SoundHack Delay Trio

This is a group of three plugins that I developed as class demonstrations while teaching computer music and studio technique at UC San Diego. All of these are derived from the same basic delay algorithm: a hermite interpolated delay line with variable modulation, and a feedback loop with dc blocking and saturation. Pitch shifting is achieved with a dual head crossfading delay (ala Eltro Tempophon/Dennis Gabor/Pierre Schaeffer phonogene) and is decidedly low-fi.

The three plugins are **+delay**, which presents most typical delay options; **+pitchdelay**, which is essentially the same plugin with controls oriented toward pitch shifting; and finally **+bubbler**, which is a granular delay in which grains are pulled from the delay line with randomized start time, delay time and pitch shift.

The plugins are in RTAS, VST, AU formats for Mac and Windows. They require OS X 10.4 and above, or Windows XP SP3 and above. RTAS plugins require ProTools 7.0 or above. The Mac plugins are Universal Binary.

Hosts tested include Plogue Bidule, Ableton Live, Digidesign ProTools, MOTU Digital Performer, Apple Logic, Cycling74 Max/MSP and Cubase Nuendo.

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Tom Erbe
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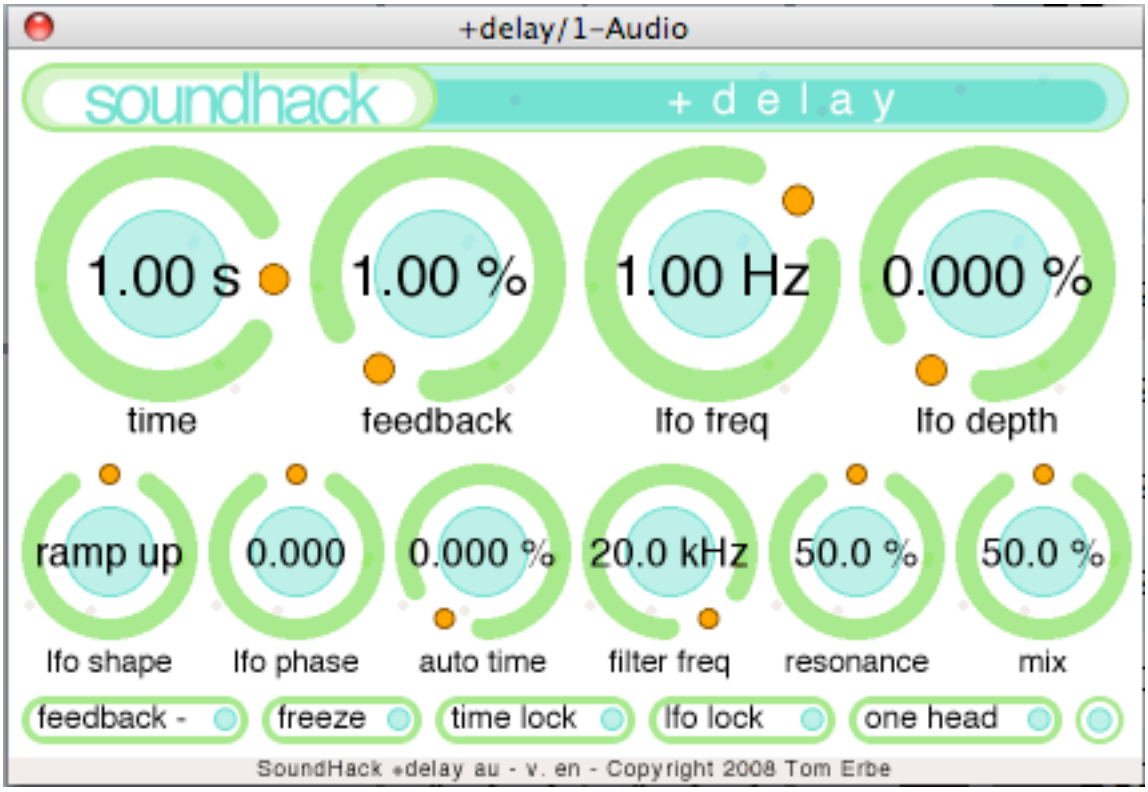

SoundHack +delay

time - the delay time, variable from 1 millisecond to 5 seconds. This control is logarithmic so that there is more knob resolution on the lower time values.

feedback - the feedback varies between 0% to 200%. This controls the amount of delayed signal that is mixed with the input and reinserted into the delay line. Because there is a potential of 300% gain at this mix point (100% input + 200% delay), the summed signals are put through a soft saturation processor and DC blocker.

lfo freq - the frequency of the low frequency oscillator which modulates the delay time. This control is exponential, and varies from 0.01 Hertz (100 seconds per cycle) to 10 Hertz.

