Horizon combines two elements commonly used in electronic music - unison oscillators and a short transposing sequence.

It's a basic and generic idea I haven't seen anyone implement yet.

The audio signal runs in stereo, making Horizon appropriate for wide, lush timbres.

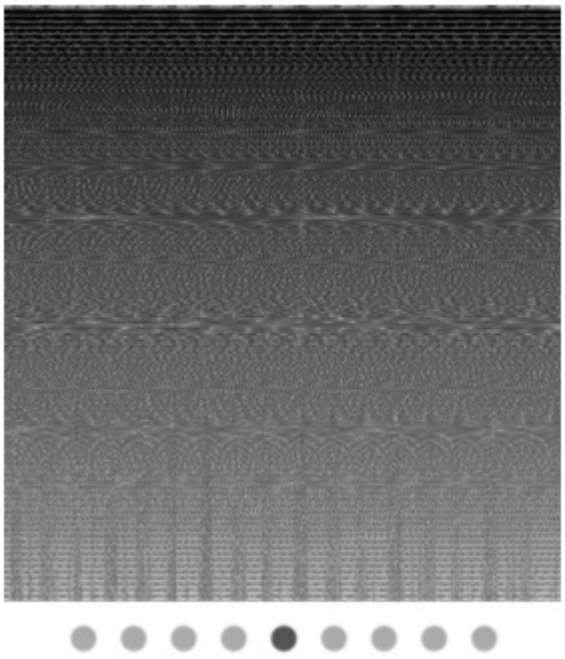
Horizon features:

- 2 32 voice oscillators with five stereo algorithms
- 10 oscillator waveforms including 4 modulating contours
  - (sine, saw, ramp, peak, triangle, square, curve, pulse-saw, sine-saw, res)
- noise oscillator
- per voice prefilter distortion with 6 modes
- 2 stereo 6 pole filters run in serial or parallel
- 3 tempo syncable LFOs
  - (sine, triangle, ramp, saw, square, dip, hump, 4 curve modes, step rnd, smooth rnd)
- 3 envelopes
- 9 modular destinations
- 8 step phrase sequencer which transposes to user input scale

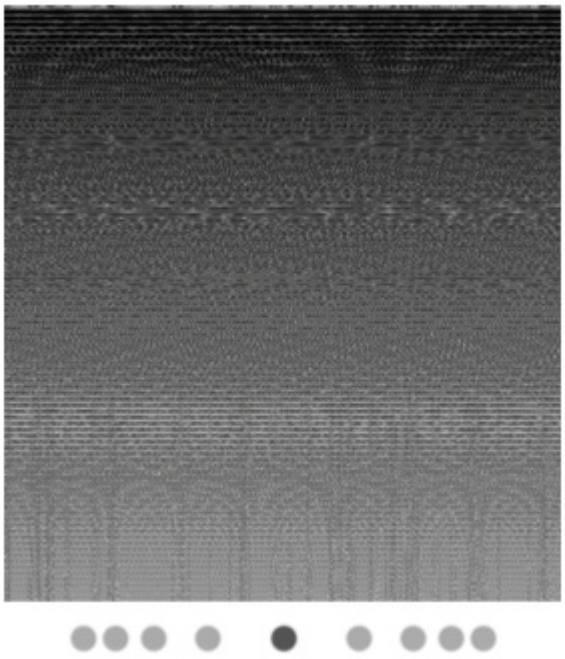
Unison Oscillators

Oscillators are detuned around a central frequency. Detuned frequencies can be concentrated towards the center or the extremes of the detune range using the spread parameter.

the spread parameter



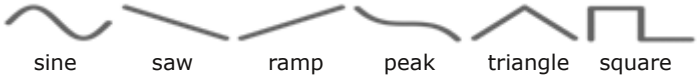
linear frequency distribution



wide frequency distribution

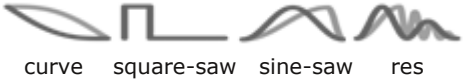
These spectrograms indicate that linear spacing between frequencies produces cyclic artifacts (which are generally annoying), shown by the more pronounced vertical striping along the time axis. Introducing a nonlinearity to the detune values produces smoother, more scintillating unison timbres.

