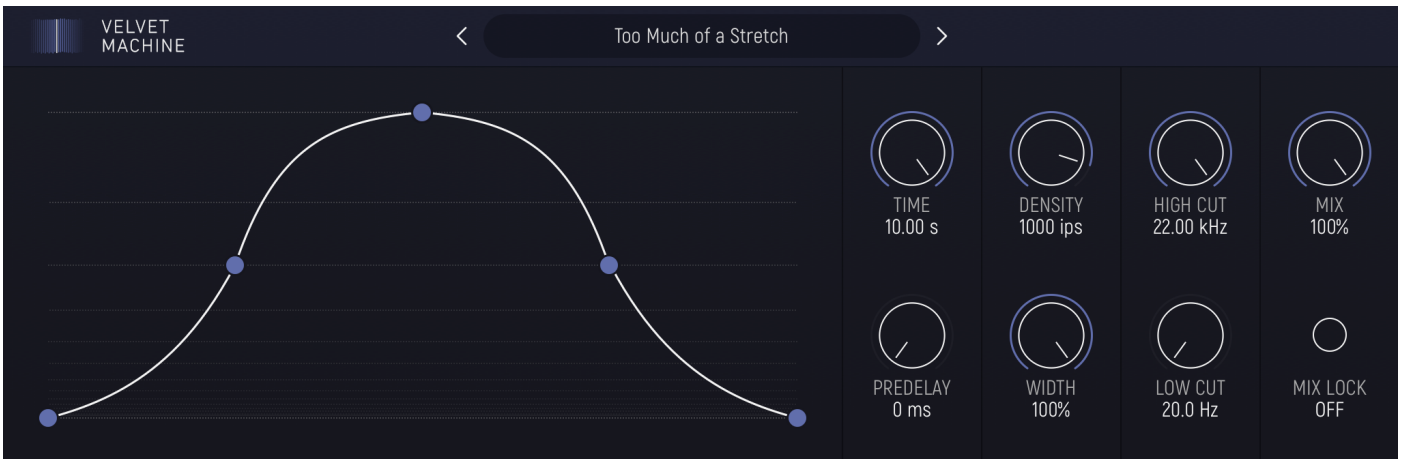# VELVET MACHINE

User Guide
1.0.0

Velvet Machine is an audio effect based on real-time convolution with enveloped velvet noise. Here's what it can do:

- Stretch and blur out even short sounds to lengths of up to 10 seconds
- Produce reverb-like textures with flexible volume envelope (including reverse, fading in and out, pulsating etc.)
- Work as a variable density random multi-tap delay (bordering on granular-like sounds)

Warning: Velvet Machine is a CPU-intensive effect. A *minimum* of 5th Gen iPad, iPhone 6s or 1st Gen iPhone SE is required.

For your reference, here are the measurements for a single instance of the plugin loaded in AUM on my 5th Gen iPad:

- Static maximum time and density: 43-49% CPU
- Changing time and density close to maximum values: 55-75% CPU
- Maximum time and half density: 25-28% CPU
- Half time and half density: 15-17% CPU

Velvet Machine includes a functional standalone app, however it's mainly intended to be used as an AUv3 plugin app extension in a host app such as GarageBand, AUM, Cubasis and others. It does not support the now deprecated Inter-App Audio.

HOW IT WORKS

> **TL;DR:** Input signal is repeated up to tens of thousands of times at time offsets randomized in a particular way and spanning up to 10 seconds. The volume of these repeats is controlled by a flexible multi-point envelope.

Velvet Machine convolves input signal with **velvet noise**, which is a kind of signal consisting of relatively sparse single-sample impulses with values +1 or −1, while the rest of the signal is zero. The sign of the impulses is chosen randomly. The impulses are distributed randomly as well, while still adhering to a set average spacing determined by the *density* parameter, usually ranging from hundreds to thousands of *impulses per second*. (In Velvet Machine it can go down to 1 ips, which makes for a different type of effect than high or medium density. Refer to Controls section for details.)

For each of these impulses the whole input signal is repeated at a time offset determined by the time of the impulse and volume determined by its value. If an impulse is negative, the phase of the signal is flipped. In addition to that, Velvet Machine applies a **flexible multi-point envelope** to the noise, so that the impulses are no longer just +1 or −1, but scaled to the envelope, making their volume change over time.

In other words, you can think of Velvet Machine as a special kind of multi-tap delay with a huge number of randomly located and densely spaced taps, where the volume of each tap is determined by the envelope. At high enough density, the repeats are just milliseconds or even less than a millisecond apart – at this point they are perceived as one sound. Using a huge number of these repeats spread over a long time creates the effect of the sound being stretched or blurred out in time. The randomness of tap locations and phases helps keep the frequency response flat. Since the overall loudness of the effect varies drastically depending on the number of taps and their proximity to each other, Velvet Machines provides automatic gain compensation.

