# ChowMatrix User Manual

**ChowMatrix** is an infintely growable delay matrixing effect. The fundamental idea of the effect is to create a "tree" of delay lines, each with it's own proprties, such as delay-time, feedback, paning, etc. This flexibility allows musicians and producers to create a wide array of delay-based effects, from simple multi-tap echoes, to lush reverberant spaces.The plugin is currently available as VST/VST3/AU/LV2 for Windows, Linux, and Mac.

## Installation

To install ChowMatrix for Mac or Windows, download the latest release, unzip the downloaded file, and copy the plugin files to your plugin folder. Note that Macintosh users may need to allow applications from unidentified developers. Linux users may compile from source.

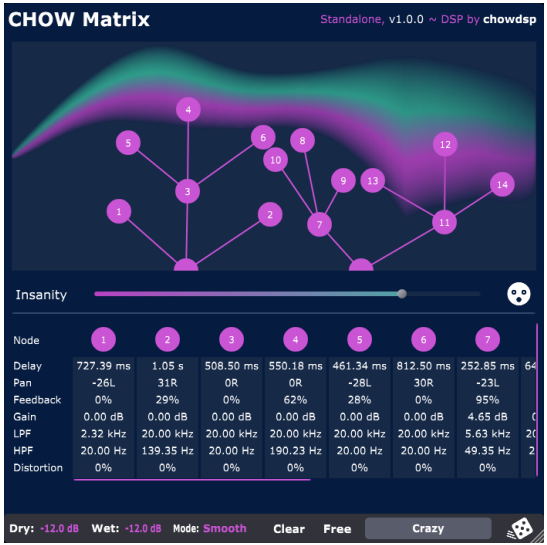


Figure 1: *ChowMatrix User Interface*

## Processing

The way in which ChowMatrix processes audio may not be immediately obvious, especially compared with more "traditionally" designed audio plugins. ChowMatrix is made up a "tree" of delay "nodes", where each node has a "parent" node and potentially one or more "child" nodes. The tree has two "root" nodes, representing the left and right input channels to the plugin. Each node accepts a mono input from its parent node, passes a mono signal on to its children, and outputs a stereo signal to the main plugin output.

### Delay Nodes

Each delay node consists of a delay line, as well as a gain, high-pass filter, lowpass filter, diffusion filter, distortion, pitch-shifter, a global feedback path, and panner. The full processing architecture for a single delay node is shown in fig. 2.

The input **Gain** applies a simple gain to the signal before being processed by the delay node. Adjusting the gain can be useful for making certain delay nodes louder/quieter in the mix.

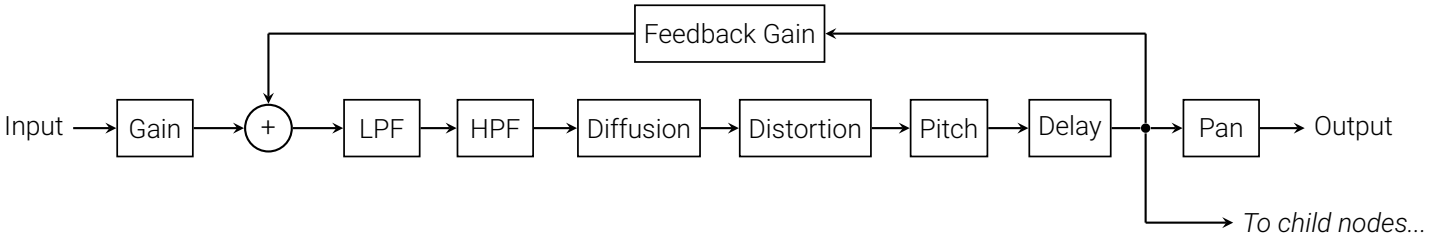


Figure 2: *Signal flow for a single delay node.*

The **Lowpass/Highpass** filters are simple first-order filters with adjustable cutoff frequencies. Note that since the filters are in the feedback loop, the filtering process will be applied recursively to every "echo" of the signal through the feedback loop.

The **Diffusion** filter is a multi-stage allpass filter, that "smears" out the signal across the delay line. Using diffusion in combination with feedback for rhythmic and percussive sounds, can be a cool effect.

**Distortion** applies an anti-aliased waveshaping distortion[1] to the the signal. As with the filters, note that this distortion will be applied recursively to the echos created by the feedback path.

The **Pitch** processor uses a simple real-time pitch processing algorithm to pitch the signal up or down, by a given number of semitones. This effect can be useful for obtaining interesting and creative soundscapes.

The **Delay** line has a length that can be controlled either as a "free" parameter, with units of milliseconds, or synced to the tempo of the song.

The **Feedback** gain controls how much of the delayed signal is fed back to the input. At its maximum value, the feedback control turns on "Freeze" mode, which freezes the current signal in the delay line, and mutes any incoming input signal.

The **Pan** processor applies a constant-power panner to the mono signal processed by the delay node, turning it into a stereo signal that is then fed to the plugin output.

## Modulation

Each delay node also contains modulations controls for the delay time and panning. The modulation section has three controls:

[1] Anti-aliasing is done without oversampling using anti-derivative anti-aliasing. For more information, see: Parker et. al., 2016.

**Mod Freq** determines the modulation frequency, and ranges from 0 to 5 Hz. **Delay Mod** controls the amount the delay length is modulated for this node. **Pan Mod** controls the amount the panning for this node is modulated. Note that this control can be set to negative values to invert the modulation signal.