The linear indicator on the spread parameter at 1/3 rotation should be avoided in use.



Static Contours

These waveforms use the lowest amount of cpu. The peak waveform is a sawtooth waveform with a reduced fundamental, making it suitable for spectrally rich patches with reduced bass.



Modulating Contours

The modulating waveforms are arranged in order of cpu use, with res being the highest. The sine-saw and res waveforms use phase distortion algorithms. The curve waveform produces a sawtooth in the central position.

The square-saw contour crossfades between a sawtooth at low modulation and a variable width pulse waveform at full modulation, creating stepped or spiked contours at intermediate settings (place mod to the right for pulse waveform).

When using the square-saw oscillator, the double-saw button alters the output mode to crossfade between a single saw at high modulation and two phase offset saws at low modulation.

Panning Modes

Split panning modes (eg. left/right) alternate each voice between left and right channels from lowest to highest. This mode has more pronounced comb effects. Center to side modes are smoother sounding than split modes, as are the side to side modes (eg. left-right).

The highest numbered voice will generally be the most noticable in the stereo field. Alternating the panning of the high voice between both oscillators helps to create a balanced stereo image.

In random mode, panning for each oscillator is determined at each MIDI note or sequencer gate event. Note that panning algorithms are also arranged from lowest to highest in cpu use.

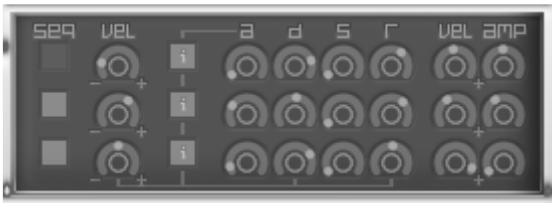
The polyphony knob selects between legato, mono and 6 voice polyphonic performance.

Output Panel and Envelopes

Horizon's distortion module is located after the oscillator mix and before the filter in the signal chain. The gain parameter is scaled for high boosting, and very low gain settings are appropriate for most applications. Six modes are available:

SC - soft clipping method documented by Julius Smith (no tone parameter)
HC - hard clipping algorithm (tone applies to high pass)
BW - barbed wire, proprietary waveshaping algorithm with tone parameter
Rat Breath - decimating algorithm (not derived from ProCo pedal)

The barbed wire algorithm is available with either soft or hard clipping. A twin stage hard clipping mode is included.



The amp envelope works similarly to the assignable envelopes pictured above. Velocity modulation is applied to all stages except sustain. A toggle button inverts modulation of the envelope attack rate, so that velocity applied to decay and release will either increase or reduce the attack rate.

Velocity rate trimmers have a small flat response region in the center to help in manually resetting the control to zero.

Envelopes can be assigned to be triggered by the internal sequencer. Destinations are assigned using the send panel.

Filters

The two multimode filters can be run in parallel or in series. In serial mode, the mix knob fades between the unfiltered and filtered signal. The output of the first filter can be inverted for subtractive mixing.

Filters are selectable between 1 and 6 poles (6db stages). Key tracking tracks the keyboard in the center position, and is twice the scale at far right.

LFOs

The LFOs can be synced to the host at rates of 64, 32, 16, 8, 4, 2, 1, 2/3, 1/2, 1/3, 1/4, 1/6, 1/8, 1/12, 1/16, 1/24, 1/32, 1/48 and 1/64 measures. Unsynced (and unmodulated) duty cycle range is from about 300 seconds to 55Hz. LFOs may be synced to phase position on MIDI note events. They are reset to phase when the host is started.

The bias function shifts the contour above or below DC 0. The leftmost position makes all modulation negative, and the rightmost position makes all modulation positive.

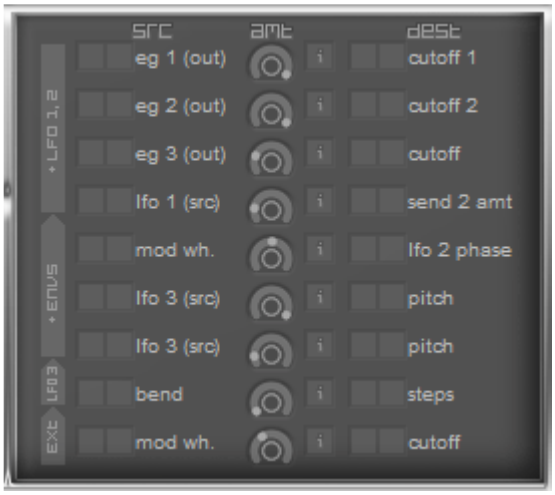
All LFOs can be assigned to the phase, rate and amount of lower numbered LFOs.

