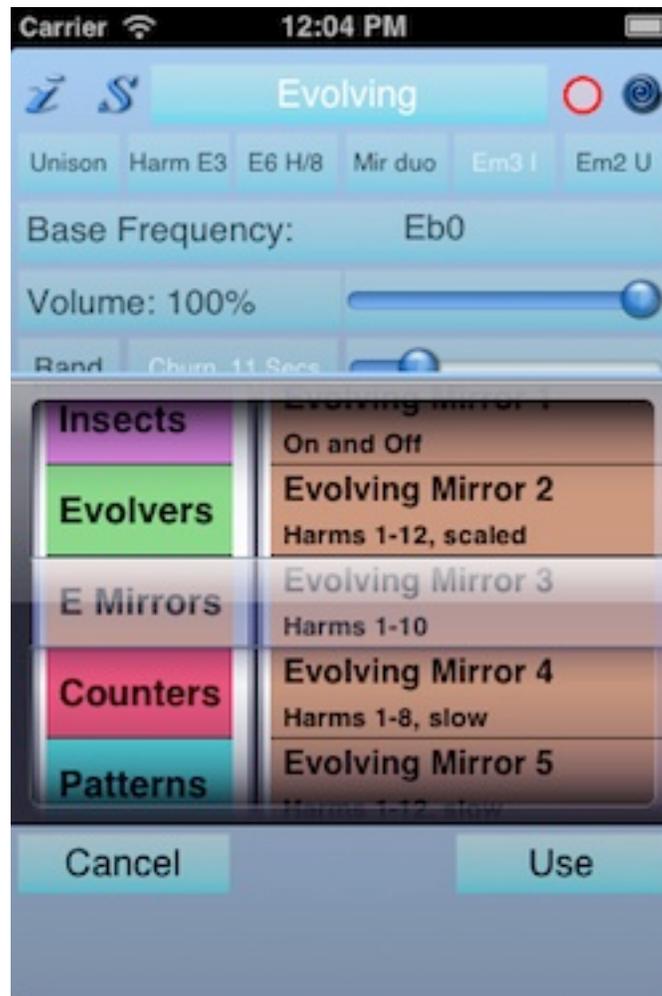
The **modulation slider** controls the speed of sound modulation changes. These can add a lot of life to the sound of the drone. By tapping the name of the modulation (Chorus or Churn), it chooses the type of modulation you wish to set.

- **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 zip 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.

- Sine - a simple sine wave, no harmonics at all.
- Sine3 - you can hear a fifth
- Sine5 - you can hear a third
- Sine7 - you can hear a seventh.
- Sine9 - you can hear a ninth.
- Sine11 - you can hear an eleventh.

### **Organs:**

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

- Organ 1, harmonics 1, 2
- Organ 2, harmonics 1, 2, 3, 4, 5
- Organ 3, harmonics 1, 2, 3, 4, 5, 6, 7, 8
- Harmonium 1, taken from the spectrum of a harmonium reed.
- Harmonium 2, also taken from the spectrum of a harmonium reed. Good with low pitches!
- Buzzy Organ, very buzzy. Odd with some light even harmonics. Very much like a sawtooth wave.

### **Analog:**

these are similar to waveforms found in analog synthesizers.

- Triangle
- Triangle 1/4 has a duty cycle that puts the peak of the triangle at 1/4 of the whole wave.
- Triangle 1/8 has a duty cycle that puts the peak of the triangle at 1/8 of the whole wave.
- Square
- Square 1/4 has a duty cycle that puts the transition of the square at 1/4 of the whole wave.
- Square 1/8 has a duty cycle that puts the transition of the square at 1/8 of the whole wave.
- 

### **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.

- A Voices ("karma")
- U Voices ("tuning")
- O Voices ("drone")

- E Voices ("best")
- I Voices ("bees")

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

## **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.

- Insect 1
- Insect 2 is an octave higher than Insect 1
- Insect 3 is an octave higher than Insect 2
- Insect 4 is an octave higher than Insect 3

## **Evolving timbres**

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. Because of this, they also smoothly (for the most part) blend into

what's already playing! The new harmonics are often 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. I'm trying to minimize artifacts, but some still remain!

These timbres are a little computationally intense, so they may be less "clicky" sounding if unused reeds have their volumes set to 0 or have frequencies set to "off". In general, that's a good idea!

- Evolving 1: merely fades a sine wave timbre in and out randomly (but slowly).
- Evolving 2: randomly adds none, 1,2 or 3rd harmonics.
- Evolving 3: randomly adds up to the 8th harmonic.
- Evolving 4: randomly adds up to the 12th harmonic, more slowly.
- Evolving 5: randomly adds up to the 16th harmonic, more slowly.
- Evolving 6: 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, they 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 still be used as harmonic material by the left side. 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" on the "right" side of the churn.