Unlike with FFT-based fast convolution used for arbitrary IRs, the relative sparsity of the noise signal allows Velvet Machine to perform processing directly in time domain without any extra latency, while achieving comparable or better performance and allowing for smooth time and envelope changes without resorting to a parallel engine which would more than double CPU usage when crossfading.

There is an important distinction to be made between Velvet Machine and reverb effects. A typical reverb, be it a real space or an algorithmic effect, applies recursive filtering (progressively dampening higher frequencies with each reflection), increases reflection density over time (imitating sounds scattering around a room), and has an overall decaying volume envelope. In contrast, Velvet Machine filters all 'reflections' equally, has constant density, and can use almost *any* envelope shape. Overall, although it can be used as a reverb, it really shines for effects that are simply not possible with typical reverb topologies.

CONTROLS
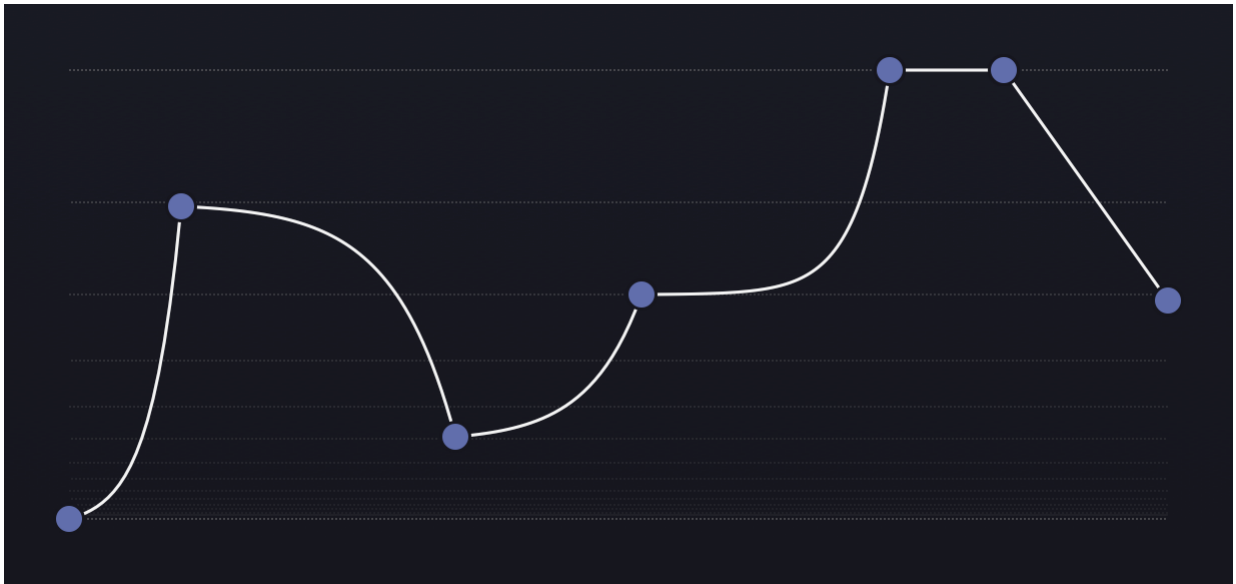
ENVELOPE controls the overall volume dynamics of the effect. First of all, there is a couple of key points to how the envelope works in Velvet Machine:

○ It is not applied to input or effected signal directly. Instead, it determines the volumes of the taps.

○ Its timing is relative: the rightmost point of the envelope always corresponds to the time set by the TIME control.

The envelope can be set to a wide variety of shapes. It has an arbitrary number of *breakpoints*, i.e. points with specific level and time. Any breakpoint can have any level, while time is fixed for the first and last points. Breakpoints are joined by lines with adjustable curvature, or *segments*.

Dragging a breakpoint vertically adjusts its level while dragging horizontally adjusts its time. To delete a breakpoint, double-tap it. To add a new breakpoint, double-tap anywhere else - the point will appear in that position. To change the curvature of a segment, drag vertically in any horizontal location between adjacent breakpoints.

Horizontal lines behind the envelope indicate levels 3 dB apart: the top line is 0 dB, the second from the top is -3 dB, the next one is -6 dB and so on.

TIME sets the length of the velvet noise, and thus the duration of the effect. The range is 100 ms to 10 s.

DENSITY sets the number of impulses per second (ips) and thus the average distance between impulses. It can be set to 40 discrete values ranging from 1 to 2000. High densities sound the smoothest, while low densities produce discrete repeats. Medium densities can sound noisy with transient-rich signals, but similar to higher densities with smoother input signals. Overall, the sharper the transients in source material, the more apparent the difference between density options and the more density is required to achieve smooth results.