All LFOs are polyphonic. To vary LFO modulation between simultaneous notes, select a polyphonic source on the send panel to modulate the LFO (for example, slightly modulating LFO rate with key tracking for swirlier pads).

Send Panel

LFO 3 can be assigned to the envelopes, which can be assigned to LFOs 1 and 2. The sends are split into groups accordingly, as indicated on the left. Sends can be assigned to higher sends (for example, to apply velocity to another modulation amount). Global sources such as velocity or MIDI controllers can be applied to all modulators.

Envelopes and LFOs can be tapped either at the source or the output, before or including amplifying and biasing. When using the output as a source, the rightmost setting indicates unity.



Sequencer

The sequencer implements a simple concept: up to 8 steps which transpose to a user set scale. The panel is divided into regions:

The clock rate is set along the top right of the panel, as a function of the host's beat. Rates slower than one beat can be selected using the 1/n button. The wrench icon holds the current value while manually adjusting the rate in performance. Swing and offset knobs have a flat response region in the center to assist in resetting them to zero.

The scale is set in the bottom left of the panel. Scale degrees are selected by the numbered buttons. Bias selects whether the played MIDI note will be rounded down or up to fit the scale. The hold option filters out incoming MIDI NoteOff messages and sends AllNotesOff when disengaged.

The number of steps in the sequence is set in the top left. The sliders page between pitch, length and velocity using the button under the leftmost slider. The first length or velocity value can be applied to all steps by selecting the "same" option.

The pitch sequence has five pitch range options, 1, 2 or 4 octaves applied above or centered on the played note.

There are three glide modes. "Key glide" does not apply portamento to the pitch sequence, but to the MIDI note input, producing riffs that slowly rise and lower when played legato. "Seq. glide" applies modulation to all notes, and "leg. glide" only to legato notes in the sequence.

The highest "length" setting ties the sequence gate event to the next. Retrigger playing should use length settings slightly under the highest.

The sequence can be reset manually by tapping the reset button, or on all MIDI notes, using the arrow button above "key." The sequencer is designed to apply the same step to all voices, however it can be coaxed into polyphonic progressions by using polyphonic modulation sources in the send panel.

You will observe that it is possible to modulate the number of steps in the sequence, and that doing so increases cpu use significantly. This increase stops when modulation is removed, though in some cases it's worth it.

Both oscillators are tuned to scale, making the osc 2 semitone control function as a chord note offset. When using the sequencer, LFOs and envelopes may be applied as normal to the pitch, or to the sequence pitch, as "seq pitch" and "seq pitch 2" in the destination list.

Another sequencer trick is using the sends to use sequence pitch or length as modulators. It would be conceivable to route pitch to "seq pitch 2" to produce different pitch progressions in each oscillator.

A variety of more complex riffs can be created by assigning synced LFOs to sequence pitch.

Keeping CPU Low

With it's stereo signal path, Horizon is intended to be used for key sounds. The cpu use can vary dramatically based on the patch. In addition to the sequence destinations mentioned above, here are a few factors to be aware of if you are working with a cpu ceiling.

Oscillator, panning and distortion selections are arranged from lowest to highest cpu expense. The res waveform can use close to 4 times as much cpu as the sine waveform when modulated.

One of the most significant factors in overall use is the amp release time, if reducing this slightly avoids an additional render.

Where Next

Horizon is a simple idea - making simple in-key riffs easy. The sequencer could be made more dynamic in a broad number of ways, having more steps or alternate patterns, modulating start point, direction, clock rate and so forth. As you can see, even this simple implementation has a fair number of parameters.

This VST was waiting to be made. For the record, you're more likely to see physical modeling and algorithmic VST from me in the future than a series of 'deluxe' editions.

Thanks to Cinningbao for contributing to the preset selection.

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