lfo depth - the depth of modulation of delay time. This control varies from 0% to 100%. Delay time modulation is based on the current delay time, so that if the delay time is 1.0 second, and LFO depth is at 50%, the delay time will vary from 0.5 seconds to 1.5 seconds.

lfo shape - 6 wave shapes are available for delay time modulation: sine, triangle, square, ramp up, ramp down and random. The random setting picks a new random value at the start of each LFO cycle, and then creates a ramp toward that value.

lfo phase - when processing a stereo signal with LFO time modulation, the left and right channels will receive 2 phase offset LFO signals of the same shape and frequency. A phase offset LFO gives a more spacious sound when used with chorus settings. This control varies from -180 degrees to +180 degrees.

auto time - this is a possibly useless control which modulates the delay time based on input signal strength. Maybe a nice effect on percussive sounds.

filter freq - this controls the frequency of a lowpass resonant filter in the feedback loop. This is an exponential control with a range from 20 Hertz to 20 kiloHertz. At 20 kiloHertz, the filter is removed from the feedback loop.

resonance - this controls the resonance of the lowpass filter. This control goes from 0% to 100%. Above 50%, the filter is highly resonant.

mix - this controls the mix of unprocessed (dry) to processed (wet) signal. At 0% it is completely dry, at 100% it is completely wet.

feedback +/feedback - - this allows you to invert the feedback signal, which will effect the harmonics being emphasized when the delay time is below 20 milliseconds, and the delay is acting like a comb filter.

freeze - this control does two things, it turns off the input, and sets the feedback at 100%, which allows the delay to playback the current contents of the delay indefinitely. Delay time modulation and feedback filtering are still present when freeze is turned on.

time lock - this control locks the delay time to the nearest integer multiple or divisor of the MIDI clock period.

lfo lock - this control locks the LFO time to the nearest integer multiple or divisor of the MIDI clock period.

one head/two head - in one head mode, the delay acts like a conventional delay. In two head mode, an additional playback head (tap) is added to the delay which is 180 degrees out of phase from the original delay. The two heads/taps are continuously crossfaded. Two head mode is used when pitch-shifting by modulating the delay time with a ramp wave, in order to hide the discontinuity in the ramp.

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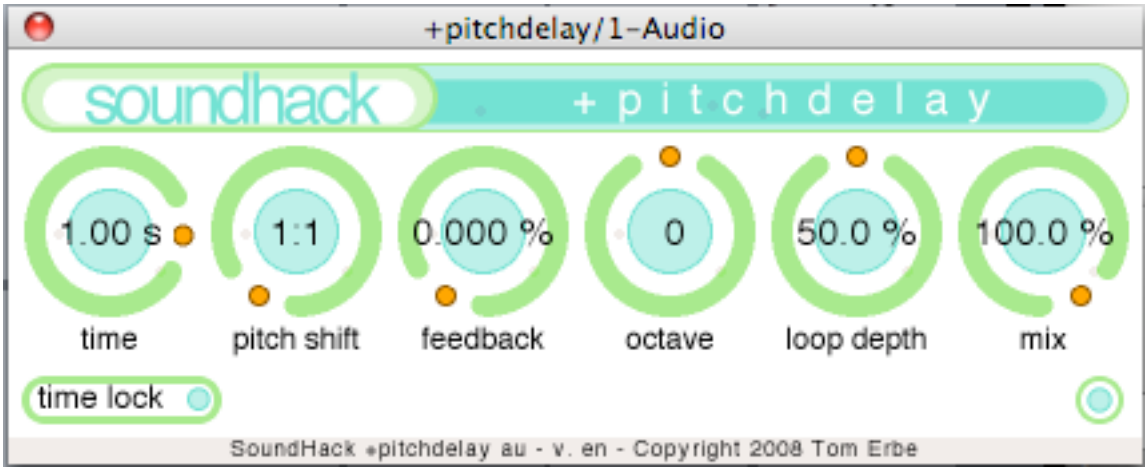

SoundHack +pitchdelay

This plugin uses the same algorithm as SoundHack +delay, with the controls changed to focus on pitch shifting. The pitch-shifting this plugin offers is not a modern transparent type, but is based the early rotary head technique, as used in the Eletro or Springer Tempophon.

time - the delay time. Since the pitch-shifting effect is based on modulating the delay time, it has a higher fidelity when the delay time is higher.

pitch shift - this knob selects ratios and equal tempered semitones from 1:1 to 2:1.

feedback - the same feedback with saturation from SoundHack +delay. This allows interesting effects like a circle of fifths delay.

octave - the knob adds or subtracts a number of octaves to or from the pitch shift value. It varies from -3 to 3, and at extremes will give very distorted pitch-shifting.

loop depth - this controls the amount of delay line which is used for pitch-shifting.

mix - this controls the mix of unprocessed (dry) to processed (wet) signal. At 0% it is completely dry, at 100% it is completely wet.