- Evolving Mirror 1: fades the opposing timbre in and out randomly (but slowly).
- Evolving Mirror 2: uses the opposing timbre to build random harmonics, from the 6th to the 12th harmonic. So set the base frequency low!
- Evolving Mirror 3: 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: uses the opposing timbre to build random harmonics, up to the 8th harmonic, slowly choosing a new harmonic, but adding it quickly.
- Evolving Mirror 5: uses the opposing timbre to build random harmonics, up to the 16th harmonic, very slowly choosing a new harmonic, and slowly adding it.
- Evolving Mirror 6: uses the opposing timbre to build random harmonics, up to the 16th 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.

## **Counters:**

These timbres play the 8 reeds in various orders at various speeds, a process related to counting. All counters are mirrors to make them flexible. You can reset the count by setting the volume to 0 (and then back).

- Counting Mirror 1: Binary. 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
  - etc.
- Counting Mirror 2: 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
  - Counting Mirror 3: binary alternating pairs. In this case, a '0' means the first of the pair, a '1' means the second.



This setup alternates between a major triad and a fifth above it, but not all at once.

- Counting Mirror 4: It plays each reed in turn, sort of like a sequencer. It's a kind of stately pace.
- Counting Mirror 5: It plays like Counting mirror #1, but using gray code instead of binary. 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
  - 1111

## • 1110

**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 sequencing, but only by adding harmonics to a reed. Here is where timbre, melody, and harmony all merge together. If you are using a pattern mirror timbre, as timer counts off, the label of the reed is decoded into which harmonic it should add next. 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							

You make a label with a pattern made out of these characters. Each reed will repeat the 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 (or you can make an importable voice and use an editor or script to make your patterns). 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 two pattern timbres available:

Pattern Mirror 1: a slowly changing pattern counter

Pattern Mirror 2: a quickly changing pattern counter.

I usually rough out a voice using pattern mirror 1, and later swap to pattern mirror 2 when I have more patience.

You can reset the count by setting the volume to 0 (and then back).

Yes, a future version of Droneo or a new program will be written to open up all the internals of this system so that all aspects of timbral harmonics and "sequencing" are exposed. But for now, you get these two.

This make for some VERY INTERESTING melody experiments. It's analogous to putting a series of harmonic frets on an open string. For example,

You can make a 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.

1/1 10  
5/4 100  
3/2 1000  
7/4 10000  
9/8 100000

This makes a just major ninth and repeats the harmonics at different speeds.

1/1 4  
1/1 10203

This patch , mirroring Insect 2 at a base frequency of 1Hz makes a nice polyrhythm.

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

### **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, just silence or one of the vocal timbres.

They don't work well with Evolving Mirrors though.

- Evolving Chant 1: Quickly changing chanting
- Evolving Chant 2: Slowly changing chanting
- Evolving Chant 3: More quickly evolving chant

- **Evolving Chant 4:** Very quickly evolving chant.

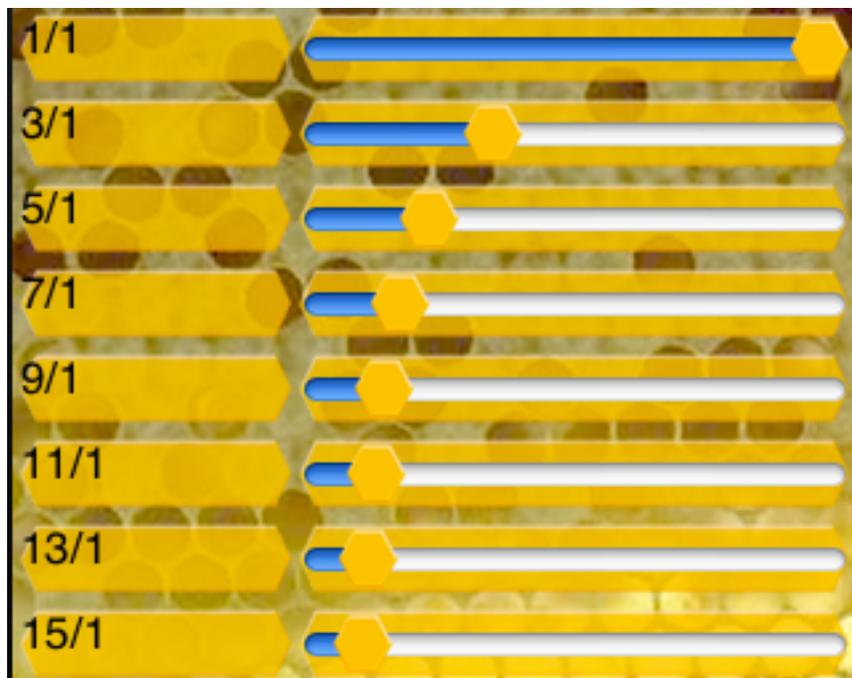
These voices are computationally expensive, so may cause the phone to warm up! They also recalculate at a control rate that sometimes is audible as a slight ticking, mostly with purer drones.

