ChowMatrix User Manual

ChowMatrix is an infinitely growable delay matrixing effect. The fundamental idea of the effect is to create a "tree" of delay lines, each with it's own properties, such as delay-time, feedback, paning, etc. This flexibility allows users to create a wide array of delay-based effects, from simple multi-tap echoes, to lush reverberant spaces. The plugin is currently available for Windows, Linux, Mac, and iOS, in the following formats: VST/VST3, AU, LV2, AUv3, AAX, and Standalone.

Installation

To install ChowMatrix, download the latest release, and run the installer. If you would like to try the latest builds (potentially unstable), visit the Nightly Builds page. Note that it is also possible to compile from the source code. ChowMatrix for iOS can be installed from the App Store.

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 of 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.
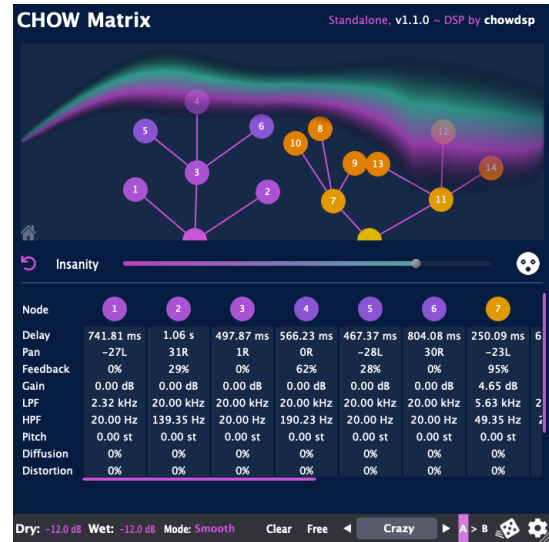

Figure 1: *ChowMatrix User Interface*

Delay Nodes

The signal processing in each delay node consists of a delay line, as well as a gain, highpass 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.
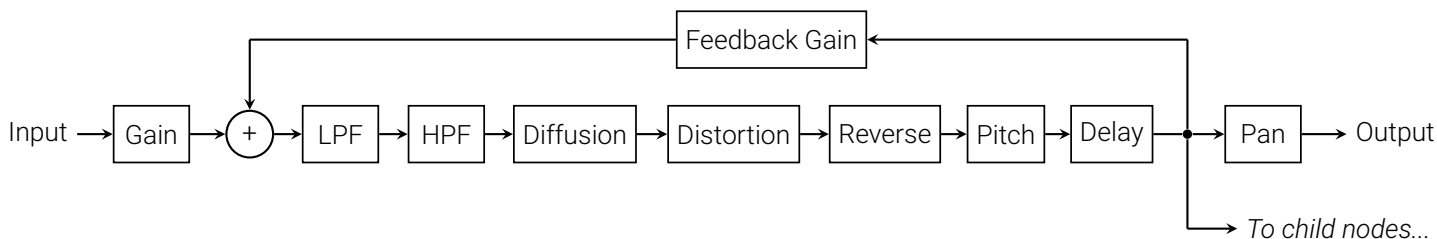
Figure 2: *Signal flow for a single delay node.*

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 create an interesting 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 re-pitches the signal up or down by a given number of semitones. This effect can be useful for obtaining interesting and creative soundscapes.

The **Reverse** processor will reverse grains of a given length in the delay line. Note that the length of the grain will be added to the apparent delay time of the signal.

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. Setting the feedback to control to its maximum value enables **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.

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

Modulation

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

Mod Freq determines the modulation frequency. Similar to the delay length, the modulation frequency can be controlled as either a free parameter (0 - 5 Hz), or synced to the tempo of the song.

Delay Mod controls the amount the delay length is modulated for this node. Note that changing the delay interpolation mode will change how this modulation sounds.

Pan Mod controls the modulation amount for the node pan control. Note that this control can be set to negative values to reverse the modulation.

Controls

The ChowMatrix interface is made up of four main sections: the "Graph View", "Details View", "Bottom Bar" and "Insanity Control". The three-dots button in the top left corner of the plugin UI can be used to control whether the Graph View and Details View are visible.

