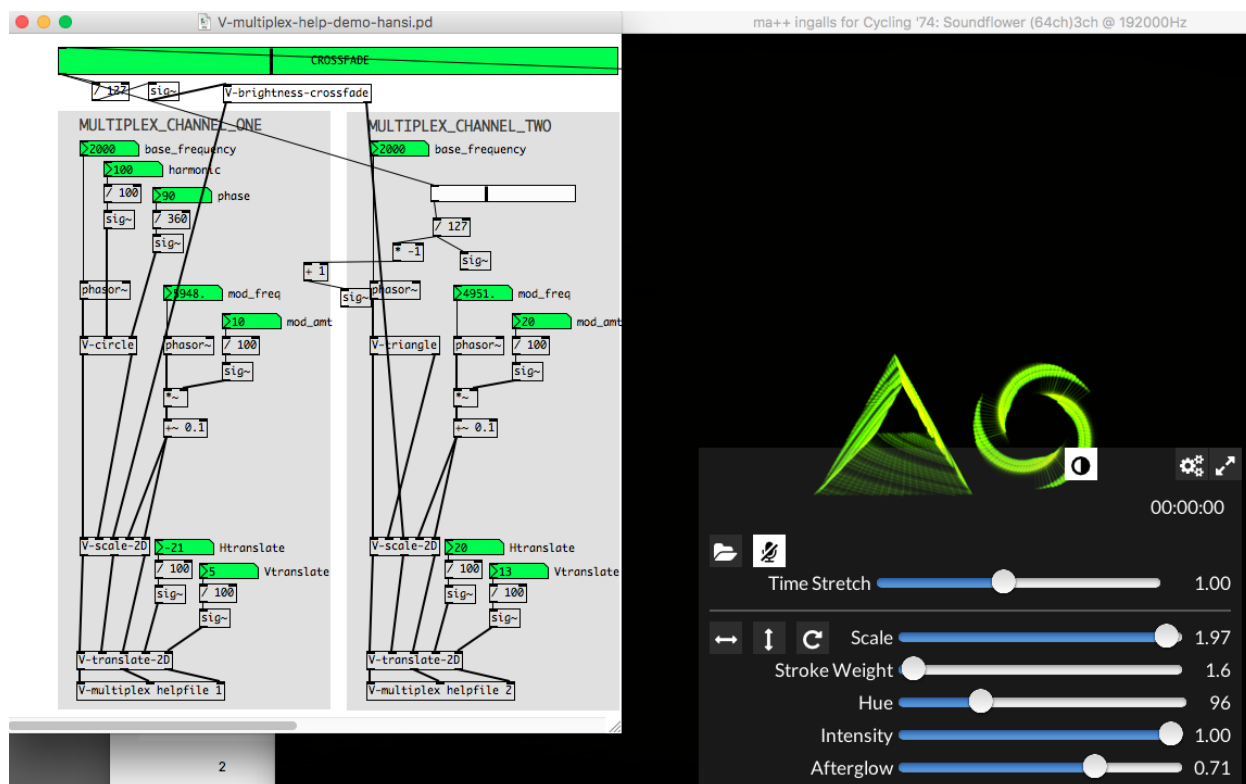


# TUTORIAL: USING HANSI RABER'S OSCILLOSCOPE to PREVIEW VECTOR SYNTHESIS on MacOS



This tutorial show how to use SoundFlower and Hansi Raber's Oscilloscope app to visualize X, Y, and brightness signals from my Vector Synthesis library (as well as any other Lissajous type graphics you want to try) without a hardware oscilloscope or DC coupled soundcard.

1) First, download and install the following:

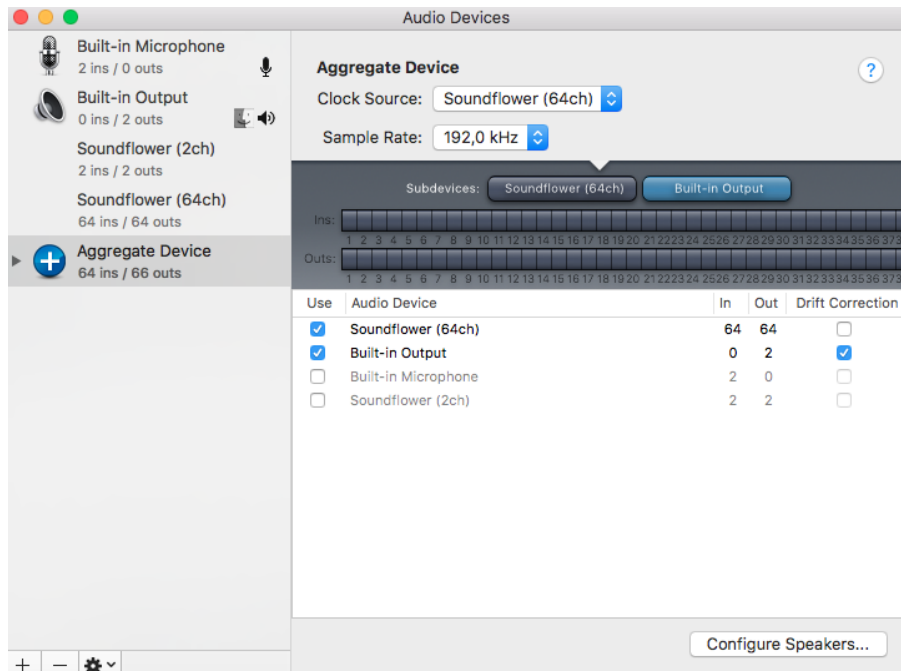
<https://github.com/kritzikratzi/Oscilloscope/releases/tag/1.0.9>