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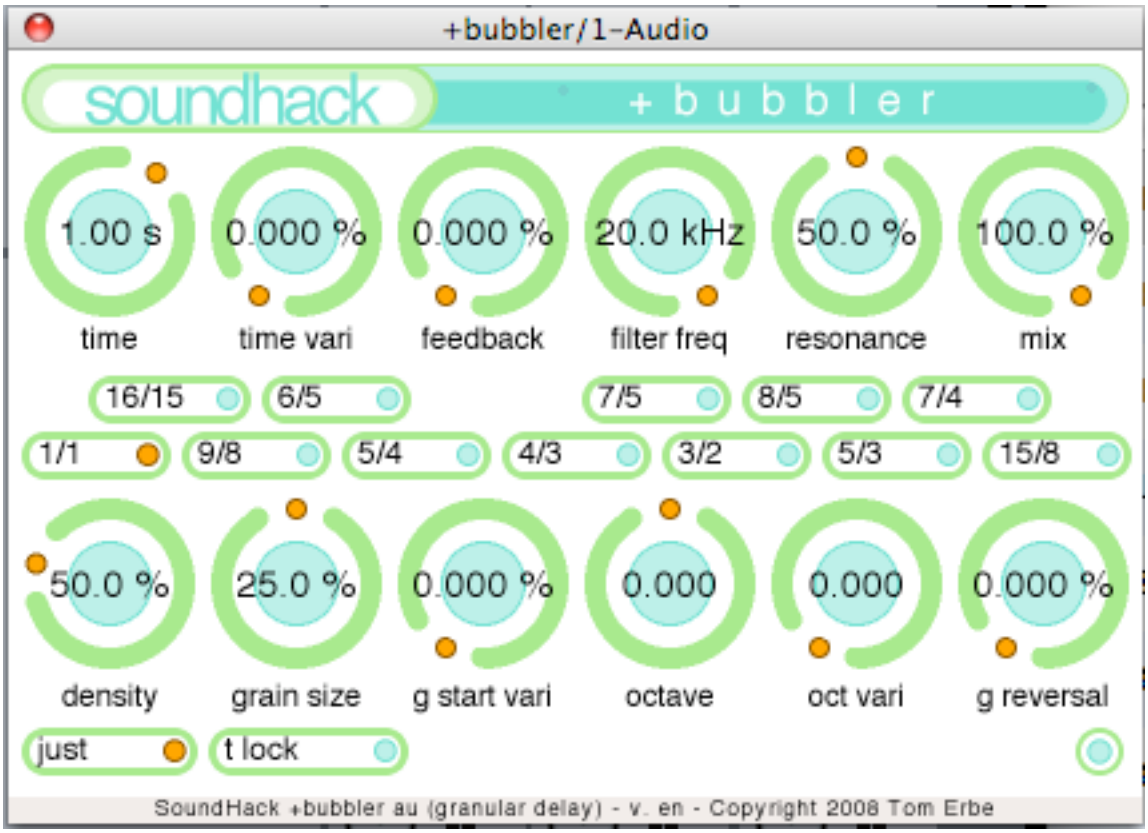

SoundHack +bubbler

This is a granular delay. That is, small or large bits of sound (grains) are read from the delay, and are recombined before sending to the output and feedback. The grains of sound are given smooth envelopes, so that they can be recombined without transient distortion. The start of the grain, the delay in each grain, the playback direction and the pitch of each grain can be randomized. I have also made this plugin responsive to MIDI so that pitch shift values can be played live.

time, feedback, filter freq, resonance, mix, time lock - these are identical in function to the same parameters in SoundHack +delay. The only exception is that the range of time is from 20 milliseconds to 10 seconds.

time vari - this will select a random delay time for each grain from time - (time vari * time) to time + (time vari * time). This control has a range from 0% to 100%.

density - this controls the number of grains present at any given moment. It varies from 0% to 200%. At 100%, grains are created at a rate so that two grains are present (on average). This is done because each grain is enveloped, and it is necessary to overlap grains for smooth audio.

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grain size - this is the size of each grain as a percentage of the delay time. This control varies from 0% to 50%.

g start vari - this control varies from 0% to 100%. At 0% grains will be created at a fixed frequency (grain rate) dependent on the grain size and density, for synchronous granular synthesis. When the g start vari is increased, the grain start time will deviate from this fixed frequency.

pitch shift buttons/octave - these controls give each grain a pitch shift. When multiple pitch shift buttons are on, the pitch shift values are randomly selected from for each grain. The octave value is added to the pitch shift. The pitch shift buttons will respond to incoming MIDI.

octave vari - this will add a random octave pitch shift to each grain.

g reversal - this will randomly reverse the grain. At 0%, none of the grains will be reversed, at 100%, all of the grains will be reversed. This is especially effective when the grain size and delay time is large.

12tet/just - this button sets the pitch shift buttons to 12 tone equal temperament, or to just intonation.

Bibliography

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