Graph View

The **Graph View** is the main interface for interacting with the delay nodes and managing the connections between nodes, as
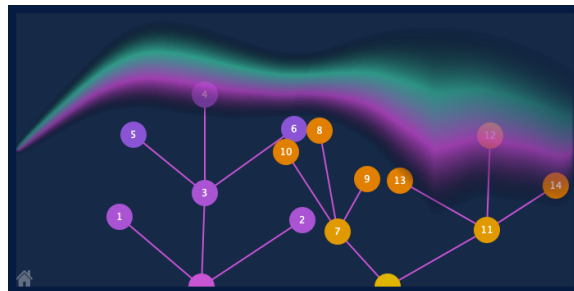
Figure 3: *ChowMatrix Graph View*

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, click the background of the Graph View.
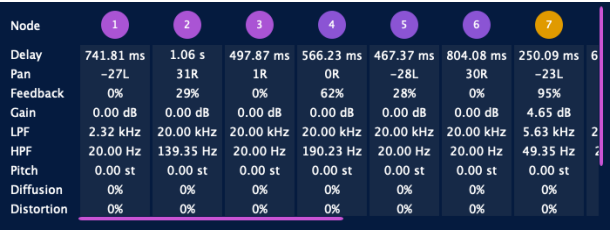
When you `Click+Drag` to **move** a node, the panning and delay time of that node will change accordingly. The panning is

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 select a node in the Details View, click the corresponding node

circle. Note that selecting a node in the Details View will select the same node in the Graph View.

To edit a parameter, `Click+Drag` on the parameter value. Alternatively, 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 the delay or pan value to toggle "insanity lock" and "insanity reset" for a given parameter (see below). `CMD+Click` on the mod freq. parameter to toggle between a free and tempo-synced LFO.

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.

Insanity Lock/Reset

Since the Insanity control alters the other parameters in the plugin, it is important to understand the Insanity "reset" behaviour so that Insanity can be used without fear of losing existing settings. To the left of the Insanity slider is the global **Insanity Reset** button, which will instantly bring each delay node back to the state that it was in when Insanity was turned on.

It is also possible to enable **lock** or **reset** for an individual parameter by using `CMD+Click` or right-clicking on a parameter slider. A parameter with "lock" enabled will not be affected by the Insanity behaviour, while a parameter with "reset" enabled will snap back to its original value as soon as Insanity is turned off.
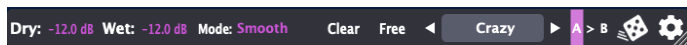

Figure 5: *ChowMatrix Bottom Bar*

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`. Note that by right-clicking on the Wet gain control, automatic gain conpensation can be enabled, which will attempt to match the levels of the dry and wet signals (before the Dry and Wet gains are applied).

Mode controls the style of delay line used by the delay nodes. The differences between most of the delay modes is in how they handles delay-line interpolation[2], which is most noticeable when moving or modulating the delay nodes quickly.

- **Glitch** uses zero-order interpolation.
- **Rough** uses linear interpolation.

- **Smooth** uses 3rd-order interpolation.
- **Ultra Smooth** uses 5th-order interpolation.
- **Liquid** uses a short Sinc interpolation.
- **Super Liquid** uses a longer Sinc interpolation.
- **Lo-Fi** uses a bucket-brigade device (BBD) delay line[3].
- **Analog** uses a longer BBD delay line.
- **Alien** uses a broken BBD delay line for glitchy effects.

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. For plugin hosts that do not supply tempo information to plugins, ChowMatrix will default to 120 BPM.

The **A/B** control allows the user to toggle between two plugin states. This can be useful for using insanity mode without losing your current settings. Use the "A" or "B" buttons to load one of the saved states as the current active state. Use the "arrow" button to save the current state as either the A or B state.

The **Randomise** button will randomise the parameters for all the delay nodes. This can be useful for quickly dicovering new delay node configurations. Note that by right-clicking on a parameter, you may "lock" parameters so that they are not affected by randomisation.

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

[3]For more information on BBD emulation, see Holters and Parker, 2018.

The **Param Assignment Menu** shows which delay node parameters are assigned to global parameters that can be altered from the plugin host (see below).

Parameter Assignment / Automation

ChowMatrix will expose node parameters to the DAW, up to the 50th node. These parameters can be used to record automation for node parameters, or link certain parameters to a MIDI controller.

However, if you require control over more than 50 nodes, or if you would like to control a certain parameter for all nodes simultaneously, ChowMatrix also contains 8 "target" parameters each of which can be mapped to any number of parameters within the plugin.

To assign a delay node parameter to a target, right-click on the parameter slider, and select either "Assign Param", which will map the parameter to the target for the given delay node, or "Assign Global", which will assign the parameter to the target for *all* delay nodes. The "Param Assignment Menu" accessible from the bottom bar can be used to quickly view which parameters are mapped to which targets, and to remove unwanted mappings.

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

Shortcuts

Action	Shortcut	Item
Add Node	`SHIFT+Click`	Graph View
Delete Node	`CMD+Click`	Graph View
Solo Node	`ALT+Click`	Graph View
Unison Change	`SHIFT+Drag`	Param Slider
Insanity Lock	`CMD+Click`	Param Slider
Set to default	`Double-Click`	Param Slider
Freeze Mode	$> 95\%$	Feedback Slider
Tempo-sync LFO	`CMD+Click`	Mod. Freq. Slider
Assign Parameter	`right-click`	Param Slider

Note than on iOS, most extended actions are available via context menus that will be shown when "long-pressing" on an element in the UI.