> **Note:**
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> o CPU usage is very much proportional to TIME and DENSITY values. If you find Velvet Machine using too much CPU, try reducing DENSITY.
> o Changing TIME and/or DENSITY as well as editing the envelope is a fairly CPU-intensive process involving recalculation of up to tens of thousands of tap parameters. CPU usage may go up to 1.5x normal or more, please keep this in mind, especially when using automation.

PREDELAY sets the amount of time between the dry signal and the onset of the effected signal. The range is 0 to 500 ms.

WIDTH controls the stereo width of the effected signal. 0% is mono, 100% is full stereo. Velvet Machine processes each stereo channel using a separate set of taps, making for a wide-sounding effect even with mono input signals. This, however, can feel too wide in some situations and that is when this knob may come in handy.

HIGH CUT and **LOW CUT** set the cutoff frequencies of respectively low-pass and high-pass filters applied to the effected signal.

MIX controls the blend between the dry and wet (effected) signal. 0% is dry only, 50% is equal amounts of both, 100% is wet signal only.

MIX LOCK - if this button is *ON*, the MIX setting will not change when switching presets. For your convenience, the MIX control still can be operated even when MIX LOCK is engaged. The state of this control will not be saved as part of preset, but will be included in the plugin state saved by the host app.

> **Parameter Automation:** All parameters except the Envelope and Mix Lock are available for host control and automation. For more details on how to use this feature, check your host's documentation.

PRESETS

The preset button (located in the top center of Velvet Machine window) shows the name of the current preset. Tap this button to open the preset browser, which allows you to load, save and manage presets. (To close the browser, tap the button again.)
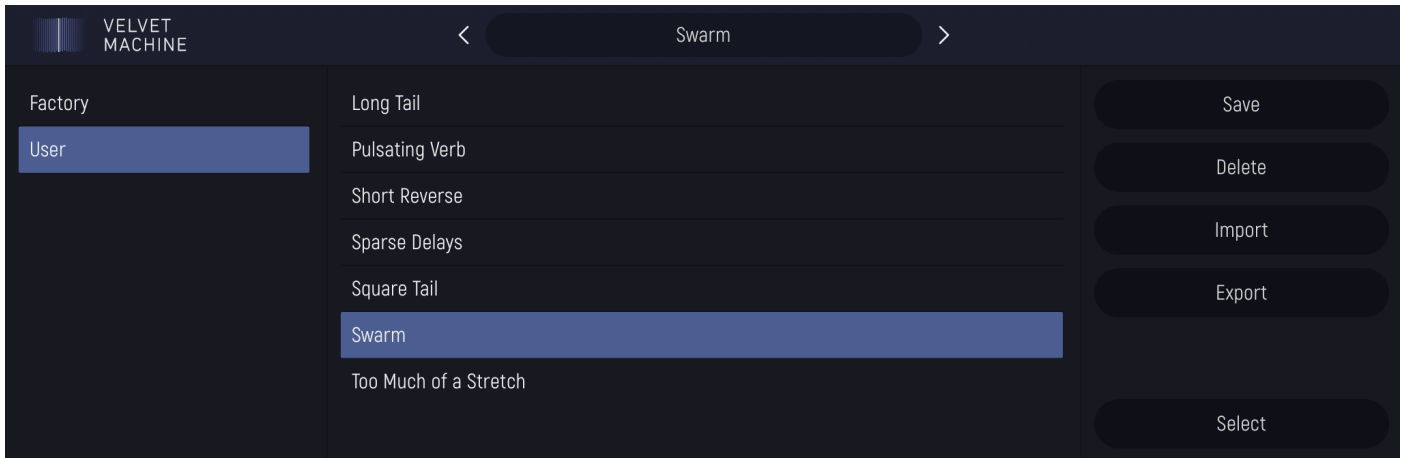
Velvet Machine comes with a number of presets available in the *Factory* bank on the left. These presets cannot be deleted. The presets you save will be located in the *User* bank.

To *load* a preset, tap the preset name in the list.

To *save* a preset, tap **Save** and enter the preset name. If a preset with this name already exists, you will be asked if you want to replace it.

To *delete* a preset, select it in the list, tap **Delete** and confirm deletion in the popup dialog. Alternatively, tap **Select**, put checkmarks against the presets that you want to delete and tap **Delete**.

Similarly, you can *export* a single preset or multiple presets using the **Export** button, except in this case you will be presented with a system sharing dialog.

To *import* presets, tap **Import**, select the presets you want to import in the presented system file browser and tap **Open**.