<https://github.com/mattgall/Soundflower/releases/download/2.0b2/Soundflower-2.0b2.dmg>

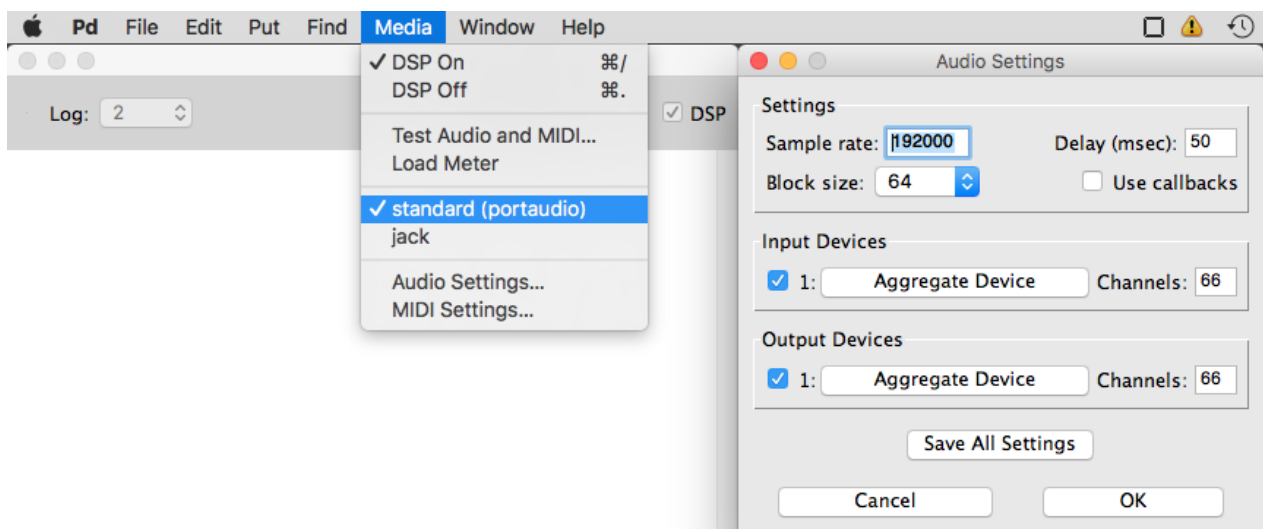
Plus the Vector Synthesis library patches at:

<https://github.com/macumbista/vectorsynthesis>

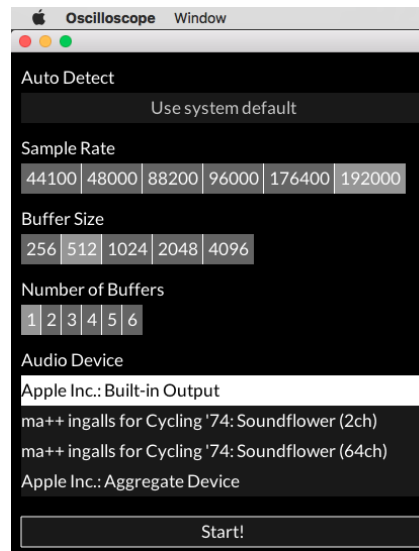
2) Next, we should create an "aggregate device" in your Audio/MIDI settings which sends the output of Pd both to the oscilloscope software and to your soundcard. That way you can see and hear the vector shapes at the same time. Go to "Audio MIDI Setup" under your MacOS Applications/Utilities folder. Create a new Aggregate Device and add first "Soundflower (64 chan)" to it, and then "Built In Output" (or whatever audio interface you want to use). The order you add them is important! Set this device's Sample Rate to 192.0 kHz for best visual results. Your audio interface will downsample whatever you send it, but this technique can certainly cause audible aliasing artifacts!