# Controls

The ChowMatrix interface is made up of four main sections: the "Graph View", "Details View", "Bottom Bar" and "Insanity Control".

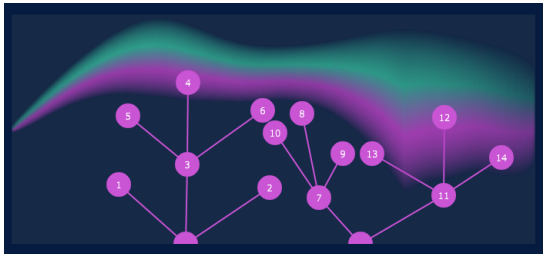


Figure 3: *ChowMatrix Graph View*

## Graph View

The **Graph View** is the main interface for interacting with the delay nodes and managing the connections between nodes, as well as providing an informative and inspiring visualization of the delay processing being performed by the plugin.

At the bottom of the graph view are two **Input Nodes**, represented by half-circles. The Input Node on the left represents the left input channel, and the right Input Node represents the right input channel.

To **create** a new node, `SHIFT+Click` on the background of the Graph View. If a node is selected, the new node will be created as a "child" of the selected node. If no node is selected, the new node will be created as a child of the nearest Input Node.

To **select** a node, simply click on the node. A menu will appear showing the parameter controls for the selected node. To un-select, simply click the background of the Graph View.

When you `Click+Drag` to **move** a node, the panning and delay time of that node will change accordingly. The panning is controlled by the node's angle relative to its "parent" node, and the delay line is controlled by the distance from the node to its parent.

To **delete** a node, `CMD+Click` on the node, or press the `Delete` key when the node is selected.

To **solo** the audio from a specific node, `ALT+Click` on the node. TO un-solo the node, click on the background of the Graph View.

The mouse can be used to explore the far reaches of the Graph View by scrolling, or clicking and dragging. Click the **Home** icon in the bottom left corner, to return to the default view position.

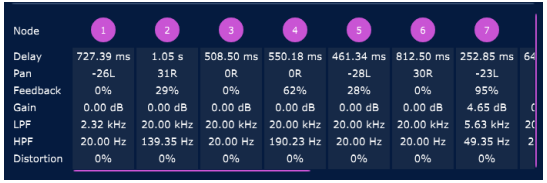


Figure 4: *ChowMatrix Details View*

## Details View

The **Details View** is below the Insanity Slider on the interface, and allows the user to view and edit the parameters for each node without having to select the node in the Graph View.

To edit a parameter, `Click+Drag` on the parameter value. Alteratively, single-clicking on the value allows you to type in a value for the parameter. Double-clicking will reset the parameter to its default value.

Using `SHIFT+Click+Drag` will change the same parameter for all the delay nodes in unison. `CMD+Click` on a value to "lock" the parameter so that it will not be affected by the "Insanity" control.

## Insanity Control

ChowMatrix also features an **Insanity** parameter. By turning up the Insanity, the plugin will allow the delay nodes to "wander" randomly, with a speed and intensity determined by the parameter value. Insanity is useful for finding new delay node configurations, or for adding a source of chaotic modulation.

## Bottom Bar

The "Bottom Bar" section includes several auxiliary controls, as well as a presets menu.

The **Dry/Wet** sliders control the level of the dry and wet signals coming out of the plugin. To use ChowMatrix as a "send", turn the Dry level all the way down to `-inf`.

**Mode** controls the delay interpolation mode[2] used by the delay nodes. Using higher-order interpolation modes will make the delay nodes sound more "smooth" when the delay length is changed, at the cost of slightly higher CPU usage. First-order interpolation will make the delay nodes sound "rough" when the delay length is changed, as well as attenuating high frequencies passing through the delay. Zero-order interpolation will make the delay nodes sound "glitchy" when the delay length is changed. The differences between the delay modes are most noticeable when moving the delay nodes quickly, particularly in "Insane" mode, and are further accentuated when lots of feedback is used.

**Clear** will flush all signal from the delay nodes. This can be useful if you have delay nodes with lots of feedback, and wish to clear the delay lines without having to wait for the feedback to echo until silence.

**Sync/Free** toggles whether the delay times are synced to the tempo of the song, or "free" to be any length.

[2] For more information on delay-line interpolation, see Smith III, 2010.

The **Randomise** button will randomise the parameters for all the delay nodes. This can be useful for quickly dicovering new delay node configurations.

# Presets

Presets provide a quick way to achieve a specific sound with the plugin. ChowMatrix comes with a set of built-in factory presets. To contribute your presets to be added to the factory presets list for future releases, please email me.

## User Presets

To save the current plugin state as a user preset, open the presets menu, and select "Save". The first time a preset is saved, you will be asked to choose a preset folder. All future presets will be saved to this folder, and when the plugin opens, it will search this folder, as well as any subfolders, to load new user presets. Presets located in subfolders will be placed in their own groups in the preset menu.

# Open Source

ChowMatrix is open-source software that is free (as in "free beer"), and free (as in "free speech"), under the 3-clause BSD license. As an open-source project, ChowMatrix is open to outside contributors. If you would like to contribute to the development of ChowMatrix, please visit the issues page for a list of outstanding tasks. If you would like to implement a new feature, please create an issue ticket first, so the feature can be discussed by the community.

# Feedback

If you notice any bugs, or have any questions, feel free to email me directly, or create an issue ticket on GitHub. GitHub issues are preferred, since they are publicly visible.

Enjoy!

Jatin Chowdhury

https://github.com/Chowdhury-DSP/ChowMatrix