**Consorts:**

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

Name	1	2	3	4	5	6	7	8
Sine	Sine	Sine	Sine <sup>3</sup>	Sine <sup>3</sup>	Sine <sup>5</sup>	Sine <sup>7</sup>	Sine <sup>9</sup>	Sine <sup>11</sup>
Organ	Organ 1	Organ 1	Organ 2	Organ 2	Organ 3	Harm 1	Harm 2	Buzzy
Analog	Sine	Sine <sup>3</sup>	Triangle	Triangle 1/4	Triangle 1/8	Square	Square 1/4	Square 1/8
Voices	A	A	U	U	O	O	E	I
Insect	Insect 1	Insect 1	Insect 2	Insect 2	Insect 3	Insect 3	Insect 4	Insect 4
Organ & Vocal	Organ 1	Organ 2	Harm 1	A	U	O	E	I
Analog & Insect	Sine	Sine <sup>3</sup>	Triangle	Square	Insect 1	Insect 2	Insect 3	Insect 4
Organ & E-Chant	Organ 1	Organ 2	Harm 1	Evolving Chant 1	Evolving Chant 2	Evolving Chant 3	Evolving Chant 4	Evolving Chant 4

# Volume Sliders



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 either:

- typing in an interval ratio (e.g.  $3/2$ ,  $21/20$ ,  $81/256$ ). Ratios are much used in specifying tuning systems using just intonation.
- 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.
- typing in a degree and division of an equally divided octave (e.g. 5:19 is the 5th note of 19 tone equal temperament, which is pretty close to a  $6/5$ !). These degrees are numbered from 0!
- Normally, an equally tempered degree is based on dividing an octave into equal parts. Droneo lets you divide any interval into equal parts by putting an at sign (@) after the equally tempered octave 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.
- 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.

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 will calculate a frequency that is the base frequency times that interval, 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 standard 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

$$\text{frequency} = \text{base\_frequency} * 2^{(\text{cents}/1200)}$$

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

$$\text{frequency} = \text{base\_frequency} * 2^{(\text{degree}/\text{division})}$$

and doing the same for an arbitrary interval:

$$\text{frequency} = \text{base\_frequency} * (\text{interval})^{(\text{degree}/\text{division})}$$

*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.

Don't make the labels too long (more than 16 characters) or they will be truncated.

You can keep the reed from sounding at all by typing "off" or "zero" or "?" as the interval setting. This is 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. See: [this section of the instructions](#).

# 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 Website

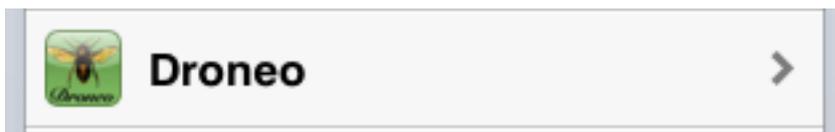
More information can be found on the Droneo Web pages at: <http://www.jhhl.net/iPhone/Droneo/>. That website will carry the current, revised version of these instructions, as well as samples, tips and links. You can also get and save Droneo voices from

<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." There you get a choice of the original "Honeycomb" skin, the "Blue and Green" skin, or "Aqua" . 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.

With version 1.3 comes the ability to record your drones. These recordings can be maintained via the iTunes Document interface. However, in old operating systems, like 3.1.3 on the first generation iPhone, there is no iTunes document interface, which means every recording is saved and cannot be deleted. There are some third party apps that can help you with this - or you can repeatedly delete Droneo and reinstall it. 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 recording you cannot maintain.

Droneo can play in the background under post iOS4.0 operating systems. If you don't want that to happen, there's a setting which lets you turn off the background sound. It's on by default, though. You can also remove Droneo from the "quick start" menu, which will also shut it off. Try this:

1. Press the home button (as if you were shutting it off the usual way),
2. Double click the home button to reveal the "quick launch" menu,
3. Touch the Droneo icon and hold it until it wiggles
4. Tap the circled "x" in the icon's corner. I hope Apple makes this easier some time!

# Credits

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Drone picture from <http://tvtropes.org/>

The formant data for the vocal timbres is taken from [CSound](#).