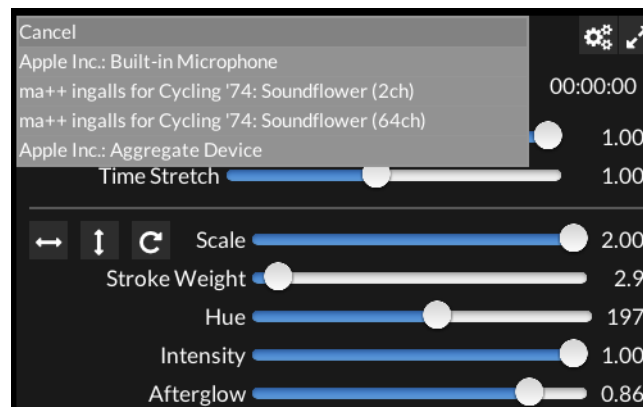
3) Start Pd and choose "Aggregate Device" as output, and set the number of channels to 66. Make sure the sample rate here matches the sample rate of the Aggregate Device for best results. Open a patch which uses brightness modulation ("VS-multiplex-help.pd" for example) and turn on audio DSP in Pd.



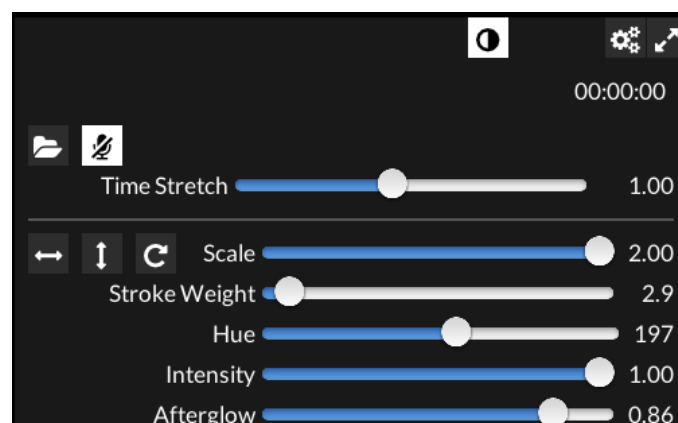
4) Start Oscilloscope! and choose "Built In Output" as output. (The app will crash if you select the same device for both input and output.) Make sure your sample rate in this app matches the sample rate of the Aggregate Device for best results.



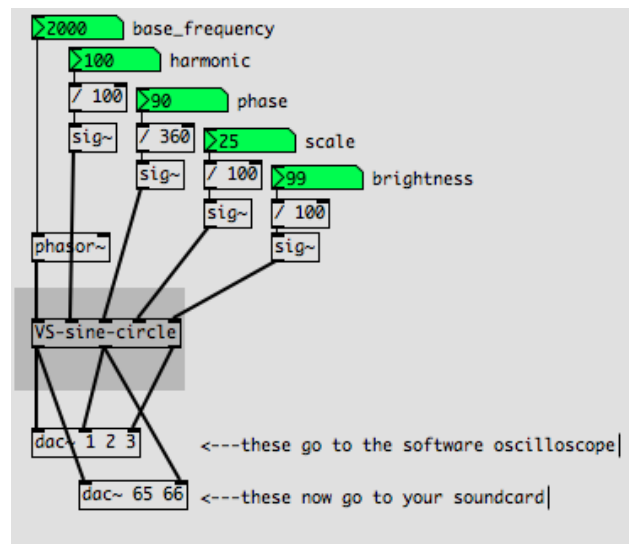
5) Click "Start!" button in Oscilloscope. In the next screen, click the microphone icon. Then hold down the SHIFT key and click the "Aggregate Device" as input.



6) Once you have done that, you will see a little "half-moon" icon which toggles the brightness modulation on and off. (If it does not appear, it's because you did not hold SHIFT while selecting the Aggregate Device input.) TIP: the Tab key gets rid of the menu in this window.



7) In Pure Data, the first 64 output channels are sent to SoundFlower once you have done this. Oscilloscope listens to the first three and uses them as the X, Y, and brightness channels respectively. The next 61 channels are virtual and unused. To hear your X and Y channels, create an object called [dac~ 65 66]. (This has been done for you in the output of the "VS-multiplex-help.pd" patch already.) Channels 65 and 66 of your Aggregate Device go to the first two hardware outputs of your built in soundcard, or whatever other audio device which you specified when you created the Aggregate Device.



Please do not bug Hansi with bug reports on this application, it is a pre-release specifically for us to play around with. It may sometimes crash if you do weird things to it.

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